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BISCAYNE BAY COASTAL WETLANDS FINAL INTEGRATED PROJECT IMPLEMENTATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT

COMMUNICATION

FROM

THE ASSISTANT SECRETARY OF THE ARMY, CIVIL WORKS, THE DEPARTMENT OF DEFENSE

TRANSMITTING

PROPOSAL FOR THE BISCAYNE BAY COASTAL WETLANDS PHASE 1 PROJECT

VOLUME 2 OF 6

SEPTEMBER 25, 2012.—Referred to the Committee on Transportation and Infrastructure and ordered to be printed

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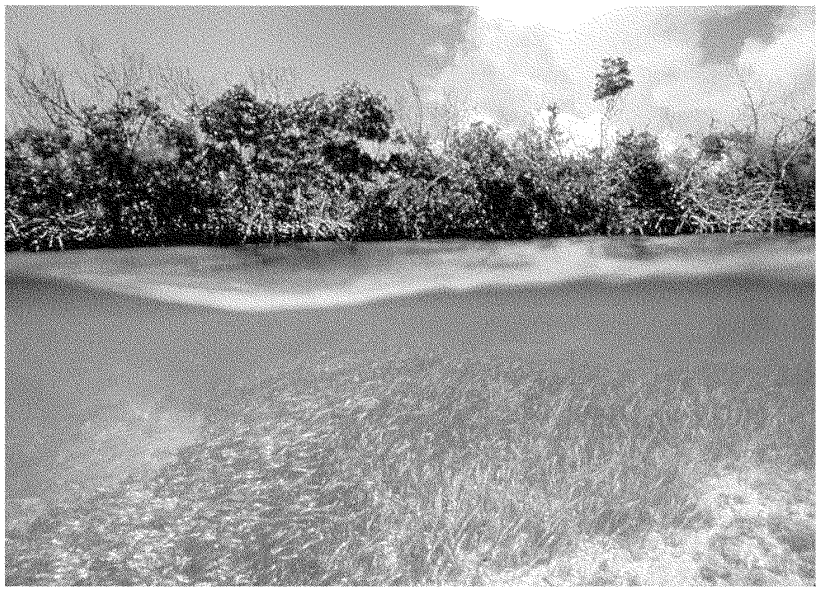
CENTRAL AND SOUTHERN FLORIDA PROJECT
COMPREHENSIVE EVERGLADES RESTORATION PLAN
BISCAYNE BAY COASTAL WETLANDS PHASE 1

FINAL INTEGRATED
PROJECT IMPLEMENTATION REPORT AND
ENVIRONMENTAL IMPACT STATEMENT



Volume 2 – Annexes A-B **July 2011 – revised March 2012**

US Army Corps of Engineers ®

U.S. ARMY CORPS OF ENGINEERS
JACKSONVILLE DISTRICT

SOUTH FLORIDA WATER
MANAGEMENT DISTRICT

(1)

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CENTRAL AND SOUTHERN FLORIDA PROJECT
BISCAYNE BAY COASTAL WETLANDS
PHASE 1

FINAL INTEGRATED
PROJECT IMPLEMENTATION REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

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U.S. ARMY CORPS OF ENGINEERS
JACKSONVILLE DISTRICT

SOUTH FLORIDA WATER
MANAGEMENT DISTRICT

July 2011- revised March 2012

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

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A.0 ANNEX A–FISH AND WILDLIFE COORDINATION ACT AND ENDANGERED SPECIES ACT COMPLIANCE

A.1 COORDINATION ACT REPORTS

United States Department of the Interior

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

May 21, 2010

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

Service Federal Activity Code: 41420-2006-FA-0261
Project: Biscayne Bay Coastal Wetlands Project

Dear Colonel Pantano:

The enclosed report is the final Fish and Wildlife Coordination Act (FWCA) report on the Biscayne Bay Coastal Wetlands Project Phase 1. The final FWCA report is based on the National Environmental Restoration (NER) Plan and the Tentatively Selected Plan (TSP) as described and analyzed in the U.S. Army Corps of Engineers' (Corps') draft Project Implementation Report (DPIR). This final FWCA report provides the U.S. Fish and Wildlife Service's (Service's) continuing guidance and recommendations for the benefit of fish and wildlife resources related to Biscayne Bay and adjacent coastal wetlands. This report is provided by the Service in accordance with the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*).

The Service completed consultation with the Corps under section 7 of the ESA for this action on November 18, 2009, which addressed the project impacts on federally listed threatened and endangered species in the project area. These species included, the Florida panther (*Puma concolor coryi*), West Indian manatee (*Trichechus manatus*), American crocodile (*Crocodylus acutus*), wood stork (*Mycteria americana*), sea turtles, and eastern indigo snake (*Drymarchon corais couperi*).

The Service supports the BBCW Project NER Plan and the TSP as a first step in restoring the nearshore waters of southwestern Biscayne Bay and the adjacent tidal wetlands. Even though the spatial extent envisioned by the Central and Southern Florida Comprehensive Review Study will not be realized by the NER Plan or the TSP, the redistribution of freshwater from harmful point source discharges to a more natural flow across the tidal wetlands to nearshore bay waters should improve habitat conditions in the project area. Reestablishing freshwater inflow to the bay across a broader front along the shoreline should lower salinities there resulting in more suitable estuarine habitat for seagrasses, eastern oysters, pink shrimp, spotted seatrout, red drum, and other fish and invertebrates. The combination of a restored hydrology, a more natural fire

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regime, and a non-native vegetation control program can be expected to evolve toward reestablishing the pre-drainage character of the BBCW wetland plant communities and their associated fauna. At the landscape level, completion of the BBCW Project is important to the management and improvement of resource values of the adjacent conservation areas with Federal interest, such as Biscayne National Park, Crocodile Lake National Wildlife Refuge, and Everglades National Park. In addition to contributing to reestablishing an extensive regional landscape for wildlife, the restoration area will conserve infiltration areas to benefit groundwater resources and maintain barriers to salt-water intrusion. All lands within the TSP footprint would be in public ownership and managed as a natural area, thus protecting them from development.

If you or your staff has any questions regarding the findings and recommendations contained in this final report, please contact Patrick Pitts at 772-562-3909, extension 231. The cooperation of your staff and the staff of the South Florida Water Management District is greatly appreciated.

Sincerely yours,

Paul Souza
Field Supervisor
South Florida Ecological Services Office

Enclosure

cc: w/enclosure (electronic copy only)
BNP, Homestead, Florida (Mark Lewis)
Corps, Jacksonville, Florida (Ernie Clarke)
Corps, West Palm Beach, Florida (Tori White)
District, West Palm Beach, Florida (Matt Morrison)
DOI, Miami, Florida (Terrence Salt)
EPA, Jacksonville, Florida (Eric Hughes)
FWC, Tallahassee, Florida (Mary Anne Poole)
NOAA Fisheries, West Palm Beach, Florida (Audra Livergood)
NPS, Homestead, Florida (Betty Grizzle)
Service, Atlanta, Georgia (Fernando Nunez)
Service, Jacksonville, Florida (Miles Meyer)

Final Fish and Wildlife Coordination Act Report

BISCAYNE BAY COASTAL WETLANDS PROJECT

Submitted to:
Jacksonville District
U.S. Army Corps of Engineers
Jacksonville, Florida

Prepared by: Patrick A. Pitts
Reviewed by: Todd Hopkins and Pam Repp
Approved by: Paul Souza

Fish and Wildlife Service
South Florida Ecological Services Office
Vero Beach, Florida

April 2010

EXECUTIVE SUMMARY

In 1999, the Central and Southern Florida Comprehensive Review Study (Restudy) recognized the need for restoring central and southern Biscayne Bay and adjacent coastal wetlands. As a result, the Biscayne Bay Coastal Wetlands (BBCW) Project was identified and described as an Other Project Element under the Restudy. The BBCW Project was included as one of 68 components under the Comprehensive Everglades Restoration Plan (CERP), which was approved as a framework for the restoration of the natural system under Section 601 of the Water Resources Development Act of 2000 (WRDA 2000).

The goal of the BBCW Project is to restore or enhance freshwater wetlands, tidal wetlands, and nearshore bay habitat by redirecting freshwater from major conveyance canals into adjacent coastal wetlands. The intent is to rehydrate the coastal wetlands, provide a more natural flow of freshwater to western Biscayne Bay, and reduce harmful point source discharges to the bay. The project includes pump stations, spreader swales, flow-ways, levees, culverts, and backfilling or plugging drainage and mosquito ditches. The project is located in southeast Miami-Dade County and includes undeveloped coastal wetlands extending from the C-100 Basin south through the Model Lands to Barnes and Card Sounds.

The South Florida Water Management District (District) has included components of the BBCW Project under its Expedited Everglades Restoration Projects program for the purpose of accelerating design and construction of a number of critical restoration projects consistent with the CERP. The State anticipates these expedited projects will provide immediate environmental, social, and economic benefits in the south Florida region. The District initiated construction of the BBCW expedited project in January 2010.

Due to budget constraints and uncertainties of flood impacts, the U.S. Army Corps of Engineers determined that the construction of the Federal BBCW Environmentally Preferred Plan (EPP), also known as the Conceptual Watershed Alternative or Alternative O, will be phased over time. For planning purposes, the Corps will seek authorization for the project via two Project Implementation Reports (PIRs). PIR 1 describes the BBCW EPP and Phase 1 of that plan. Phase 1 is considered the National Ecosystem Restoration (NER) Plan and the Tentatively Selected Plan (TSP). The TSP includes components of the BBCW expedited project and additional management measures and features that address primarily restoration of saltwater wetlands and nearshore bay areas. It is intended that the remaining features of Alternative O not constructed in Phase 1 will be studied and constructed under Phase 2. Phase 2 will emphasize freshwater wetland restoration.

The information provided in this U.S. Fish and Wildlife Service (Service) Fish and Wildlife Coordination Act Report (FWCA Report) for the BBCW Project is based on pertinent regional research, information contained in various BBCW and Biscayne Bay restoration planning documents (including the PIR), and other communication with the Corps and District. This report discusses the ecological effects of the project for all alternatives, the EPP (*i.e.*, Alternative O), and the TSP (*i.e.*, Phase 1 of Alternative O).

The Service supports the BBCW Project EPP and TSP as they should provide meaningful hydrologic and ecologic improvements to the nearshore waters of southwestern Biscayne Bay and the adjacent coastal wetlands. Estuarine resources in the project area will be positively affected by the restoration of a more natural freshwater flow regime. Reduction of harmful point source discharges at major conveyance canals as a result of implementing the BBCW Project will reduce the unnaturally large fluctuations in salinity near canal mouths, resulting in more stable salinity regimes in these areas, which will improve habitat for fish and invertebrates inhabiting the areas near the canal outlets. Reestablishing freshwater inflow to the bay across a broader front along the shoreline should lower salinities there resulting in more suitable estuarine habitat for eastern oysters, pink shrimp, spotted seatrout, red drum, and other fish and invertebrates. Lowering salinity along the shoreline should also result in the expansion of shoal grass and widgeon grass in these areas which increases benthic diversity and is a food source for the endangered West Indian manatee (*Trichechus manatus*).

The combination of a restored hydrology, a more natural fire regime, and a non-native vegetation control program can be expected to evolve toward reestablishing the pre-drainage character of the BBCW wetland plant communities. Wetland habitat types found in the project area, particularly freshwater graminoid marsh and mangrove wetlands, supply plant biomass to the food web of Biscayne Bay. Both also serve as vital refuge and nursery grounds for a wide variety of freshwater and estuarine fish and invertebrate species, as well as foraging grounds for a variety of wading birds and reptiles, including the federally endangered American crocodile (*Crocodylus acutus*). Freshwater and oligohaline graminoid marshes foster the production of large numbers of mosquito fish, sailfin mollies, and other small fishes that serve as the prey base for many of the region's wading birds and higher trophic level predators. Restoring more natural salinities, hydroperiods, and water levels to these marshes, as planned in the BBCW Project, should serve to increase prey fish production and further enhance these habitats for amphibians, otters, wading birds and other fish and wildlife resources.

At the landscape level, completion of the BBCW Project is important to the management and improvement of resource values of the adjacent conservation areas with Federal interest, such as Biscayne National Park (BNP), Crocodile Lake National Wildlife Refuge, and Everglades National Park. In addition to contributing to reestablishing an extensive regional landscape for wildlife, the restoration area will conserve infiltration areas to benefit groundwater resources and maintain barriers to salt-water intrusion. Currently the BBCW Project area has a hydrologic influence over the western part of BNP. BNP lands and submerged areas along the western side of Biscayne Bay have been impacted by overdrainage and other altered hydrologic effects, and therefore should benefit from hydrologic restoration planned by the BBCW Project. All lands within the TSP footprint would be in public ownership and managed as a natural area, thus protecting them from development.

Recovery of federally threatened and endangered species would be fostered by improved habitat conditions in the project area. These species include, but are not limited to, the Florida panther (*Puma concolor coryi*), West Indian manatee, American crocodile, wood stork (*Mycteria americana*), sea turtles, and eastern indigo snake (*Drymarchon corais couperi*). Informal consultation under the Endangered Species Act was completed for these and other federally-

listed species found in the project area with the Service's concurrence letter dated November 18, 2009. Implementation of the project should benefit several federally listed species by improving salinity regimes, and thus habitat conditions, in the coastal wetlands and nearshore region through increased freshwater flow to these areas. Lowering salinity in the coastal wetlands should increase productivity of prey fish, thus providing an increase in the forage base of wood storks and State-listed wading birds. Lower salinities in the coastal wetlands should also make the habitat more suitable for hatchling and juvenile American crocodiles. However, there will likely be some short-term and small scale negative impacts to listed species, such as, disruption of local feeding areas due to project construction activities and elimination of 97 acres (ac) of natural habitat to accommodate project features. Despite localized, short-term effects the project will have an overall benefit to listed species. Please refer to the Service's letter dated November 18, 2009, that concurs with the Corps' effect determination of 'not likely to adversely effect" for the above listed species.

The recommendations provided by the Service on this project are intended to make the project more environmentally compatible and to further enhance the diversity and abundance of fish and wildlife resources in the project area, while assuring that the optimum ecological benefits are delivered to Biscayne Bay and adjacent coastal wetlands consistent with the basic project purpose. Our three primary recommendations are to (1) plan and implement Phase 2 of the project as soon as possible, (2) include freshwater storage features as part of the Phase 2 design, and (3) identify and provide additional freshwater for the project area. Another important recommendation is the implementation of adequate ecological monitoring for the project. Given the lack of reliable modeling and the high level of uncertainty of the effects from implementing the TSP, the implementation of sound monitoring and adaptive management plans are critical to project success. The Service has also offered recommendations to improve the implementation of the action and these are identified in Section X of this report.

While the Service supports the BBCW Project, we have concerns about the benefits that will be provided by project features, given the reduced scope of the project as envisioned by the Restudy. The Service's primary concern is the lack of available freshwater for the project to fully restore the coastal wetlands and nearshore areas of western Biscayne Bay, particularly during the dry season. The need to increase freshwater flows to improve ecological conditions in Biscayne Bay has been well documented. The Restudy's Draft Integrated Feasibility Report and Environmental Impact Statement and the Service's Restudy FWCA Report described the need and justification for additional water for the bay. The Corps' commitment to providing adequate water requirements to Biscayne Bay is documented in the Project Management Plan (PMP) for the BBCW Project. The PMP states that the "PDT will establish the optimal water requirements and identify unmet requirements" for the project, and that "RECOVER will recommend potential supplemental water supply options to meet the unmet demands." During the past six years there have been at least four independent estimates (three of which were conducted by Project Delivery Team [PDT] member agencies) of the volume of freshwater required to successfully restore appropriate salinity conditions in the nearshore region of western Biscayne Bay, and all are in agreement that approximately 110-150 acre-feet (ac-ft) per year per acre is required. This is approximately two to three times the current annual flow into the bay through the major

conveyance canals in the project area. As of the completion of this report the source and process for alleviating this freshwater deficit has not been identified.

Of equal concern to the Service is the volume of water that is being reserved or allocated for the natural system in the BBCW Project area by the State in accordance with section 601 of WRDA 2000. For the BBCW Project, the water to be reserved or allocated for the natural system was defined as the volume of water that is diverted by all the project features (i.e., water diverted from canals into coastal wetlands) on a daily basis. In general, the features in Phase 1 use just a portion of the total amount available on any given day. This is especially true in the wet season when runoff is greatest. The fraction of available water (i.e., water currently flowing into Biscayne Bay through major conveyance canals) that the BBCW Phase 1 diverts ranges from about 48 percent to 88 percent in a given year. The project features are not designed to capture all water available because it would be impractical to install pumps large enough to capture all peak flows. The Service believes that all of the existing water currently flowing to Biscayne Bay is required to protect the natural system and must be protected by the State of Florida from consumptive use. Even the water currently flowing to Biscayne Bay is not enough to restore desired target ecological hydrologic conditions.

The Service is also concerned about the lack of freshwater storage capability in the project. The disruption of dry season flows to the coastal areas has perhaps been the anthropogenic modification of greatest impact to the project area, and has underlined the need for storage of wet season flows for use in the dry season for the natural environment. The BBCW PDT attempted to address this problem in some project alternatives. Local storage reservoirs would have to be lined and bermed due to the porous local soils, which is costly. The required minimum size of these storage features (many tens of thousands of acre-feet) also added to the project cost. Project alternatives with storage features were eventually screened out as too expensive for CERP. The BBCW PDT was instructed that if local storage features could not be included in the project design, then the other CERP projects or CERP's REstoration COordination and VERification program would be responsible for providing the necessary dry season flow volumes. This issue has not been resolved.

A key management measure that would partially alleviate the water deficit in the project area during the dry season is the elimination of the fall season drawdown for row crops and nursery farms in southeastern Miami-Dade County. This drawdown has resulted in an average of 64,876 ac-ft of freshwater being released each year between 1995 and 2006 from the Biscayne Aquifer via the C-102 and C-103 canals—two of the major conveyance canals in the project area. Elimination of the drawdown would raise stage at the end of the wet season to take advantage of the storage afforded by the surficial aquifer. Each 0.1 ft of increased stage could provide two to four weeks of flows to the nearshore zone without the construction of expensive project features. All BBCW Project alternatives, including the EPP and TSP, originally included a water management operational change that would eliminate this seasonal drawdown for agriculture. During the process of determining possible flood impacts to the project (under CERP Guidance Memorandum 3) the District concluded that the elimination of the drawdown would adversely affect agricultural interests in the project area. As a result, the elimination of the drawdown was removed from the TSP. The Service believes that a qualitative or

experimental analysis should be conducted to evaluate whether agricultural drawdowns are necessary to maintain the current level of flood protection. The Service also believes that including this important operational change in Phase 2 of the BBCW Project will help achieve the ecological benefits of the envisioned project. The District recognized the potential ecological benefit to coastal wetlands and reduction in saltwater intrusion that would be provided by the elimination of the seasonal drawdown, and they initiated a study to examine seasonal drawdown impacts and alternative water management options in 2009. The Service supports this effort. Also, the District's BBCW expedited project may provide an opportunity to review the benefits and impacts of the drawdown through project monitoring and adaptive management.

The spatial scope of the BBCW Project envisioned by the Restudy encompassed approximately 60,000 ac of coastal wetlands and approximately 7,000 ac of nearshore bay habitat. The spatial extent of coastal wetlands anticipated to be restored by the EPP and the TSP is approximately 11,000 and 4,800 ac, respectively. The extent of nearshore bay habitat restoration will also be reduced in the EPP and the TSP due to lack of available water, particularly during the dry season, as noted above. Even though the project has diminished significantly in spatial scale from what was originally envisioned, the Service fully supports the project as an important first step in restoring the nearshore waters of southwestern Biscayne Bay and the adjacent coastal wetlands. However, the Service supports seeking all opportunities and creative means to more fully achieve the spatial extent of restoration in the BBCW study area envisioned by the Restudy.

Much of the land parcels needed for Phase 1 have been purchased by the District or were already in public ownership. However, much of the land required for the full EPP has yet to be acquired. The Service is concerned about possible contaminated soils in these areas because most of these lands are, or were at sometime in the last half century, in active agricultural production. Contaminants of concern include organochlorine, organophosphate, and carbamate pesticides for insect control, as well as a variety of herbicides and fungicides. Environmental assessments have been conducted on most properties acquired by the District in the BBCW Project area and some have revealed significant contamination of soils. In some cases, the contamination detected is at a level that is toxic to fish and wildlife. The Service's Environmental Contaminants staff will continue to review the assessment reports, and based on the potential risk indicated by limited soil sampling and food chain modeling, the Service will make specific recommendations to the District.

Another concern of the Service is whether Phase 2 of the EPP will be realized. We are concerned that land and construction costs may inhibit the implementation of Phase 2. The Service is also concerned about the cost/benefit evaluation in the Project Implementation Report. Based on the evaluation, Phase 1 (the TSP) would provide 71 percent of the benefits of the EPP at 24 percent of the cost. It is unclear how this was determined given that Phase 1 would divert only about half the water estimated to be diverted by the full EPP (Alternative O) and is expected to only marginally restore freshwater wetlands. Freshwater diversion from the conveyance canals into the coastal wetlands is the primary driving force behind the benefits calculations, and Phase 1 would only divert approximately 55 percent of the water estimated to be diverted by the EPP. Additionally, Phase 1 addresses only about 400 ac of freshwater wetlands, while the EPP addresses approximately 6600 ac. The Service is concerned about the methodology used to

calculate benefits and that, if inappropriate, their results may reduce the potential implementation of Phase 2, given a lack of apparent benefits. Although the Service recognizes that it is very difficult to accurately quantify ecological benefits, we caution that the benefits calculations should only be used for relative comparisons of alternatives within a given project.

The Service questions whether a TSP of only 4,800 ac of wetland restoration captures the intent of the Restudy, but supports the process of moving forward. We support the inclusion of a well defined adaptive management plan in the Phase 1 PIR and the information collected in the monitoring and adaptive management plan to be included in Phase 2. We also recommend the Corps and District develop creative funding mechanisms to place into public ownership the remaining land parcels needed for Phase 2 of the EPP.

The Service reiterates that we support the BBCW Project TSP as a first step in restoring the nearshore waters of southwestern Biscayne Bay and the adjacent tidal wetlands. Even though the spatial extent of wetland restoration envisioned by the Restudy will not be realized by the TSP, the redistribution of freshwater from harmful point source discharges to a more natural flow across the tidal wetlands to nearshore bay waters should improve ecological conditions in the project area. The Service appreciates the cooperation of the Biscayne Bay Coastal Wetlands PDT and our restoration partners in responding to our concerns and recommendations throughout the planning process. We remain committed to assist in addressing our remaining concerns and recommendations to further enhance fish and wildlife resources as detailed project plans are reviewed and the project is constructed, and we look forward in providing assistance to planning and implementing Phase 2 of this CERP Project.

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LIST OF ACRONYMS AND ABBREVIATIONS USED IN THE TEXT

ac-ft	acre-feet
ATV	all terrain vehicle
AFB	Alternatives Formulation Briefing
BBCW	Biscayne Bay Coastal Wetlands
BBCWRPP	Biscayne Bay Coastal Wetlands Rehydration Pilot Project
BNP	Biscayne National Park
C&SF	Central and Southern Florida Flood Control Project
CBEEM	Criteria-based Ecological Evaluation Method
CERP	Comprehensive Everglades Restoration Plan
CFA	Core Foraging Area
CFR	Code of Federal Regulations
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
C-111SC	C-111 Spreader Canal Project
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DDx	any combination of DDD, DDE, and DDT
DERM	Miami-Dade Department of Environmental Resources Management
District	South Florida Water Management District
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMB	Everglades Mitigation Bank
ENP	Everglades National Park
EPOC	Emerging Pollutants of Concern
EPP	Environmentally Preferred Plan
ERDC	Engineer Research and Development Center
ESA	Environmental Site Assessment
FDEP	Florida Department of Environmental Protection
FPL	Florida Power and Light
FSM	Feasibility Scoping Meeting
FWC	Florida Fish and Wildlife Conservation Commission
FWCA	Fish and Wildlife Coordination Act
FWCA Report	Fish and Wildlife Coordination Act Report
ft	foot or feet
HU	habitat unit
in	inches
kg	kilogram
MCDC	Multi-criteria Decision Making
mi^2	square miles
mgd	million gallons per day
mg/L	milligram per liter
NEPA	National Environmental Policy Act

NER	National Ecosystem Restoration
NGVD	National Geodetic Vertical Datum
NMFS	National Marine Fisheries Service
OC	organochlorine
PAL	Planning Aid Letter
PAR	Planning Aid Report
PDT	Project Delivery Team
Phase 1	Alternative O Phase 1 or Tentatively Selected Plan
PEC	Probable Effects Concentration
pg/kg	pictogram per kilogram
PIR	Project Implementation Report
PM	performance measure
PMP	Project Management Plan
ppt	parts per thousand
RECOVER	Restoration Coordination and Verification
Restudy	Central and Southern Florida Comprehensive Review Study
SSC	Species of Special Concern
Service	Fish and Wildlife Service
SQAG	Sediment Quality Assessment Guidelines
STA	Stormwater Treatment Area
TABS-MDS	TABS Multi-dimensional Sediment model
TEC	Threshold Effects Concentration
TSP	Tentatively Selected Plan
UCL	upper confidence limit
ug/l	micrograms per liter
WASH123D	Watershed Systems of 1-D Stream-River, 2-D Overland Regimes, and 3-D Subsurface Media model
WCA	Water Conservation Area
WRDA 2000	Water Resources Development Act
YB	Yellow Book alternative

I. PURPOSE, SCOPE, AND AUTHORITY

A. Introduction

The Comprehensive Everglades Restoration Plan (CERP) was approved as a framework for the restoration of the Everglades natural system under Section 601 of the Water Resources Development Act of 2000 (WRDA 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. CERP's components will be implemented over an approximately 40-year period. Together, these components will benefit the ecological functioning of more than 2.4 million acres (ac) of the south Florida ecosystem by improving and restoring the quantity, quality, timing and distribution of water made available for the natural system while also addressing urban and agricultural water supply and maintaining existing levels of flood protection.

Previous ecosystem restoration and water supply planning efforts, including the U.S. Army Corps of Engineers (Corps) Central and Southern Florida Comprehensive Review Study, Final Integrated Feasibility Report and Programmatic Environmental Impact Statement (Restudy) (Corps 1999) have recognized the need for restoring central and southern Biscayne Bay and adjacent coastal wetlands. As a result, the Biscayne Bay Coastal Wetlands (BBCW) Project was included as an Other Project Element under the Restudy. The goal of the project is to restore or enhance freshwater wetlands, tidal wetlands, and nearshore bay habitat by rehydrating wetlands, and reducing point source discharge to Biscayne Bay. The project consists primarily of a land intensive system that retains water, improves wetland hydroperiods, and directs water through alternative routes similar to the natural drainage system. The envisioned project includes pump stations, spreader swales, stormwater treatment areas (STAs), flow-ways, levees, culverts, and backfilling canals located in southeast Miami- Dade County and covers 60,000 ac of coastal wetlands and 8,500 ac of nearshore bay habitat from the Deering Estate at C-100C, south through the Model Lands to Card and Barnes sounds.

The South Florida Water Management District (District) has developed a program called Expedited Everglades Restoration Projects for the purpose of accelerating design and construction of a number of critical restoration projects consistent with the CERP prior to one or more of the following: administration approval, congressional committee resolution, congressional authorization, or Federal construction funding. The State anticipates the expedited projects will provide immediate environmental, social, and economic benefits in the south Florida region. The program includes part of the BBCW Federal Environementally Preferred Plan (EPP) as a component of the program. All expedited projects must be specifically authorized by Congress before becoming a part of the Federal CERP. The District is the state agency responsible for water resources management in south Florida and acts as the non-Federal sponsor for Federal water resources projects, including the CERP and is responsible for implementing all Expedited Everglades Restoration Projects.

The District proposes to initiate construction of the BBCW expedited project prior to implementation of the Federal BBCW Project, Phase 1. The Corps is proceeding with two separate and independent but related actions, the feasibility-level evaluation of the Federal project and the regulatory evaluation of the District's proposed expedited project, both of which

are described in the Draft Integrated Project Implementation Report (PIR) and Environmental Impact Statement (EIS). The purposes of the Federal BBCW EPP identified in the Draft PIR and the District's BBCW expedited project are consistent. Therefore, it is anticipated that the Draft PIR and EIS will also serve as the basis for the Corps Regulatory Division's National Environmental Policy Act (NEPA) evaluation of the District's ongoing expedited project.

Construction of the BBCW EPP (also called Alternative O) will be phased over time. For planning purposes, the Corps will seek authorization for the project via two PIRs. PIR 1 (or Phase 1) will include components of the BBCW expedited project, and additional management measures and features as described in the draft PIR 1 (Corps 2010). Phase 1 is considered the National Ecosystem Restoration (NER) Plan and the Tentatively Selected Plan (TSP) under PIR 1. Phase 2 will include the remaining features of the EPP that are not constructed under Phase 1.

The information provided in this Fish and Wildlife Service (Service) Fish and Wildlife Coordination Act Report (FWCA Report) for the BBCW Project is based partly on information contained in the PIR and EIS, and other communication with the Corps and District. This report discusses the ecological effects of the project for all alternatives, the EPP, and the EPP and the TSP.

B. Purpose and Scope of Project

As described in the BBCW Project Management Plan (PMP)(Corps and District 2002), the primary purpose of the BBCW Project is to redistribute freshwater runoff from the watershed into Biscayne Bay, and away from the canal discharges that exist today to provide a more natural and historic overland flow through existing and or improved coastal wetlands. Specific restoration objectives include:

1. Reestablishing productive nursery habitat along the shoreline
2. Redistributing freshwater flow to minimize point source discharges to improve freshwater and estuarine habitat
3. Restoring and improving the quantity, quality, timing, and distribution of freshwater to the bay, including Biscayne National Park (BNP)
4. Preserving and restoring the spatial extent of natural coastal glades habitat, and
5. Re-establishing connectivity between the Biscayne Bay coastal wetlands, the C-111 Basin, the Model Lands, and adjacent basins.

These objectives are consistent with the overall goals and objectives of CERP.

The proposed BBCW Project will help restore historic overland flow and partially compensate for the reduction in groundwater seepage by redistributing available surface water entering the area from regional canals through a spreader system. The proposed redistribution of freshwater flow across a broad front is expected to restore or enhance freshwater wetlands, tidal wetlands, and nearshore bay habitat. Sustained lower-than-seawater salinities are required in tidal wetlands and the nearshore bay to provide nursery habitat for fish and shellfish. The project is expected to create conditions that will be conducive to the re-establishment of eastern oysters (*Crassostrea virginica*) and other components of the oyster reef community, as well as the enhancement of native shrimp species, estuarine fish, and other macroinvertebrates. Diversion

of canal discharges into coastal wetlands is expected to both re-establish productive nursery habitat along the shoreline and reduce the abrupt freshwater discharges that are physiologically stressful to fish and benthic invertebrates near canal point source discharges.

As envisioned by the Restudy, the BBCW Project was subdivided into five sub-components, which are described below. Project features include pump stations, spreader swales, flow-ways, levees, culverts, and backfilling or plugging of drainage and mosquito ditches located in southeast Miami-Dade County. Locations and sizes of the project features described in the sub-components are preliminary estimates that will be updated as modeling and more detailed design are performed. A concerted effort will be made to recommend non-structural alternatives where possible.

Figure 1 shows the study area of the BBCW Project. The envisioned project influence spans approximately 60,000 ac along the southwestern coast of Biscayne Bay from the C-100 basin (also known as Cutler Drain) to the Model Lands. Land ownership, land availability, and hydrologic conditions vary within the project area and, therefore, approaches will vary depending on location. Some areas are hydrologically separated from others. Some areas will likely require extensive land acquisition, while others will not.

There are a number of challenges associated with restoring the hydrology and ecology of this area. These challenges include an extensive mosquito and drainage ditch system that interferes with historic flow patterns; the presence of invasive, non-native plants and animals; potential water quality problems; and land ownership constraints. Consequently, the ditch system needs to be filled or plugged and the area would require an initially extensive invasive non-native plant removal program with periodic maintenance.

Other ongoing or planned restoration efforts that occur within the BBCW Project footprint that have been considered for project planning include:

1. Beginning in 1993, the District funded the L-31E Surface Water Rediversion Pilot Project. The purpose of this project was to develop the technical and ecological expertise necessary to minimize the effects of compartmentalization and restore coastal ecosystems in southern Biscayne Bay. This involves redistributing freshwater from C-102 and C-103 canals into coastal wetlands within and adjacent to BNP. Lessons learned from this project have proven invaluable to the BBCW Project planning team.

2. The Miami-Dade County Parks and Recreation Department, which presently owns and manages the Deering Estate, obtained funding in 2002 from the Service to implement part of sub-component 1 of the BBCW Project. This restoration effort involved construction of a weir across Cutler Drain with the purpose of re-hydrating freshwater and mangrove wetlands on the Deering Estate property. This project was completed in June 2008.

3. Florida Power and Light's (FPL) Everglades Mitigation Bank (EMB) is a 13,249 acre site located approximately 5 miles south of Florida City, just southwest of FPL's Turkey Point Power Plant and east of U.S. Highway 1. The EMB consists of two major phases. Phase I

contains 4,223 ac located between U.S. Highway 1 and Card Sound Road and consisted primarily of invasive non-native plant removal with no hydrologic enhancement. Phase I was permitted to operate as a mitigation bank in 1996. Phase II contains 9,026 ac located east of Card Sound Road extending to Card Sound then north along the L-31 Canal. Phase II will include a number of hydrologic enhancements to improve freshwater distribution to the Barnes Sound wetlands, including the placement of 40 culverts under the L-31E Canal from Card Sound Road to the power plant. The BBCW EPP must integrate the existing FPL facilities (including the EMB) with the proposed project features for the BBCW area.

4. The Miami-Dade Department of Environmental Resource Management began construction on the South Dade Stormwater Treatment and Distribution Area Pilot Project in the fall of 2006. The project involves approximately 80 ac of degraded wetlands east of Homestead Air Reserve Base. The parcel abuts the north side of Military Canal and is bounded on the east by the L-31E canal. The project purpose is to explore methods for hydrologic and biological restoration and enhancement, by rerouting water from the storm drainage canals (specifically Military Canal) into coastal wetlands to rehydrate and promote sheet flow through the wetland. The project includes a pump system to provide water to the wetland, construction of small distribution canals, elimination of existing drainage ditches and invasive non-native vegetation, and monitoring. The intent of the project is to provide improvements in the quality and timing of freshwater discharges to Biscayne Bay and BNP while gaining information on the feasibility and function of coastal filtering wetland systems required by restoration on a more regional scale. The project site is entirely within the footprint of the BBCW Project. It will help develop technical water quality, flood protection, and biological criteria needed to determine how much wetland area is required to treat or detain canal discharge. Construction was completed in early 2008, and 3 'operational runs' have been completed to date. The project includes robust water quality and operational monitoring. The project has provided significant information on impoundment seepage rates in a coastal wetland system, which will assist the BBCW PDT in refining design requirements for wetland detention areas included in the BBCW EPP.

C. Authority

The Service has prepared this FWCA Report for the Corps as defined by the Scope of Work for the BBCW Project. This draft FWCA Report is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and section 7 of the Endangered Species of 1973, as amended (87 Stat. 884; 16 U.S.C.1531 *et seq.*). This draft FWCA Report constitutes the report of the Secretary of the Interior as required by section 2(b) of the FWCA; it does not constitute a biological opinion under section 7 of the Endangered Species Act. This draft FWCA Report provides guidance and recommendations regarding resource conservation issues associated with Phase 1 of the BBCW Project. Additional natural resource protection legislation relevant to this project includes the National Environmental Policy Act, as amended (42 U.S.C. 4321 *et seq.*), the Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 701 *et seq.*), the Estuary Protection Act (16 U.S.C. 1221-1226), and the Coastal Zone Management Act (16 U.S.C. 1451-1464).

The Water Resources Development Act (WRDA) of 2000 (P.L. 106-541) provides authority for the CERP. Although WRDA 2000 does not provide specific authorization for the BBCW Project, the authority for the project is contained within WRDA 2000. Section 601(b) of the WRDA 2000 states CERP "is approved as a framework for modifications and operational changes to the C&SF Project that are needed to restore, preserve, and protect the South Florida ecosystem." The BBCW Project was identified as an Other Project Element under the Restudy and thus is considered as part of the "framework" of CERP. Because the BBCW Project was not specifically authorized under Section 601(b) or (c) of the WRDA 2000, separate and specific authorization by Congress will be required according to WRDA 2000 section 601(d).

II. PREVIOUS SERVICE INVOLVEMENT IN THE BBCW PROJECT

The Service participated in most project-related public workshops and NEPA hearings, Project Delivery Team (PDT) and working subgroup meetings, field site inspections, and conference calls from February 2002 to the present. The following sections include details of technical assistance and planning participation provided by the Service as part of our coordination under the FWCA for the BBCW Project.

A. Planning Aid Letters, Planning Aid Reports, and draft FWCA Report

This section provides in chronological order the list of Planning Aid Letters (PALs), Planning Aid Reports (PARs), and the draft FWCA Report submitted by the Service to the Corps for planning the BBCW Project. A brief description of the contents of these letters and reports is provided.

March 25, 2002 – The Service submitted a PAL to the Corps that recommended two sections of text to be included in the PMP. These sections described ongoing monitoring studies for the American crocodile (*Crocodylus acutus*) and West Indian manatee (*Trichechus manatus*). The Service believes that the inclusion of these studies in the PMP was necessary because of the likely affect of the project on these two federally listed endangered species.

June 21, 2002 – The Service submitted a PAL to the Corps that provided comments on the Draft PMP. The comments primarily addressed our role in the CERP process, and provided recommendations for the Hazardous, Toxic, and Radioactive Waste Assessment for this project. The PAL also provided an unofficial list of federally threatened and endangered species, and it expressed other project concerns, such as the need to accelerate land acquisition for the project.

December 24, 2002 – The Service sent a PAL to the Corps that provided 12 detailed recommendations for selection and development of the hydrologic and hydrodynamic models to be used for the project. Some of these included using appropriate model selection criteria, inclusion of additional available models in the evaluation, use of appropriate model domain, recommendations for resolution and accuracy, and capability to link with appropriate ecological models. The PAL also noted the importance of acquiring appropriate salinity, bathymetric, topographic, and geotechnical data to calibrate and validate the models.

June 5, 2003 – The Service sent a PAL to the Corps to document 11 ecological performance measures to which the Service had contributed substantially or taken the lead role in developing.

October 23, 2003 – The Service sent a PAL to the Corps with the recommendation that the Corps create an appropriate vegetation map for the project area to facilitate: (1) characterization and description of existing conditions; (2) development, evaluation, and differentiation of project alternatives; and (3) evaluation of project success. The PAL also reviewed the need and justification for additional water to restore and conserve the coastal wetlands and nearshore areas of central and southern Biscayne Bay.

May 13, 2004 – The Service sent a PAR to the Corps that documented existing vertebrate wildlife resources in the project area in fulfillment of tasks assigned to the Service in the BBCW PMP (Section 7.4.3.4.4.1). The PAR accomplished the assigned tasks by: (1) describing dominant wetland and upland habitat types in the project area, and their associated wildlife value; (2) documenting vertebrate species known to exist, or potentially exist in upland and wetland habitats of the project area; (3) providing information on federally and State-listed threatened and endangered species, and species of special concern; and (4) documenting non-native wildlife occurring or potentially occurring in the project area.

June 21, 2004 – The Service sent a PAL to the Corps with the recommendation that the Interagency Modeling Center review the TABS-MDS-Multi-Dimensional Sediment (TABS-MDS) and WAterSHed Systems of 1-D Stream-River Networks, 2-D Overland Regimes, and 3-D Subsurface Media (WASH123D) models. At that time the models had been developed to a stage where an Interagency Modeling Center review of model conceptualization, calibration, accuracy, and precision was warranted. The Service also recommended that the Corps resolve the problems that resulted in the delay of geotechnical and hydrogeologic data collection in support of the modeling efforts.

January 27, 2005 – The Service submitted a PAL to the Corps requesting an extension to the due date of the Tentatively Selected Plan to allow for at least one additional model run on project alternative(s). This extension also allowed for more time to refine project performance measures and to create a vegetation map to be used in quantifying project impacts and benefits.

June 9, 2005 – The Service submitted a PAR to the Corps which described wetland and upland vegetation in the project area from the Deering Estate south to SW 360th Street (northern section of the Model Lands). The report was accompanied by a detailed vegetation map created using Geographic Information System (GIS) software that included 28 vegetation classes.

November 21, 2005 – The Service submitted a PAL that provided recommendations for maximizing the values of STAs and reservoirs to fish and wildlife, as well as water quality enhancement, while maintaining the primary intended function for these facilities.

January 20, 2006 – The Service submitted a PAL that expressed concerns about the use of the WASH123D hydrologic model for BBCW Project evaluation.

September 25, 2006 – The Service submitted a PAL expressing concerns regarding: (1) the validity of benefits being claimed in a 580-ac area by the Tentatively Selected Plan, (2) the preferential use of water in the project area, (3) hydrologic modeling for the project, and (4) project phasing.

July 9, 2008 – The Service submitted the draft Fish and Wildlife Coordination Act Report, which contains detailed descriptions of Service concerns and recommendations regarding this important restoration project.

B. Review of Environmental Assessments and Environmental Site Assessments

The Service submitted the following reviews of Environmental Assessments (EA) and Environmental Site Assessments (ESA) to the District for contaminants issues related to the BBCW Project:

June 26, 2002 – Service review of the Phase I/II EA for Tract 100-002. Although contaminants such as chromium, copper, and arsenic were found to exceed FDEP threshold effects levels for sediment according to the Sediment Quality Assessment Guidelines (SQAG), the 95 percent Upper Confidence Limit (UCL) of the mean for these chemicals was below the threshold effects levels. No concentrations of any contaminants analyzed in this study were found to exceed Probable Effects Concentration (PEC) at any sample site. Based upon the results, the Service did not recommend further investigation of this parcel.

May 17, 2004 – Service review of the Phase I/II EA for Tract 500-001. Dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethylene (DDE), and dichlorodiphenyldichloroethane (DDD) were organochlorine (OC) pesticides detected in the samples. PECs were exceeded for DDT and DDD, while the threshold effects concentration (TEC) was exceeded for DDE. The EA stated that OC contamination appeared to be confined to the southeast area of the property. Arsenic and copper were found in a few samples at concentrations that exceeded their TECs. The Service concurred with the contractor-generated ecological risk assessment that predicted potential risk exists for aquatic organisms and aquatic dependent avian species due to the presence of OC contamination. However, the Service believes the Phase III assessment recommended by the contractor for soils from tract 500-002 should either be done on soils from the apparently more contaminated tract 500-001, or be done on soils from tract 500-001 in addition to soils from tract 500-002. Use of results from a less contaminated tract 500-002 for the more contaminated tract 500-001 may underestimate the risk for 500-001. The Service believes the spatial extent of contamination on the property requires further evaluation and recommended re-sampling of the entire property at a sampling density of one sample per 2-3 ac. Also, contamination at one problem area should be delineated and remediated by soil removal. The Service also recommended modifications to the sampling protocols.

May 17, 2004 – Service review of the Phase I/II EA for Tract 500-002. DDE, DDD, and chlordane were detected in the samples at concentrations considerably exceeding SQAG PECs. The EA report stated that DDE, DDD, DDT, and chlordane contamination on this parcel may

present a significant risk to aquatic organisms and aquatic dependent avian species. The Service concurred with this and the report's recommendation for a site specific ecological risk assessment. Further, the spatial extent of contamination on the property requires further evaluation. Repeated sampling efforts to "confirm" earlier results inconsistently repeated earlier results. A sampling density of one sample per 2 to 3 ac was recommended. The Service also recommended modifications to the sampling protocols.

July 14, 2004 – Service review of the Phase I/II ESA for Tract 500-003. Only chromium and barium were found in samples at concentrations exceeding SQAG ecological criteria values. Barium and chromium concentrations both exceeded TECs for possible effects to benthic organisms. However, the 95 percent UCLs for both were less than their respective TECs. Arsenic concentrations exceeded residential soil clean-up target levels, but residential use is not expected for the property. The Service believes the ecological risks from contamination on tract 500-003 are minimal and will not exceed the benefits of inclusion of this property within the proposed project.

July 14, 2004 – Service review of the Phase II ESA for tracts 400-001 through 400-028 and tracts 800-006 through 800-021. This 983-acre property, located in Miami-Dade County, Florida, is comprised of 37 non-contiguous tracts. The majority of the tracts range from 5 to 20 ac, with one (400-002) being comprised of 436 ac, 365 of which is reservoir. Significant persistent OC persticide contamination was detected in the collected soils. The means for total DDT and total chlordane exceeded their respective TEC. All of the means for DDE, DDD, DDT, and total chlordane exceeded each chemical's respective PEC. Significant contamination was also found in samples north of the canal. While lower than for samples south of the canal, the means for DDE and total chlordane still exceeded their respective PECs, and the mean for DDD exceeded its TEC. Copper, chromium, arsenic, lead, cadmium, and zinc were also detected at concentrations exceeding their TECs, again with most of the detected excessive contamination in Phase II North. However, none of the Service calculated arithmetic means for the metals in Phase II North exceeded their TECs. While the reported data gives some indication of contaminant presence, the Service believes the spatial extent of contamination was not adequately assessed. Large portions of Phase II South and Phase II North, south of the Military Canal, were not sampled. The Service had the following recommendations: (1) better spatial sampling coverage is necessary in tracts south of the Military Canal in Phase II North and in Phase II South, which will provide a more accurate picture of contamination on the site than sampling along the periphery; (2) fugacity modeling should be rerun utilizing individual chemical data rather than total DDT, with the results being used to assess risk for avian species; and (3) all solid waste, including the sludge, should be removed from the property.

August 9, 2005 – Service review of the Phase I/II EA for Tract 100-003. No OCs were detected in any sample, while one metal (barium) was found in one sample at a concentration exceeding its TEC. The EA report predicted no ecological concerns from contamination on this property. The Service concurs that this property, in its current condition, is suitable for the intended purpose of wetland restoration.

January 19, 2005 – Service review of supplemental Phase II EA for tracts 400-001 through 400-028 and tracts 800-006 through 800-021. This 983-acre property, located in Miami-Dade County, Florida, is comprised of 37 non-contiguous tracts. The majority of the tracts range from 5 to 20 ac, with one (400-002) being comprised of 436 ac, 365 of which is reservoir. Given the contamination magnitude and biased sampling in the earlier EA for these tracts, it was necessary to better determine the spatial extent of contamination on these tracts. The follow-up sampling clearly demonstrated widespread OC contamination that may influence the aquatic invertebrate and fish communities that develops within the future wetland if no corrective actions are implemented. The widespread OC contamination will also present a risk for avian species that might utilize the future wetland without corrective actions. The Service concurred with the supplemental EA's conclusion regarding risk to benthic invertebrates. The Service also concurred with the supplemental EA's conclusion about risk for avian species. The Service had the following recommendations in its review: (1) a complete ERA is needed for areas B through D; (2) an ERA be performed for each DDT analogue rather than for total DDTs; (3) assuming the contractor's 40 micrograms per kilogram (ug/kg) target cleanup level is accurate, Tract 400-005 of Phase II North should be remediated; (4) closer consideration needs to be given to Tract 400-009 since UCLs for several contaminants exceeded SQAG; and (5) expanded sampling in Phase II South due to the biased sampling of the prior EA, and the prior EA's statement that historical agricultural activities in the tracts were a potential concern.

June 8, 2006 – Service review of supplemental Phase II ESA for Lennar Landfill mitigation site. Low levels of metal contamination were detected at the landfill. Arsenic concentrations exceeded the SQAG TEC in 9 of 20 samples. In addition, barium, cadmium, and lead slightly exceeded their respective TEC. A screening level ecological risk assessment predicted no risk (hazard quotients < 1) from metal contamination to any Federal trust resource. OC pesticide contamination was detected from the landfill area. Both alpha- and gamma-chlordane were detected at concentrations exceeding their respective TEC in 4 of 20 samples, one of which also exceeded the PEC. Concentrations of 4,4'-DDE were above the PEC in 1 sample and an additional 10 samples also exceeded the TEC (3.2 pg/kg). A screening level ecological risk assessment predicted no risk (hazard quotient < 1) to any aquatic avian fauna from exposure to the 95 percent UCL concentration of OC pesticides. Further delineation was recommended for sampling location SB-10, where alphaand gamma-chlordane and 4,4'-DDE were above their respective PEC. Several polycyclic aromatic hydrocarbons had calculated 95 percent UCLs above their respective TEC; however, all concentrations were well below the PEC. Since the concentration of pyrene exceeded its PEC, the contractor recommended further delineation for pyrene at the problem location. After reviewing the analytical data, the Service concurred with the recommendation for further delineation at the problem location.

June 8, 2006 – Service review of the Phase I/II ESA for tracts GZ300-011, -013, and -015. Since no evidence of point source contamination exists on the property, only background contamination was assessed. Metals were the most frequently detected contaminants. TECs for effects to benthic organisms were most frequently exceeded for copper, lead, and cadmium. PSI performed food chain modeling for the maximum detected concentration for each contaminant. Only copper resulted in a risk quotient that indicated risk for birds. The ESA report recommended delineation of copper contamination at the location represented by grab

sample P-133, followed by excavation and reuse of the soils elsewhere in the project area where it would not be inundated. PSI also recommended further research into the brownfield area that encompasses Tract GZ300-015. The Service noted and recommended the following: (1) cadmium contamination in the soils may impact benthic community development in the future wetland, (2) due to the overall low contamination level on the property, adverse impacts to aquatic dependent birds that may utilize the future wetland are unlikely, and (3) following the recommended remediation, the property is suitable for its intended purpose.

May 1, 2007 – Service review of the Phase I/II ESA for Tract TA500-018. The only identified potential concern for the property was residual agricultural chemicals from past farming activities. However, no contaminants were detected in any soil sample at concentrations that exceeded SQAG for impacts to benthic invertebrates. Based on these results, the ESA report recommended no further assessment for the property. Provided that the solid waste is removed from the property, the Service concurs that this property is suitable for its intended purpose of wetland restoration.

May 4 2007 – Service review of the Phase I/II ESA for the Deering Estate Powers Parcel. Potential ecological concerns noted upon reconnaissance of the property were several 55-gallon drums with surrounding stained soils, an above ground storage tank, and the nursery where agrichemicals may have been used. The Service does not believe contamination detected to date on the property presents a significant risk to its trust resources. No contamination in soils from the two samples in the area of the future wetland exceeds concentrations that would impact benthic organisms, and while DDE and copper exceed SQAG values in the two samples from the northern half of the property, that portion of the property will not be converted to wetland. Therefore, the Service concurs that the property is suitable for its intended purpose.

June 5, 2007 – Service review of the Phase I/II ESAs for tracts GZ200-005 through 009, TA500-022 through -025, TA500-027 and TA500-054, which comprise 1,613.92 ac along Biscayne Bay just north of BNP in southeast Miami-Dade County. DDE, DDD, and DDT were detected in the composite sample from grid Comp-6 at concentrations exceeding their SQAG PEC. But, since none of these contaminants were detected in the duplicate and split sample from Comp-6, or from any other composite sample from the sampled tracts, the contractor believed the detections were spurious. Copper exceeded its TEC in seven of 138 collected discrete samples, and it exceeded the interim screening value for risk to the Everglade snail kite (*Rostrhamus sociabilis plumbeus*) in one of those discrete samples. The arsenic concentration from Comp-13 exceeded arsenic's TEC. Re-analysis of the discrete samples from Comp-13 revealed that all contained arsenic at concentration exceeding the TEC. Arsenic concentrations across much of the acquired properties exceeded the residential direct exposure soil cleanup target level. Barium was detected in the Comp-13 composite at a concentration that exceeded its TEC. The Service does not believe the arsenic contamination in grid Comp-13 will significantly impact Federal trust resources. The Service agrees that the suspected DDT, DDD, and/or DDE (DDx) contamination in grid Comp-6 should be further investigated. If the concentrations exceed the PEC as indicated by the initial sampling, the contamination should be delineated and remediated. With the possible exception of grid Comp-6, the Service believes contamination on

these properties would present minimal risk to Federal trust resources once the properties are reverted to wetlands.

October 7, 2007 – Service review of "Cutler Flow Way Summary Report" by Professional Services Industries, Incorporated. The Service gave unconditional concurrence on the use of the following parcels for the intended project purpose: TA500-003, TA500-023 through -028, TA500-030 through -033, TA500-039, TA500-053, TA500-062, GZ300-012, and GZ300-013. The Service gave conditional concurrence on parcels TA500-001, TA500-001, TA500-038, and GZ300-015. The Service concurs that DDx contaminated soils on Tracts TA500-002 and TA500-001 should be remediated if the plans for those properties change to include their conversion to wetlands. The current plans for these tracts are unlikely to result in additional risk to Federal trust resources from the DDx contamination. The Service recommends remediation of the copper contaminated soil at sample location P-133 in Tract GZ300-015 prior to rehydrating those soils as part of the project. For TA500-038, the Service recommends confirmatory sampling in soils around the SB-10 location of the Lennar Landfill following soil removal.

October 11, 2007 – Service review of "Cutler Flow Way Summary Report" by Professional Services Industries, Incorporated (PSI). This summary document reported data from a site assessment conducted on properties not previously reviewed by the Service (TA500-028, -030 through -033, -039, -053, and GZ300-012). The Service requested and received the site assessment (dated January 23,2006) for those properties so that it could evaluate together all properties in the CFW project that will be rehydrated (Tracts TA500-022 through -028, TA500-030 through -033, and GZ300-012, -013, and -0 15). The Service agrees that cadmium is not likely to present a direct risk for birds that may utilize the future wetland. However, based on the available data that indicates the average cadmium concentration exceeds the TEC, cadmium may impact development of the future benthic community. The Service recommends remediation of the copper contaminated soil at sample location P-133 in Tract GZ300-015. In a letter dated June 8, 2006, the Service concurred with PSI'S recommendation to delineate and remove the contaminated soils, and then reuse them elsewhere in the project. The delineation sampling showed that the extent of copper contamination is limited and that the amount of soil to be removed should be small. The Service concurs that DDX contaminated soils on Tracts TA500-002 and TA500-001 should be remediated if the plans for those properties change to include their conversion to wetlands. The current plans for these tracts are unlikely to result in additional risk to Federal trust resources from the DDX contamination. The Service recommends confirmatory sampling in soils around the SB-10 location of the Lennar Landfill following soil removal. Following the recommended remediation, contamination remaining on the properties to be rehydrated is unlikely to adversely impact Federal trust resources. Risks from any remaining contamination do not exceed the benefits from eliminating the point source discharges into Biscayne Bay.

November 30, 2007 – Service review of "Phase I and Phase II ESA, Biscayne Bay Coastal Wetlands Parcel: GZ300-039" by Professional Services Industries, Incorporated (PSI). Slated to be incorporated within the Deering Estates Flow-way of the Biscayne Coastal Wetlands Project, Parcel GZ300-039 is a tidally inundated 7.86-acre property located in eastern Miami-Dade County. Minimal environmental concerns were found on this property. A review of historical

records dating to 1923 found no evidence of cultivation. PSI stated no remediation would likely be necessary should this property be utilized for water storage or as a natural area. The Service concurred that the contamination in the soils on this property is unlikely to adversely affect its trust resources.

September 21, 2009 – Service review of "Cutler Flow Way Summary Report for the Biscayne Bay Coastal Wetlands Project, Miami-Dade County, Florida" and Supplemental Cadmium Sampling, Biscayne Bay Coastal Wetlands – Cutler Flow Way, Miami-Dade County, Florida" by Professional Services Industries, Incorporated (PSI). Results of EAs conducted on 19 tracts in the Cutler Flow-way component were described. Based on the inability to verify initial concentrations of metals and the arguments presented by PSI, the Service concurred that concentrations of cadmium and copper are unlikely to present a risk to the benthic community or avian fauna. According to the project construction plans, Tracts TA500-001 and TA500-002 will be the site of an above-grade concrete-lined channel. Because these tracts will not be flooded directly and no water will come in contact with the pesticide impacted soils, there is no ecological concern for Service trust resources. If for any reason the project plans change to include water exposure directly to soils, then the Service recommended corrective actions to remediate the organochlorine pesticide contamination prior to inundation. Based on the corrective actions and confirmatory sampling at SB-10 in Tract TA500-062, the Service agreed that organochlorine pesticide and polycyclic aromatic hydrocarbon impacts have been removed. The Service concurred that no further action is needed for this area.

September 21, 2009 – Service review of supplemental soil sampling report for BBCW Tract GZ100-001 submitted by Professional Services Industries, Incorporated (PSI). This document summarizes the supplemental soil sampling results for metals at this 35.54-acre property, located in southeastern Miami-Dade County. The initial Phase I and II ESA detected concentrations of selenium above the Service's recommended screening value. In addition, concentrations of chromium and mercury exceeded their respective Florida Administrative Code (FAC) Soil Cleanup Target Levels based on leachability to surface water (SCTL-LSW). Resampling across 35.54-acre tract GZ100-001 could not confirm the previously identified selenium concentrations found in the initial Phase I and II ESAs. While the resampling did confirm concentrations of chromium and mercury above the SCTL-LSW, Synthetic Precipitation Leaching Procedure testing indicated that the observed concentrations are unlikely to leach into the surface water at concentrations exceeding the surface water quality criteria. Based on these findings, the Service concurred that the site is unlikely to present risk to Service trust resources and is suitable for its intended purpose as part of the Biscayne Bay Coastal Wetlands Project.

October 20, 2009 – Service review of the "Military Canal Supplement Soil Assessment – 38 Tracts, Biscayne Bay Coastal Wetlands, Miami, Miami-Dade County Florida Report" by Professional Services Industries, Incorporated (PSI). PSI concluded the concentrations of organochlorine pesticides on the property were significantly lower than the previous results found by Langan. PSI recommended further soil sampling across the tracts to further verify their results and confirm that the previous Langan results were not representative. The Service concurred with the conclusions made by PSI and recommended that additional samples be collected from the exact locations where pesticide contamination was identified by Langan. All

future sampling from the subject tracts should also include analysis for total organic carbon. Because the subject tracts are proposed for hydroflow restoration, and not a water storage reservoir or a stormwater treatment area, the Service recommended running the food web model using a dilution factor of 0.5 or greater and accounting for the additive risk for collocated organochlorine pesticides.

October 20, 2009 – Service review of "Phase I ESA, Biscayne Bay Coastal Wetlands, Tracts: TA400-006, TA400-007, TA400-024, Miami, Miami-Dade County, Florida" by Professional Services Industries, Incorporated (PSI). The Service concurred with PSI findings that tract TA400-006 and TA400-007 are unlikely to present risk to Service trust resources upon use in Biscayne Bay Coastal Wetlands restoration. Considering the significant organochlorine pesticide contamination that was identified by Langan and the fact that sampling locations could not be duplicated due to vegetative cover, the Service supported the recommendation for further assessment in tract TA400-024. In addition to the lower concentrations of organochlorine pesticides detected by PSI, the average total organic carbon content was notably lower (5 percent reported by Langan, versus 0.2 percent reported by PSI). Due to this discrepancy, the Service believes that the risk based concentration calculated by Langan needs revision. All future sampling from the subject tracts should also include analysis for total organic carbon. Because the subject tracts are proposed for hydroflow restoration, and not a water storage reservoir or a stormwater treatment area, the Service recommended running the food web model using a dilution factor of 0.5 or greater and accounting for the additive risk for collocated organochlorine pesticides.

C. Additional Involvement

In addition to the above PALs and PARs and review of ESAs, the Service provided the following substantial contributions to the BBCW Project planning. This listing does not include the individual meetings and teleconferences in which the Service participated.

June 05, 2003 – The Service provided a draft of "target end states" (*i.e.,* what we expect the project area to look like after the project is implemented) to the District via e-mail.

March 3, 2004 – The Service provided a revised and compressed performance measure list to the Corps via e-mail. This work, performed by the Service and National Park Service, reduced the number of performance measures from over 50 to around 20, by eliminating duplicity and redundancy.

March 10, 2004 – The Service provided written a review of the "Existing Conditions" section for the Feasibility Scoping Meeting (FSM) document to the Corps via e-mail.

July 29, 2004 – The Service provided a revised "Problems and Opportunities" section for the FSM document to the Corps via e-mail.

August 10, 2004 – The Service provided documentation sheets for two performance measures (2B and 2C) developed by the Service to the Corps via e-mail.

August 19, 2004 – The Service provided a draft ecological benefits analysis method to the Corps via e-mail.

October 15, 2004 – The Service provided written comments to the Corps via e-mail regarding the FSM document.

November 10, 2004 – The Service provided written responses to the Corps via e-mail regarding CESAJ-OC and CESAJ-PD-PN comments on the FSM document.

January 6, 2005 – The Service submitted to the PDT alternative development sub-team a written description and maps for Alternative E.

January 13, 2005 – The Service provided to the Corps via e-mail a detailed description, including maps of Alternative E. Salient features of this alternative included 90 percent existing water capture, reservoirs and STAs for water storage and treatment, and decompartmentalizing the project area by backfilling L-31E and North Canal.

January 18, 2005 – The Service submitted to the Corps a revised and reformatted written description and maps for Alternative E.

January 24, 2005 – The Service sent to the Corps a letter listing all federally threatened and endangered species known to exist or potentially exist in the project area. Federally listed species in the project area include, but may not be limited to, the Florida panther (*Puma concolor coryi*), West Indian manatee, American crocodile, wood stork (*Mycteria americana*), bald eagle (*Haliaeetus leucocephalus*), eastern indigo snake (*Drymarchon corais couperi*), and Schaus swallowtail butterfly (*Heraclides aristodemus ponceanus*). Listed plant species of concern included Johnson's seagrass (*Halophila johnsonii*), tiny polygala (*Ploygala smallii*), crenulate lead plant (*Amorpha crenulata*), endangered deltoid spurge (*Chamaesyce deltoidea* ssp. *deltoidea*), endangered Small's milkpea (*Galactia smallii*), and threatened Garber's spurge (*Chamaesyce garberi*). The letter also noted that critical habitat for the American crocodile and the West Indian manatee lie within a few miles of the project area.

March 1, 2005 – The Service sent an e-mail to the Corps supporting and justifying the removal of the L-31E Canal as a viable feature to include in Alternative E. The L-31E Canal compartmentalizes the landscape and disrupts the natural sheetflow of freshwater across the system.

March 24, 2005 – The Service e-mailed the Corps recommending performing some dry runs of scoring performance measures using actual model output. The Service provided recommendations of how to complete this exercise.

April 12, 2005 – The Service forwarded to the Corps via e-mail three sub-sections of the Existing Condition section of the PIR that were reviewed and revised by the Service lead

biologist for the project. Those sub-sections included: Section 3.8 Vegetation; Section 3.9 Fish and Wildlife, and Section 3.10 Threatened and Endangered Species.

April 21, 2005 – The Service e-mailed the Corps recommendations for revising WASH123D model post-processing procedures. The Service provided a second e-mail on the same date recommending an alternate wading bird performance measure for the project.

May 5, 2005 – The Service sent to the Corps and PDT benefits sub-team a copy of the draft vegetation map of the project area developed by the Service.

May 13, 2005 – The Service submitted to the Corps via e-mail a draft of the Future Without Project scenario for vegetation, fish, and wildlife.

June 28, 2005 – The Service e-mailed to the Corps and PDT ecological sub-team a memo addressed to the CERP Restoration Coordination and Verification (RECOVER) Leadership Group asking RECOVER for assistance in determining the water availability for the BBCW Project and the viability of reused wastewater as an option for additional water for the project.

August 8, 2005 – The Service e-mailed the Corps and ecological sub-team members draft targets and the rationale for those targets for four BBCW ecological performance measures.

August 19, 2005 – The Service provided via e-mail to the Corps and ecological sub-team the list of eight primary creek systems to be restored by the project.

August 24, 2005 – The Service provided via e-mail to the Corps and ecological sub-team the rationale and specifications for the project's freshwater marsh performance measure.

October 13, 2005 – The Service e-mailed the Corps some of our concerns and responsibilities regarding contaminants in the project area.

October 19, 2005 – The Service sent via e-mail to the Corps and District copies of Service reviews of EAs conducted on various tracts in the project area.

November 2, 2005 – The Service provided via e-mail to the Corps our hydrologist's review of the latest WASH123D model output.

December 20, 2005 – The Service provided by e-mail to the Corps some of our primary concerns regarding the latest WASH123D model output.

January 3, 2006 – The Service provided to the Corps and District via e-mail some concerns and process regarding water assurances as provided by a Service hydrologist.

January 6, 2006 – The Service provided to the Corps, District, FDEP, NPS, and Miami-Dade Department of Environmental Resources Management (DERM) via e-mail a copy of the ecological benefits method paper developed by the Service lead biologist for the project.

January 6, 2006 – The Service provided to the Corps via e-mail some of the procedures required for post processing the WASH123D model output according to performance measure specifications.

January 25, 2006 – The Service sent an e-mail to the PDT benefits sub-team with an update on the GIS analysis of some of the benefits metrics and described how the Service proposed to handle the vegetation classes of the non-native vegetation metric. The e-mail included other issues and concerns with the analysis.

January 30, 2006 – The Service sent an e-mail to the PDT benefits sub-team the spreadsheet containing the GIS analysis components of the ecological benefits matrix.

March 21, 2006 – The Service sent by e-mail to the Corps, DERM, and Everglades National Park (ENP) the revised ecological benefits matrix.

March 21, 2006 – The Service sent an e-mail to the Corps expressing concerns the PDT benefits sub-team had about estimated cost for certain project features.

March 21, 2006 – The Service sent to the Corps a draft narrative description of the Multi-criteria Decision Matrix (*i.e.,* the ecological benefits analysis).

March 23, 2006 – The Service sent an e-mail to the Corps cautioning the use of the WASH123D model to determine land acquisition needs, given the model's apparent problems and poor review by the Interagency Modeling Center.

March 27, 2006 – The Service submitted via e-mail to the Corps suggested expansion of the Multi-criteria Decision Matrix.

March 31, 2006 – The Service submitted its scoring for the expanded Multi-criteria Decision Matrix to the Corps via e-mail.

April 4, 2006 – The Service sent to the Corps via e-mail the revised rankings and justifications for the expanded project benefits matrix.

April 6, 2006 – The Service sent to the Corps via e-mail information on ecological response times for the three ecological zones in the project area.

April 12, 2006 – The Service sent an e-mail to the Corps questioning the Quarterly Review Board's direction regarding the C-111 Spreader Canal (C-111SC) Project and noted that the most recent recommended alignment of the C-111 spreader would match up with the BBCW Alternative Q spreader in the northern Model Lands area.

April 26, 2006 – The Service sent to the Corps and other PDT members the list of bullets that describe why Alternative Q is superior to Alternative M.

June 28, 2006 – The Service participated in an aerial overview of the project area with PDT members.

July 24, 2006 – The Service made a site visit to the project area with staff from the Florida Marine Research Institute to determine optimum oyster monitoring locations.

September 26, 2006 – The Service submitted a request to the CERP Remote Sensing Sub-team to review the draft BBCW vegetation monitoring plan.

October 5, 2006 – The Service submitted to the Corps and District a copy of the draft BBCW ecological monitoring plan for their review.

November 1, 2006 – The Service sent via e-mail to the Corps and District a table of the draft BBCW ecological monitoring plan cost estimates.

December 28, 2006 – The Service sent via e-mail to the Corps and District a revised draft BBCW ecological monitoring plan.

April 19, 2007 – The Service submitted via e-mail to the Corps our comments on the draft BBCW formulation strategy paper prepared by the Corps.

April 25, 2007 – The Service submitted via e-mail to the Corps additional comments on the BBCW Phase 1 formulation strategy paper.

May 14, 2007 – The Service submitted to the Corps via e-mail an ecological benefits method section for inclusion in the BBCW Phasing formulation strategy paper being prepared by the Corps.

June 12, 2007 – The Service submitted via e-mail to the Corps a detailed narrative description of the method used for determining ecological benefits for the project.

June 12, 2007 – The Service submitted to the Corps via e-mail maps showing location of freshwater wetland storage benefits.

June 19, 2007 – The Service submitted via Documentum to the Corps a review and comment on Tab 5 of the Alternative Formulation Briefing (AFB) document.

June 21, 2007 – The Service submitted via Documentum to the Corps a review and comment on Tab 2 of the AFB document.

August 7, 2007 – The Service submitted via Documentum to the Corps a review and comment on Appendix G of the AFB document.

August 7, 2007 – The Service submitted to the Corps via e-mail a written description of how and why the additional features to be included in Phase 1 of the project were determined, and how each of these features will increase ecological benefits for the project and provide valuable adaptive management information and direction.

August 17, 2007 – The Service submitted a letter to the Corps declining the invitation to become a cooperating agency for the development of the EIS on the BBCW Project.

August 30, 2007 – The Service sent to the Corps and District via e-mail a revised draft BBCW ecological monitoring plan. The revision incorporated the latest information on monitoring being conducted by the RECOVER Monitoring and Assessment plan in the project area.

October 16, 2007 – The Service provided comments to the Corps via e-mail on the Corps' Internal Technical Review of the project. The primary Service concern was the proposed phasing of the project and possible NEPA conflicts.

November 29, 2007 – The Service provided to the Corps a revised version of the ecological benefits method description to address concerns raised by the Corps' Internal Technical Review of the AFB document.

December 3, 2007 – The Service participated in the AFB where we voiced support for the project and expressed concern about certain issues to Corps South Atlantic Division and Washington Headquarters staff.

January 4, 2008 – The Service provided to the Corps via e-mail complete written documentation for two of the project's ecological performance measures.

January 16, 2008 – The Service provided to the Corps via e-mail a detailed wetland functional analysis for the freshwater wetland area that will be included in Phase 1.

January 23, 2008 – The Service participated in the follow-up AFB meeting with Corps South Atlantic Division and Washington Headquarters staff.

January 30, 2008 – The Service provided to the Corps via e-mail the quantified values for Performance Measure 7 and 8 for each project alternative.

March 18, 2008 – The Service provided to the Corps and District via e-mail a review and comment on the Draft Project Operations Manual.

April 15, 2008 - The Service provided to the Corps and District via e-mail a review and comment on the Draft Project Assurances document.

April 30, 2008 – The Service and ENP staff made a site visit to the North canal freshwater wetlands restoration component to survey ditching and connections with adjacent conveyance canals.

August 5, 2008 – The Service provided to the Corps all relevant paleoecological information on the project area.

August 8, 2008 – The Service participated in the District's Environmental Monitoring Coordination Team's review of the BBCW monitoring plan.

August 25, 2008 – The Service submitted a revised project adaptive management plan.

January 26, 2009 – The Service conducted an indigo snake survey in support of the Endangered Species Act consultation.

February 2, 2009 – The Service submitted comments on the CBEEM (benefits calculation method) presentation to the Corps.

March 30, 2009 – The Service conducted an indigo snake survey in support of Endangered Species Act consultation.

April 29, 2009 – The Service responded to comments on the external review of the CBEEM (benefits calculation method).

May 8, 2009 – The Service provided written responses on the District's Technical Review Briefing comments on the draft PIR.

June 3, 2009 – The Service submitted recommended revisions to the draft project ecological monitoring and adaptive management plans resulting from the District's review of the draft PIR.

July 7 and 11, 2009 – The Service provided comments to the Corps on the anticipated sea level rise effects on the project drafted by the Corps.

September 1, 2009 – The Service participated in a workshop to discuss the seasonal groundwater drawdown effects on the project area.

November 18, 2009 – The Service provided an Endangered Species Act informal consultation concurrence letter to the Corps.

January 21, 2010 – The Service provided technical responses to the Independent External Peer Review of the draft PIR.

January 25, 2010 – The Service participated in the panel discussion of the Independent External Peer Review of the draft PIR.

April 5, 2010 – The Service revised components of the project's ecological monitoring plan.

III. AREA SETTING

A. Project Location

The BBCW Project is located in southeast Miami-Dade County along the lower east coast of the Florida peninsula. The general geographic extent of the project is along the mainland coast of central and southern Biscayne Bay from Shoal Point near C-100 and the Deering Estate, south into undeveloped areas southeast of Homestead and Florida City known as the Model Lands. A number of conveyance canals, constructed as part of the Central and South Florida Flood Control (C&SF) Project and the South Dade Conveyance System, compartmentalize the northern half of the project area and serve as drainage conduits for the local watershed. These canals include, from north to south, the C-100, C-1 (Black Creek Canal), C-102 (Princeton Canal), Military Canal, C-103 (Mowry Canal), Florida City Canal, and North Canal. Perhaps more importantly, L-31E bisects the northern half of the project area, effectively creating a barrier to the historic west-to-east sheet flow. Conveyance canals serving the Model Lands area include the Florida Power and Light Canal, Card Sound Canal, and the C-111. All sub-basins in the project area are isolated from one another to varying degrees due to roads, levees, and canals. Extensive mosquito ditching exists in many areas that cause disruption of natural flow patterns within sub-basins.

The BBCW Project area encompasses a combination of degraded and relatively unimpacted submerged and wetland habitats. These include primarily seagrasses, mangrove forests, coastal herbaceous flats, freshwater wetlands, and non-native dominated wetlands. Areas north and northwest of the project area are heavily urbanized, whereas agriculture dominates the land use west of the project area. Significant anthropogenic features adjacent to the project area include Homestead Air Reserve Base, FPL's Turkey Point Power Plant, extensive landscape nursery plant farms, and expanding residential development.

B. Description of Study Area

1. Hydrological and Hydrodynamic Description

a. Ground and Surface Water

Subsurface hydrogeologic conditions in Miami-Dade County can be basically defined as a shallow surficial aquifer, named the Biscayne aquifer, which overlies the Floridan aquifer system. The Biscayne aquifer is exceptionally permeable, with some of the highest transmissivities (*i.e.,* ability of water to move vertically and laterally through the substrate) lying within the project area. Under predevelopment conditions in western Miami-Dade County, water entered the gray limestone aquifer by lateral movement from Broward and Collier counties, and by downward seepage from the Everglades and the Biscayne aquifer, and moved southward and southeastward into Miami-Dade County to coastal discharge areas. Circulation in the Biscayne aquifer inland also was primarily to the south and southeast. In eastern Miami-Dade County, the seasonal ground-water ridge that formed under predevelopment conditions supported both easterly and westerly ground-water flow away from the ridge axis (Fish and Stewart 1991).

Ground water discharge to Biscayne Bay occurs in two ways: seepage from the aquifer and flow through subsurface leakage channels (Parker et al. 1955). A zone of seepage occurs around the periphery of the bay where the water table elevation is above sea level. Prior to the construction of drainage canals, this zone was characterized by the presence of numerous springs along the shore. Springs that formerly emanated from the bottom of Biscayne Bay and a number of those that flowed along the shore are attributable to ground water discharges through natural leakage channels occurring in the rock formations. Photographs and historical records from the late 1800s indicate that some of the springs issuing from the bottom of the bay were sufficiently vigorous as to allow the collection of drinking water for ships (Halley and Evans 1983), and were estimated to flow at a rate of 100 gallons per minute (Fuller 1904). Such flows, however, occurred under conditions of high water stages west of the coastal ridge to within 3 miles of Biscayne Bay (Parker et al. 1955). Early observations (circa 1890) put the elevation of the surface water at about 10 feet (ft) above mean sea level behind the coastal ridge. The difference between the wet and dry season water elevation behind the coastal ridge was estimated to be 5 to 8 ft (Shaler 1890), and that most of the water drained through sink holes in the exposed limerock. Current average water elevations at the coastal ridge are controlled at less than 3 to 4 ft above mean sea level in the project area year round. Present day rates of ground water discharges to Biscayne Bay are evidently insufficient to produce flowing springs that can be easily identified. Overall, surface water makes up the largest input of freshwater to Biscayne Bay within the project area, however, groundwater becomes proportionally the greatest influence at the end of the dry season, typically in April and May. Operation of the drainage system has modified the water stage recession rates. For example, after the construction of the C-1 canal, the stage recession rate east of the coastal ridge doubled from about 0.2 ft per day to 0.4 ft per day (Leach et al. 1972).

A complex water-management system, part of the C&SF Project, was developed to modify much of the natural environment to human needs. Drainage resulting from extensive canal systems and large-scale pumping from municipal well fields has greatly altered the predevelopment flow system in eastern Miami-Dade County by: (1) eliminating or greatly reducing a seasonal and coastal ground-water ridge; (2) reducing deep circulation; (3) reducing or eliminating seasonal westward movement of ground water; (4) causing accelerated stormwater runoff and short ground-water flow paths; and (5) generally lowering the water table and inducing saltwater intrusion.

b. Primary Drainage Basins

The project area receives flows from two distinct but interconnected drainage systems associated with the C&SF Project: (1) the South Dade coastal drainage area and (2) the South Dade Conveyance System drainage area. The primary South Dade drainage system is composed of three major canals that extend from Levee L-31N, which forms the East Everglades Area, to Biscayne Bay. These three canals include C-1, C-102, and C-103 (Fig. 1). Five additional smaller canals (C-100, Military Canal, North Canal, Florida City Canal, and Model Lands Canal) provide drainage from the coastal sub-basins to the bay. The South Dade Conveyance System

drainage area is defined by the C-111 and Model Lands basins, which discharge into Manatee Bay and Barnes Sound at the extreme southern end of Biscayne Bay.

Surface water in the coastal drainage area is controlled by coastal structures associated with the conveyance canals. Operation of the coastal gates controls the quantity and timing of surface water discharged into Biscayne Bay. The canals and control structures provide the following primary functions: (1) provide flood protection and drainage, (2) supply water for irrigation and to recharge wellfields of local municipalities, and (3) maintain ground water table elevation adequate to prevent saltwater intrusion into local ground water (Cooper and Lane 1987; Alleman et al. 1995). Optimal operating stages in this water management area at the coastal structures range from 1.4 to 3.5 ft National Geodetic Vertical Datum (NGVD) in the dry season and 2.2 to 3.5 ft NGVD in the wet season. A general description of each basin and operation of the canals and control structures is provided below (moving north to south).

C-100 Basin. The C-100 Basin, also known as the Cutler Drainage Basin, has an area of 40.6 square miles (mi^2) that is primarily urban land. Four C&SF Project canals and six control structures operate in the basin. Discharge to Biscayne Bay is through C-100 via S-123. Note that all coastal structures associated with canals discharging to the bay in the project area are gated spillways. The other three canals are tributary to C-100.

C-1 Basin. The C-1 system drains 56.9 mi^2 of mostly urban and some agricultural land. Also known as Black Creek, the C-1 Canal flows to the southeast with discharge to the bay via S-21. Five C&SF Project canals and ten control structures operate in this basin.

C-102 Basin. This basin has an area of 25.4 mi^2 that is a mix of urban and agricultural land use. It includes two C&SF Project canals and four water control structures. The C-102 Canal, also known as the Princeton Canal, flows to the southeast and discharges to the bay via the S-21A structure.

Military Canal Basin. This basin primarily drains Homestead Air Reserve Base and is only 4.7 mi^2 in area. Water from the base is pumped into the canal. Flow in Military Canal is to the east with discharge to the bay through S-20G.

C-103 Basin. The C-103 Basin (40.6 mi^2) is being converted from mostly agricultural land to urban development. Three C&SF Project canals and five water control structures operate in the basin. The C-103, or Mowry Canal, is the outlet to the bay. It flows southeast and discharges to the bay via the S-20F, which is a gated spillway structure located 685 yards west of the bays' shore.

North Canal Basin. The North Canal drains 7.8 mi^2 of primarily agricultural land. Flow in North Canal is to the east into the L-31E Canal with discharge to the bay via C-103 and S-20F.

Florida City Canal. The Florida City Canal drains a 12.5 square mile section of southeastern Miami-Dade County. Flow in the canal is to the east and into the L-31E with discharge to the Bay via C-103 and the S-20F.

Model Land Basin. The Model Lands Basin covers 60.9 mi^2 of mostly undeveloped wetland. Water in the basin is drained primarily by the L-31E canal, which is then routed south around FPL's Turkey Point Power Plant and is discharged into Card Sound via S-20.

C-111 Basin. The C-111 Basin is 100 mi^2 in area. Seven C&SF Project canals and twelve water control structures are associated with the basin. The C-111 Canal is the primary conveyance conduit. Water flows southeast through this canal and discharges into Manatee Bay via S-197.

In addition to the above canals, a coastal levee system (L-31E) was constructed in the mid-1960s to protect low-lying lands from storm surge and saltwater intrusion. The L-31E canal and levee system runs north to south along most of the project area. It connects with C-1, C-102, Military Canal, C-103, North Canal, and Florida City Canal just landward of the water control structures for each of these lateral canals. Because of its north-south orientation, the L-31E acts as a barrier to natural sheet flow and east-west flow through former creek systems in the project area.

In addition to the barrier to natural flow caused by L-31E, the project areas contains an extensive mosquito and drainage ditch system that interferes with historic flow patterns in much of the project area between Shoal Point and Turkey Point. This ditch system is a gridwork of relatively shallow (less than 3 ft deep), closely spaced, north-south oriented mosquito ditches that are crossed by larger, deeper (up to 6 ft deep), and more widely spaced (every 400 yards) east-west oriented drainage ditches. Rock pits, berms and roads also affect the hydrology within the project area. Prior to development of drainage systems, surface flow to south central Biscayne Bay followed a general topographic gradient from west to east. The sloughs and marshes of the Everglades drained through the topographically higher coastal ridge. Low falls occurred where these shallow rivers broached the limestone bedrock. From the coastal ridge to the bay, these shallow rivers formed a zone of wetlands and creeks. As a result, freshwater wetlands extended to a narrow fringe of mangroves at the shoreline of the bay.

c. Hydrodynamics of south central Biscayne Bay

Six regions of Biscayne Bay are hydrodynamically distinct due to unique physical features such as volume, tidal inlets and bottom bathymetry. Freshwater inflows vary substantially between the regions as well. The south central region of Biscayne Bay coincides with the project area, which includes BNP, and the freshwater flows from the adjacent watershed. Most of the south central portion of Biscayne Bay is separated from the Straits of Florida by barrier islands. The south central region of the bay is well-mixed, vertically homogeneous area with salinity contours that run in a north to south direction, roughly parallel to the western shoreline. Tides range to 1.6 ft over the Featherbed Bank—the bank that separates southern Biscayne Bay from Card Sound (Swakon and Wang 1977). Tidal exchange occurs primarily through narrow cuts between the barrier islands to the south and over a series of shoals to the north. Wind speed and direction strongly influence the direction of currents, particularly the along the western shore, because of the shallow depths. The predominant wind directions are from the east and southeast, consistent with the direction of tropical low pressure systems occurring in the wet season. Higher wind speeds are associated with wind from the east and northeast and are typically associated with

high-pressure systems occurring in the dry season. Southeasterly winds cause a northerly nearshore current along the western shore and pockets of low salinity form as these currents are entrained behind points of land.

The rate of water exchange in south central bay is primarily controlled by tidal fluctuations and wind driven circulation due to the large amount of open water and long fetch (Miami-Dade County Planning Department 1986). Estimated residence times for this area are from 6 to 22 days. South central bay has a smaller tidal range than the more northern portions of the bay and has correspondingly smaller tidal velocities, less circulation and longer residence times. Partly due to these factors, hypersaline conditions commonly occur at the end of the dry season (Lee 1975). Freshwater inflows play a role in balancing evaporation and oceanic exchange in near shore areas during these events.

Vertical stratification has been observed along the western shore after periods of large freshwater inflow from drainage canals. Nearshore salinity can be strongly affected by freshwater discharges for up to 4 days, and influenced for a period of 16 days (Luo and Serafy 2002). Central bay salinity is not substantially affected by freshwater discharges over short periods of time; high levels of freshwater inflow must be sustained over days to affect persistent salinity levels.

2. Geology and Soils

The geological conditions of the BBCW will be limited to the units encountered within the Biscayne Aquifer, principal aquifer in the south Miami-Dade County area. The Biscayne Aquifer is a hydrologic unit of water bearing rocks ranging in age from lower Pleistocene to upper Pliocene. The geometry of the aquifer deposits is a seaward thickening wedge that varies from zero ft at the western boundary of Miami-Dade County to a maximum of 240 ft thick at the coast. The aquifer is comprised, from top to bottom, of parts or all of the following formations: (1) Lake Flirt Marl; (2) Miami Oolite; (3) Anastasia Formation; (4) Key Largo Limestone; (5) Fort Thompson Formation (the southern part); and (6) Caloosahatchee Marl. The base of the Biscayne Aquifer is determined as the top of the low permeability sand (marl) of the Tamiami Formation.

The Lake Flint Marl, Miami Oolite, Fort Thompson and Anastasia Formations are all Pleistocene in origin. Lake Flint Marl underlies the organic (peat) soils throughout much of the Everglades and coastal marshes age and may be up to six ft thick. It is relatively impermeable, composed primarily of calcareous mud with some areas of dense limestone. Unlike the Lake Flint Marl, Miami Oolite and Fort Thompson Formations are both highly permeable. The Miami Oolite underlies the Atlantic Coastal Ridge south to, and beyond, Florida City; it floors Florida Bay and reappears above water level in the lower Florida Keys from Big Pine Key to Key West. It is thickest along the Coast, reaching a maximum thickness of 40 ft, but its base is seldom below 20 ft below sea level. The oolite contains quartz sands that fill mostly vertical solution holes and channels. As a result, vertical permeability is high whereas the horizontal permeability is lower. The Fort Thompson Formation consists of alternating beds of marine, brackish and freshwater limestone that overlie the Caloosahatchee Marl. This formation covers the greatest geographical

expanse of all Quaternary formations in southern Florida. The Anastasia Formation may be at least 39 ft thick along the coast, and can be divided into two distinct facies, a coquina facies representing a high-energy offshore bar environment, and a shell rock facies between the offshore bar complex and the shoreline.

Several soil types exist in the project area, including peat, Everglades peat, Lake Flirt Marl, and weathered Miami Oolite. Each is fine grained and varies in thickness from a foot to about ten ft thick. The hydraulic conductivity for these materials is low. The basic soil types found in the coastal areas and creeks of Biscayne Bay are: 1) marl, 2) marly peat, 3) red mangrove peat, 4) black mangrove peat, 5) sandy mud, and 6) skeletal sand gravel. The marls are predominately calcium carbonate, and form dense, impermeable sediments with either a freshwater or low salinity gradient. A carbonate mud rich red mangrove peat (marly peat) rarely more than four inches (in) in thickness was found at the surface in small areas near the center of large basins which lacked dense mangrove cover. Red mangrove peat was found at the surface throughout almost all of the coastal wetlands. Black mangrove peats were found as thin shoestring deposits along old tidal creeks and behind the coastal levee. Black mangrove peat differed from red mangrove peat in a black rather than red color, and the presence of pnuemataphores (black mangrove root system), as well as root material as common soil constituents.

Offshore of the fringing mangroves along most of the coastline was a thin marine mud or inundated red mangrove peat, which was exposed during most wet season low tides and most of the dry season. This narrow zone frequently had little aquatic vegetation cover. The bottom deepened at a fairly constant rate from the shoreline to the depth of approximately 50 in, where the water depth increased at a faster rate. In the estuarine zone, a gray to light brown, sandy mud with varying amounts of marine mollusk skeletal material was the dominant surface sediment type. Oyster gravels with a matrix of marine sand and mud form, thin, local lenses and one sizeable oyster bar were found.

Vertical soil sequence recorded two basic, highly repetitive sequences. The first sequence, found throughout the coastal wetlands, is indicative of a condition progressively becoming more saline with decreasing freshwater discharge. In this sequence, freshwater marl was replaced rapidly upwards into a transitional marly peat (0 to 4 in thick), and then to a surface red mangrove peat. The second repetitive vertical sequence was found in the near shore area. In this sequence either freshwater marl, or more saline red mangrove peat, was overlain by marine skeletal rich sandy mud. The contact between the two strata was usually sharp. The marine sandy mud was usually less then 16 in thick and frequently included thin (1 to 3 in) oyster skeletal lenses.

The significance of soil type to the BBCW Project lies mainly in its ability to serve as a barrier to prevent water from being transmitted from the ground surface to the highly porous limestone beneath. Generally, in the areas where freshwater storage features were planned, soils consist mainly of a thin layer of marly peat which is a soil type that is permeable to water. Thus, freshwater storage features would have to be lined with some type of impermeable material to be effective.

3. Land Use

Existing land use within the study boundaries varies widely from agriculture to high-density multi-family and industrial urban uses. Urban development is generally concentrated along the lower east coast of Miami-Dade County. Although there remains substantial agricultural acreage in southwestern Miami-Dade County (90,000 ac), rapid population growth and land development practices have resulted in western urban sprawl; the predominant land use is single-family residential. The once rural population in the western areas of Miami-Dade County is rapidly evolving into an urbanized population. The FPL's Turkey Point Nuclear Power Plant is located on the shoreline near the project area. Some water used in the reactor is piped in from the Miami-Dade municipal water supply. A separate supply of water that cools the turbine steam supply for reuse comes from a supposedly closed system of 36 interconnected canals totaling over 168 miles on length.

The existing use of the land that is being purchased primarily consists of mixed open land with active agriculture, fallow fields, and degraded or high quality wetlands. Homestead Air Reserve Base borders a portion of the study area on the west, and BNP borders the study area on the east. Inside the study area boundary there is a landfill towards the northern end of the study area as well as a water treatment facility. The majority of the agricultural land use is ornamental trees and nursery crops. Row crops in or near the project area are now rare.

A large portion of the study area remains natural, although much of it is disturbed. The dominant natural features are the federally protected ENP and BNP, along with Biscayne Bay and remnant freshwater and coastal wetlands and upland systems within and adjacent to the developed areas along the coast.

4. Water Quality

The FDEP currently classifies Biscayne Bay as an Outstanding Florida Water. This designation prohibits the permitting of activities that would cause a degradation of water quality. The two predominant factors controlling the water quality of the central and southern portions of Biscayne Bay are mixing of bay waters with ocean waters and the discharge of freshwaters through the seven coastal canals. Because central Biscayne Bay is relatively open to the ocean on the eastern side, the residence time of water in this portion of the bay is shorter than the residence times for the southern or northern portions of the bay. Due to frequent flushing, water quality in the central portion of the bay is less impaired than the northern or southern portions of the bay.

In general, water quality ranges from severely degraded in the Miami River to excellent near the Featherbed Banks in southern Biscayne Bay (Alleman et al. 1995). Caccia and Boyer (2005) estimated nutrient loadings into the bay (Table 1) and recognized that the dissolved inorganic nitrogen load (64 percent of total) into Biscayne Bay is mostly from canals draining into southern Biscayne Bay (the project area) and the total phosphorous load (70 percent of total) is from canals in the northern part of the bay.

Water quality in South Dade canals associated with the BBCW Project is governed by the predominant land-use in each canal basin. In the northern portion of the project study area, the predominant land use is urban residential. The predominant land use of the basins in the southern portion of the project study area is agriculture. In general, many of the canals are impaired or have elevated concentrations of trace metals (arsenic, cadmium, chromium, copper, cyanide, lead, mercury, and nickel), specific conductance, dissolved oxygen, chlorophyll a, fecal and total coliforms, fluoride, and turbidity (FDEP 2005). In Table 2, average pollutant concentrations were calculated using Miami-Dade DERM data from one sampling location for each major canal in the project area. Sampling stations were located upstream of the tidal control structure in each canal. Black Creek (C-1) and Goulds canals have elevated ammonia and total phosphorus concentrations and low dissolved oxygen levels relative to the other South Dade canals, which is caused by polluted groundwater that seeps into the canals from the landfills. The C-103 and C-102 canals contain elevated levels of nitrate/nitrite that enter these canals from nearby agricultural areas. The Military Canal drains the lands of the former Homestead Air Force Base and is a major source to the bay for trace metals, polychlorinated biphenyls, and polycyclic aromatic hydrocarbons (Caccia and Boyer 2005).

Other water quality data obtained by Miami-Dade DERM and Florida International University indicate that target concentrations for ammonia and total phosphorus, as established by the Biscayne Bay Partnership Initiative (Murley and Moure 2001), are largely being met in nearshore, inshore and main bay areas of central Biscayne Bay. However, canal mouth, nearshore, and inshore areas of central Biscayne Bay often exceed the established target nitrate/nitrite concentration of 0.020 mg/L, and some nearshore stations exceed this target more than 50 percent of the time. Stations located in the eastern portion of the bay exceed the 0.010 mg/L target less than 20 percent of the time.

Available water quality data also suggest the existence of pollutant "hotspots" such as Black Point. Black Point is the location of the currently operating South Dade Landfill and a former Dade Landfill that has been closed and partially remediated in recent years. In the Black Point area, ammonia concentrations in nearshore groundwater may be up to 30 times greater than found in the overlying surface water (Meeder et al. 1997), which may be related to observed shifts in the benthic community structure in this nearshore area (Meeder and Boyer 2001). Although the link between elevated ammonia concentrations and altered benthic community structure in this area could not be conclusively demonstrated, ammonia in combination with other pollutants may create unfavorable conditions for turtle grass (*Thalassia testudinum*) (Meeder and Boyer 2001). Related ongoing research at Florida International University is currently underway to quantify groundwater nutrient loading to the nearshore areas of the bay. Nearshore groundwater seepage in the area between Black Point and C-103 contained higher levels of other nutrients such as phosphorus, total nitrogen, and organic carbon (Mir-Gonzalez and Boyer 2003), which may result from landfill leachate (Meeder and Boyer 2001).

5. Ecological Description

This section provides an overview of existing ecological conditions in the project area. Habitat types are described mainly in the context of vegetation types that dominate a given area. General

information on vertebrate and invertebrate wildlife utilization of those habitat types is provided. The discussion of wildlife resources includes only vertebrate species that have been observed or are anticipated to occur in or near the project area; invertebrates are not addressed in this sub-section. For a complete vertebrate species list compiled from various area surveys and reports see Service (2004).

Generally, five habitat types dominate the project area. They include submerged aquatic vegetation (primarily seagrasses), mangrove forests, coastal herbaceous flats, freshwater wetlands, and non-native dominated wetlands (primarily wetlands dominated by Australian pine [*Casuarina* sp.] or Brazilian pepper [*Schinus terebinthifolius*]). Of these, mangrove forests cover the majority of the project area north of Turkey Point, while herbaceous flats occupy the majority of the project area south of Turkey Point in the area known as the Model Lands. A brief description of these five habitat types, and their associated wildlife value, are provided below. It should be noted that other habitat types exist in the project area, such as tree islands, but as they occupy only a small fraction of the project area, they will not be described in this document.

a. Seagrasses

Ecosystem function of the bay is supported by seagrass beds consisting of turtle grass, shoal grass (*Halodule wrightii*), manatee grass (*Syringodium filiforme*), and mixed hardbottom species of plants and animals. Seagrass comprises the major benthic plant community and source of primary productivity in Biscayne Bay (Thorhaug 1976). These highly productive seagrass beds are important not only in terms of the plant biomass produced to supply the bay food web, but also as a physically stable refuge and nursery ground for fish, shrimp, crabs, and their predators (Zieman 1982; Thayer et al. 1984; Kenworthy et al. 1988). There are tens of thousands of acres of seagrass beds and hard bottom communities in the bay that are at risk from degraded inflow water quality.

Turtle grass predominates in central and southern Biscayne Bay (Alleman et al. 1995), although shoal grass is relatively common along the western shore. Widgeon grass (*Ruppia maritima*) is also found along the bay's western nearshore areas, although it is relatively sparse. Manatee grass is also relatively sparse in this area of the bay. Unpublished data collected by the Miami-Dade DERM indicates that turtle grass blade densities can exceed 2,000 per square meter (2,392 per square yard) in the bay, with a pronounced seasonal variability. During winter months blade densities decrease to approximately 50 to 60 percent of the summer maximum.

Species diversity and densities of organisms are typically high in seagrass beds. Numerous species of small shrimp, crabs, worms, clams, snails, and echinoderms inhabit these areas. The majority of commercial and recreational fish species spends at least some portion of their life histories using seagrass beds or relies on their products (Laney 1997). Other commercial fishery species, such as stone crab (*Menippe mercenaria*), various shrimp species, and spiny lobster (*Panulirus argus*) depend on seagrass for both nursery and adult habitat. Seagrass meadows also provide habitat for other species, including wading birds, waterfowl, and manatees.

b. Mangrove forests

The dominant coastal wetland community along the mainland shore of the project area is mangrove forest. Mangroves are shoreline trees that live in the intertidal zone and form an extensive forest of emergent shoreline vegetation. Four species of trees are considered to comprise the mangrove community in south Florida: red mangrove (*Rhizophora mangle*), white mangrove (*Laguncularia racemosa*), black mangrove (*Avicennia germinans*), and buttonwood (*Conocarpus erectus*). The majority of this mangrove forest is contiguous, forming a habitat corridor for coastal wildlife.

Most of the mangrove habitat in the project area can be subdivided into four forest types (Gaiser and Ross 2003). Closest to the bay shoreline is the coastal mangrove forest whose canopy is comprised mainly of black and white mangroves exceeding 30 ft in height and sometimes reaching 45 ft. The understory is mostly red mangroves. Landward of this zone is the interior mangrove forest that is dominated by black and white mangroves approximately 15 to 30 ft tall, again with an understory of red mangrove. Brazilian pepper can sometimes occur as an understory species. Adjacent to and landward of the interior mangrove forest is the transitional mangrove forest. This forest type is dominated by white mangroves approximately 7 to15 ft high, but red and black mangroves and buttonwood can be found emerging from the canopy. The most landward forest type is the dwarf mangrove forest, which is dominated by red mangroves generally less than 6 ft in stature.

Mangrove-dominated ecosystems are among the most productive natural systems in the world (Odum et al. 1982). Mangroves generate substantial amounts of organic matter that is processed by microorganisms and invertebrates, which in turn provide food for upper trophic level species such as fish and shorebirds. The high ecological value of mangroves has long been recognized, as they provide both a food base and stable habitat for a complex food web (Thayer et al. 1997). The mangrove system along Biscayne Bay produces about 6.7 tons of organic matter per year (Teas 1974) to fuel local and coastal food webs. In south Florida, this native coastal biotic community is vital in the support of bay fisheries, including shrimp, tarpon (*Megalops atlanticus*), and gray snapper (*Lutjanus griseus*) (Odum and Heald 1972), and invertebrate-wading bird food webs (Heald et al. 1984). In Biscayne Bay, sport and commercial fisheries rely on mangrove community function to support 11 species of commercial and recreational fish, such as red grouper (*Epinephelus morio*), gray snapper, and common snook (*Centropomis undecimalis*), and shellfish such as the spiny lobster, blue crab (*Callinectes sapidus*), and stone crab. Red mangroves provide physical support for an extensive invertebrate community on its prop roots in the intertidal zone. These extensive encrusting communities consist of sponges, oysters, mussels, clams, barnacles, snails, shrimp, crabs, juvenile spiny lobster, polychaete worms, hydroids, and hydrozoan Cnidarians.

The mangrove community provides habitat for federally and State-listed threatened and endangered species, as well as species of special concern. For example, ospreys (*Pandion haliaetus*) are top carnivores that utilize mangrove forest (Heald et al. 1984). Wading birds such as great blue herons (*Ardea herodias*), little blue herons (*Egretta caerulea*), tricolored herons (*E. tricolor*), and roseate spoonbills (*Ajaja ajaia*) feed on small forage fish that occupy

the tidal creeks and open areas of mangrove forests. Furthermore, mangroves in the Caribbean influence coral reef fish community structures (Mumby et al. 2004). The biomass of several species of commercially important fish was found to be twice as great when coral reef habitat was connected to mangrove habitat.

Substantial areas within the project boundary can be characterized as a low-productivity dwarf mangrove forest known as the "white zone" (Egler 1952; Ross et al. 2002). The white zone is a region of low vegetative cover and canopy height that is common in the Model Lands Basin. This area, comprised primarily of dwarf red mangrove and sparse graminoids, occurs between more densely vegetated coastal, interior, and transitional mangrove forests and more interior freshwater wetlands, and it is so named because it appears as a distinct reflective white band on remotely sensed images. The white zone has been present in the wetlands near Card Sound, Barnes Sound, and northern Florida Bay since at least the time when described by Egler (1952). Recent studies in this area by Ross et al. (2000) indicate that the inner boundary of the white zone has moved inland by an average of 0.9 mile since 1940, and the zone is expanding. The most noticeable changes to the white zone boundary and width occur in areas cut off from fresh water sources by canals or roads. For example, the expansion is greater on the Biscayne Bay side of U.S. Highway 1 than to the west. Ross et al. (2002) suggest that the low productivity of the white zone may be primarily the result of wide seasonal fluctuations in salinity and moisture content and the absence of freshwater input from upstream sources, among other factors.

c. Coastal herbaceous flats

Also referred to as saline herbaceous wetlands, this habitat type lies between mean sea level and the mean high water level, and so therefore is continuously flooded only during the annual water level peak that occurs in the fall. The vegetation is generally dominated by herbaceous, halophytic species such as sea oxeye (*Borrichia frutescens*), cordgrass (*Spartina* spp.), saltgrass (*Distichlis spicata*), and common rush (*Juncus* spp.) and sometimes spike rush (*Eleocharis* spp.). There is often a mixture of succulent herbaceous species such as saltwort (*Batis maritima*) and glasswort (*Salicornia virginica*) with scattered black mangrove (Lewis et al. 1985). Historically, this habitat type was widespread in the project area north of Turkey Point, but it is poorly represented in this area today. However, coastal herbaceous flats are a prominent feature in the Model Lands Basin.

Coastal herbaceous flats are heavily utilized by wildlife during periods of salt and fresh water inundation. Many species of larval or juvenile vertebrate and invertebrate species utilize the temporary available habitat, including fishes (some of which depend on the marsh for at least some phase of their life cycle), decapod crustaceans, and birds. Gilmore (1987) has documented 84 species of fish, 29 species of decapod crustaceans, and 38 species of birds utilizing subtropical coastal herbaceous flats associated with the Indian River Lagoon.

These periodically flooded marshes serve as habitat for various species of fiddler crab (*Uca* sp.), considered by some to be a keystone species in this habitat type. Fiddler crabs are important to the coastal ecosystem as a major prey item, a recycler of nutrients, and as an agent in oxygenating the soils. As many as six species of the genus *Uca* may exist in the coastal marsh

of the project area. Small fishes feed on the larval forms, whereas wading birds, particularly the night herons (*Nycticorax* sp.), prefer adult fiddler crabs as a food source. Snakes, various predator crab species, clapper rails (*Rallus longirostris*), and raccoons (*Procyon lotor*) have also been documented feeding on *Uca* (MacIntosh 1980).

Because the herbaceous flats are infrequently flooded, productivity occurs in pulses, which is suitable to certain species, such as the mummichog (*Fundulus heteroclitus*) (Weisberg and Lotrich 1982). This pulse productivity is also important to various other fishes and wading birds, and may play a crucial role in determining whether local wading birds successfully nest. Lower trophic level food components in this habitat include saltwort and mangrove detritus, as well as live periphyton. Copepods, arthropod zooplankton, and mosquito larvae provide other major food sources in the coastal herbaceous flats.

d. Freshwater wetlands

The freshwater wetlands in the project area can be comprised of various freshwater wetlands vegetation types, including sawgrass (*Cladium jamaicense*), cattail (*Typha* spp.), and coastal plain willow (*Salix caroliniana*). This habitat type is found mostly south of the C-103, and includes extensive areas of the Model Lands Basin. These vegetation types can be found as monocultures, but more often occur as mixed species. Even cattail, which is known for its ability to crowd out other plant species when conditions are favorable, is found mixed with species such as water hyssop (*Bacopa* spp.), mermaid weed (*Proserpinaca* spp.), willows (*Salix* spp.), and sawgrass. A variety of other freshwater wetland plant species, including periphyton species, occur in this vegetation type. Areas dominated by willow generally indicate freshwater areas that have been disturbed.

Freshwater wetlands of south Florida provide a variety of habitats for fish, amphibians, reptiles, birds, and mammals. Under the appropriate conditions, they can support a relatively large biomass of freshwater fish species, such as mosquito fish (*Gambusia affinis*) and sailfin molly (*Poecilia latipinna*), which in turn provide critical prey for the large variety of wading birds utilizing these wetlands. Freshwater wetlands are a preferred habitat for the American alligator (*Alligator mississippiensis*). For additional information on the wildlife value of these wetland types see Schomer and Drew (1982).

e. Non-native dominated wetlands

There are primarily two types of non-native dominated wetlands in the project area; namely, Australian pine dominated wetlands and Brazilian pepper dominated wetlands. The type of non-native species that dominates a given area is generally related to the topography of the wetland. The majority of the Australian pine dominated wetlands occur in artificially elevated mangrove areas. Often the pines occur as linear features along berms created by the digging of drainage and mosquito ditches. Brazilian pepper dominated wetlands are generally intermediate in elevation, hydroperiod, and function between the native wetland and upland types in the project area (EPA 1994). They can occur as dense monospecific stands that are difficult to penetrate or as stands mixed with willow, buttonwood and other mangrove species.

The wildlife value for the Australian pine dominated areas is primarily provided by the food and habitat contributions of the associated native plant species occurring as co-dominants in the canopy and the understory. These associated species are generally a combination of the four mangrove species, and they provide food and habitat value as discussed above in the mangrove section. The pines themselves have been noted to provide shade for ground dwelling animals, and habitat for a variety of insects and spiders (EPA 1994). They also provide some roosting and nesting habitat for birds, such as the great blue heron, brown pelican (*Pelecanus occidentalis*), and double-crested cormorants (*Phalacrocorax auritus*). Pileated woodpeckers (*Dryocopus pileatus*) have been observed to nest in the trunks of dead Australian pines in the project area (EPA 1994).

The limited habitat value provided by Australian pines is offset by negative impacts that include the loss of higher value native habitat, the loss of primary productivity of the native species, and change in elevation due to build-up of organic matter (EPA 1994). A particular problem with this non-native is the accumulation of fallen leaves that appear to resist breakdown by local microbes. This "duff" layer can become several inches thick, which suppresses understory development. It is unclear if the duff physically smothers native seedlings or if some sort of allelopathic chemical is leached from the leaves, which retards seedling germination (EPA 1994). The duff build-up may also slightly increase the local elevation, which results in more favorable habitat for the pines and may help the species increase its areal expansion.

Investigations on the wildlife habitat value of Brazilian pepper dominated wetlands are limited. A survey of herptofauna found in Brazilian pepper habitat in ENP revealed a total of 21 species of reptiles and amphibians, out of a total of 37 species occurring over all habitat types in the area (Dalrymple 1988). By comparison, 30 species of herptofauna were found in nearby freshwater prairie, which was the highest number of species found in any one habitat type. Curnutt (1989) compared breeding bird usage of this habitat type with pinelands in ENP. His results indicate that 35 percent fewer breeding pairs were utilizing the Brazilian pepper habitat compared with the pinelands habitat. Also, only 6 bird species were found to breed in the pepper habitat compared to 28 species in the pinelands.

Although the studies described above document certain wildlife value of Brazilian pepper dominated wetlands, most ecologists would agree that the habitat value of the native habitat type that has been supplanted by Brazilian pepper would carry a higher value than the Brazilian pepper habitat. Brazilian pepper produces an edible fruit that is consumed by a variety of wildlife, particularly avifauna and raccoons (EPA 1994). However, the fruit has relatively low food value as evidenced by the large numbers of intact berries observed in raccoon scat. Most of the food value of this habitat type is derived from the native plant species, such as willow, that sometimes co-occur with the pepper.

f. Vegetation map of the BBCW Project area

To aid planning efforts for the BBCW Project, the Service created a detailed vegetation map of the project area in 2005 (Figure 2; Service 2005). The map covers 17,875 ac of the anticipated

project area between the Deering Estate (Shoal Point) at the northern extreme of the project area and SW 360th Street in the Model Lands near Turkey Point (Figure 2). The 2005 map uses 13 primary vegetation classes, most of which fall within the broader mangrove, freshwater marsh, and non-native dominated wetland categories described above (Table 3). Two additional primary categories include open water and any area that has been filled, developed, or mechanically disturbed (*i.e.,* agriculture, urban, or commercial land use). An additional 13 mixed vegetation classes were required to characterize vegetation classes in the project area due to the complexity of the vegetation found there. Undisturbed natural areas usually reach relative equilibrium over time and typically have well defined boundaries or transition areas between the various vegetation communities. Plant community shifts due to natural forces such as fire are more predictable and less severe than changes caused by human interference. These habitats are much easier to interpret from aerial photography. When anthropogenic forces come into play the number of possible vegetation classes is higher because there is so much mixing of vegetation types (*e.g.,* Australian pine with sawgrass). Other mixed classes occur naturally such as the sawgrass/mangrove class. These areas are complex, resulting in a relatively large number of community types especially when invasive non-native species are present.

Mangroves are the dominant vegetation type east of L-31E, but they do occasionally occur just west of the levee. Coastal band mangroves (Gaiser and Ross 2003) cover 2,737 ac and dwarf dense mangroves (Gaiser and Ross 2003) cover 1,258 ac; these classes represent approximately 15 and 7 percent of the total project area mapped, respectively. Dwarf sparse mangroves are much less common, covering only 336 ac of the project area. Land coverage west of L-31E is dominated by the filled-developed-disturbed category, which comprises 4,251 ac or about 24 percent of the total project area. As noted above, agriculture is the primary land use that defines this category. Three vegetation classes have roughly equal representation west of L-31E. These three include native forested or shrub wetland/Brazilian pepper mix (1,901 ac), sawgrass (1,471 ac), and native forested wetland or shrub/Australian pine mix (1,315 ac), which account for 10.6, 8.2, and 7.3 percent of the total project area mapped, respectively. It is noteworthy that 9 of the 28 vegetation classes include non-native species, with the non-native species usually dominating the native species in these areas. Combined, these non-native classes cover 5,177 ac, or 29 percent, of the total project area mapped. Cattail is not included as a non-native species, even though it is usually present in South Florida only when water quality has been unnaturally altered.

The high degree of complexity and mixing of vegetation classes in the project area cannot be overemphasized. An example of the complexity is provided by the fact that a total of 1,050 vegetation polygons were delineated within the 17,875 ac included in this mapping effort, resulting in an average polygon size of 17 ac. Substantial mixing of vegetation types occurs throughout the project area. Of particular note is the mixing of native forested or shrub wetland and Brazilian pepper (1,901 ac), native forested or shrub wetland and Australian pine (1,315 ac), native forested or shrub wetland and other non-native species (528 ac), and Australian pine and sawgrass (521 ac).

From the description above it is apparent that the BBCW area contains a broad and diverse representation of wetland habitat types common in the south Florida ecosystem. It is also

apparent that the project area contains a complex mix of vegetation types, especially west of the L-31E. The degree of this complexity is likely unnatural and has resulted from anthropogenic actions, primarily drainage to facilitate agricultural and urban development. The prevalence of dense stands of non-native forests, particularly Brazilian pepper and various mixes of non-native and native vegetation in the project area, underscores this point. The BBCW objectives of re-establishing a more natural overland flow pattern by diverting water from conveyance canals into the coastal wetlands should serve to restore and enhance freshwater and estuarine wetlands in the project area, thus increasing the function of these habitats for fish and wildlife. Re-establishing connectivity between adjacent sub-basins, which is another project objective, should aid in restoring a more natural broad overland flow across these wetlands. Of particular importance for restoring the wetlands will be to re-establish hydroperiods and water levels that are suitable for native freshwater marshes. Hydroperiods and water levels appropriate for native marshes are not conducive to the survival and proliferation of the seedlings of many nuisance non-native species, such as Brazilian pepper and Australian pine. However, restoration of more natural hydrology alone will not likely be enough to eradicate established stands of Brazilian pepper. Physical removal this species may be necessary. Also, a return of a more natural fire regime will be required to maintain the desired vegetation communities, which will likely require the implementation of a fire management program.

6. Fish and Wildlife Resources

a. Federally Listed and Candidate Species

Fourteen federally listed threatened or endangered animal species and six federally listed plant species are present or potentially present in the study area or proposed project footprint, and may be impacted by the construction and operations of the project (Table 4). The remainder of this section provides information on the local status of the federally listed threatened and endangered species that are or have been known to exist in the project area and are most likely to be affected by the project. These include the West Indian manatee, Florida panther, wood stork, American crocodile, eastern indigo snake, and sea turtles. Detailed accounts of the distribution, habitat, critical habitat, reproduction, foraging, movements, status and trends, and respective recovery plan objectives for these species are contained within the South Florida Multi-Species Recovery Plan (Service 1999a); or the Service's endangered species web site at http://www.fws.gov/r9endspp/endspp.html.

West Indian Manatee

The West Indian manatee is recognized as an endangered species by both the Service and Florida Fish and Wildlife Conservation Commission (FWC). West Indian manatees are also protected under the provisions of the Marine Mammal Protection Act of 1972, as amended (16 U.S.C. 1461 *et seq.*), as well as Florida law. The manatee, or sea cow, is a large, plant-eating aquatic mammal that can be found in the shallow coastal water, rivers, and springs of Florida. Florida is essentially the northern extent of the West Indian manatee's range, though some manatees occasionally are reported from as far north as Virginia and the Carolinas.

West Indian manatees occur throughout Biscayne Bay, but are most frequently observed in tributaries and near-shore seagrass beds. The extensive acreages of seagrass beds in the bay provide foraging areas for manatees. Manatees also depend upon canals as a source of freshwater and resting sites. Also, the species uses the deep canals as a cold-weather refuge. The relatively deep waters of the canals respond more slowly to temperature fluctuations at the air/water interface than the shallow bay waters. Thus, the canal waters remain warmer than open bay waters during the passage of winter cold fronts. Manatees are present year-round, and are most abundant in winter, when more than 130 have been counted on a single day (Mayo and Markley 1995). Biscayne Bay is a seasonal migratory corridor for manatees, thus the total number of animals using the Biscayne Bay area is likely to be greater than the maximum number observed on any given day.

Manatees using the bay are part of the larger Atlantic region "subpopulation," which includes those animals ranging along the Atlantic coast from southern Georgia to the Florida Keys, and including the lower St. John's River. Atlantic coast manatees undertake seasonal, intraseasonal, and daily migrations or movement patterns (Deutsch et al. 2003). Radio-telemetry studies and tracking or resighting of known scarred individuals has shown that manatees may travel hundreds of miles seasonally, moving to southeast Florida or artificial sources of warmer water. Tracking studies of animals in the Biscayne Bay area also suggest a general diurnal pattern, with animals resting in canals and sheltered basins during the daytime and moving into Bay areas to feed in late afternoon and evening. Although wide-ranging, manatees demonstrate a high degree of site fidelity, yet also show individual patterns, flexibility and differential use of sites over time, and adaptation to changing conditions, moving among warm water refuges, freshwater sources and feeding sites. The general distribution of manatees is linked to freshwater, with animals more frequently occupying areas where freshwater sources are readily available (O'Shea and Kochman 1990; Mayo and Markley 1995; LeFebrve et al. 2001; Deutsch et al. 2003). Changes in timing and volume of freshwater delivery could affect manatee distribution, particularly in south Biscayne Bay.

Adult annual survival rates for manatees in the Atlantic subpopulation have been estimated at 89 to 93 percent, a rate lower than rates that have been estimated for other regions (Langtimm et al. 1998). Due to uncertainty in population model estimations, it is not possible to determine with statistical confidence whether the Atlantic population has been stable, decreasing or increasing in recent years. However, annual manatee mortality in the Atlantic region remains at high levels and appears to be increasing at a greater rate than optimistic estimates of population growth (Service 2001). Although many manatees have been killed or injured in Biscayne Bay by vessel collisions, the leading known cause of manatee death in Miami-Dade County is crushing or entrapment in water-control structures (Mayo and Markley 1995). Thus, changes in operation of these structures may directly affect survival of individuals using the Biscayne Bay area and stability of the Atlantic subpopulation.

Manatees have been observed in virtually all conveyance canals within the project boundary according to data collected by the FWC and Miami-Dade DERM. These include (from north to south), the C-100, C-1, C-102, Military Canal, C-103, Florida City Canal, North Canal, FPL Canal, Card Sound Road Canal, and C-111. Manatee sightings are especially high in C-1,

C-103, North Canal, FPL Canal, and Card Sound Road Canal. Water control structures associated with the canals in Miami-Dade County have been directly responsible for 72 manatee deaths (28 percent of the total) since 1974 (FWC 2008). Watercraft-related mortality is the other leading cause of manatee deaths (55 deaths since 1974 or 21 percent of the total). The number of deaths associated with each of these causes would undoubtedly be higher if the "undetermined" causes of death were known. Of the canals within the project area, manatee mortality appears to be particularly high in C-1 and C-103 canals (FWC 2008).

The diversion of water from the C-100, C-1, C-102, and C-103 canals would result in reducing the frequency of gate openings at the S-123, S-21, S21A, and S20F structures, which should benefit manatees by reducing the risk of harm (*e.g.*, injury) from these structures. Redirecting freshwater from these canals should also provide additional and unimpeded sources of freshwater for manatees to drink along the bay shoreline in the project area, at least during the wet season (June through November) and early part of the dry season (December through May). The freshwater diverted from the canals to the nearshore areas is likely to change the salinity regime in the nearshore area, which may affect local sea grass communities. Sea grass is an important food source for manatees (Service 1999). The effect of the project on seagrasses may change species composition, but is not anticipated to reduce seagrass biomass (*i.e.*, forage).

West Indian Manatee Critical Habitat

The project area also overlaps designated critical habitat for the West Indian manatee (35 FR 8495; June 2, 1970) and includes "all waters of Card, Barnes, Blackwater, Little Blackwater, Manatee, and Buttonwood Sounds between Key Largo, Monroe County, and the mainland of Miami-Dade County" are included as part of the critical habitat for this species (Figure 3). The southern part of the BBCW Project area includes Card Sound and Barnes Sound. Also, the northern boundary of the BBCW Project area lies 4 miles from the southern boundary of another segment of designated manatee critical habitat. This component is defined as "Biscayne Bay, and all adjoining and connected lakes, rivers, canals, and waterways from the southern tip of Key Biscayne northward to and including Maule Lake, Miami-Dade County." Redirecting canal water through the wetlands will mostly have localized effects on nearshore salinities, and thus on submerged aquatic habitats, as noted above. It is unlikely the project will significantly affect bay waters more than a mile from the project area.

Florida Panther

The Florida panther, a subspecies of mountain lion, is one of the most endangered large mammals in the world. The most recent population estimate for the Florida panther is 100 to 120 individuals, not including denning kittens (McBride et al. 2008). The population appears to be increasing or stable in the short-term. The numbers of documented panthers were 78, 82, 97, 117, and 104 in 2004, 2005, 2006, 2007, and 2008, respectively (R.McBride, pers. Comm.. 2009). This small population in south Florida represents the only known remaining wild population of an animal that once ranged throughout most of the southeastern United States from Arkansas and Louisiana eastward across Mississippi, Alabama, Georgia, Florida, and parts of South Carolina and Tennessee. The panther presently occupies public conservation lands and private lands in Broward, Collier, Hendry, Lee, Miami-Dade, and Monroe Counties totaling more than 2 million ac. Panthers have an affinity for hardwood forests and mixed swamps but

also use fresh and saltwater marshes, prairie and shrub and scrub habitats, agricultural lands (*i.e.*, wooded pasture, rangeland, citrus groves, row crops, etc.), and even urban areas. Geographic isolation, habitat loss, population decline, and associated inbreeding have resulted in a loss of genetic variability and overall health of the Florida panther population. Natural gene exchange ceased when the panther became geographically isolated from other subspecies of *Puma concolor* (Seal 1994).

The majority of the proposed project is located outside the panther focus area, while a large portion of the Model Lands lies within the primary zone as identified by Kautz et al. (2006) and the Service's panther focus area updates. This area of the project is primarily agriculture and undeveloped freshwater wetlands that provide moderate functional value for panthers. Two panther mortalities along the western edge of the Model Lands provide evidence that the project site may occasionally be used by dispersing panthers. Panther UCFP80 was killed by a motor vehicle on Card Sound Road on February 2, 2006, and panther UCFP96 was killed by a vehicle on U.S. Highway 1 just south of Card Sound Road on May 9, 2007 (Figure 3). FWC telemetry data indicates that panther #21 utilized a large portion of the Model Lands Basin between the FPL's Turkey Point Power Plant cooling canals and Card Sound Road in 1988. This individual was a victim of a motor vehicle collision and died the same year.

The project could affect potential panther habitat by rehydrating coastal wetlands. Rehydration should not affect the panther's primary food sources (white-tailed deer and feral hogs) because these prey items are not known to exist in the project area. No new roads are proposed by the project and use of existing roads will increase only temporarily during the construction phase, thus the project should have minimal and temporary effects on vehicle traffic patterns.

Wood stork

The wood stork is primarily associated with freshwater and estuarine habitats for nesting, roosting, and foraging. They have nested, at one time or another, in every county in south Florida. Typical foraging sites include freshwater marshes and stock ponds, shallow, seasonally flooded roadside or agricultural ditches, narrow tidal creeks or shallow tidal pools, managed impoundments, and depressions in cypress heads and swamp sloughs. Wood storks use a specialized feeding behavior called tactolocation, or grope feeding. A foraging wood stork wades through the water with its beak immersed and partially open (approximately 3 in). When it touches a prey item, a wood stork snaps its mandibles shut, raises its head, and swallows what it has caught (Service 1999a). This unique feeding method of the wood stork gives it specialized habitat requirements; the habitats on which wood storks depend have been disrupted by changes in the distribution, timing, and quantity of water flows in south Florida. The loss or degradation of wetlands in central and south Florida is one of the principal threats to the wood stork.

According to the Service's GIS database, the BBCW Project area lies within the outer limit of the core foraging area (an 18.6-mile radius circle from the colony center) of three active wood stork colonies (Figure 3). The "Tamiami Trail West" colony is located 17.8 miles northwest of the Deering Flow-way Component and it has been active since at least 1992 (according to the Service's GIS database). There were 400, 75, and 900/1000 active nests at this colony in 2006, 2007, and 2009 respectively. The "Tamiami Trail East" colony is located approximately 16

miles northwest of the project area and has been inactive since 1992 when there were130 nests. However, in 2009 the colony became active again with 30 nests reported. The third colony, (WCA 3B Mud East) is located 18.1 miles northwest of the Deering Flow-way Component. The data indicates a declining trend in numbers of wood stork nests at this site. The colony was established in 2004, with 130 nests that year. There were 20 nests at colony in 2005, 12 nests in 2006, and 7 failed nests in 2009.

Redirection of freshwater into coastal wetlands resulting from the BBCW Project should improve foraging habitat for the wood stork. The primary enhancement should occur during the wet season when most of the water diversion will occur. Rehydrating and lowering salinity in the coastal wetlands is anticipated to increase preyfish production during the wet season (Lorenz 2000). A more natural dry season recession is also anticipated, which should concentrate prey during the wood stork nesting season. Primary benefits to wood storks should occur in the Cutler Flow-way and L-31E Culvert components, where habitat enhancement will be on the order of several hundred acres for the wetlands east of the Cutler Flow-way and perhaps tens to hundreds of acres east of the L-31E culverts. The extent of habitat enhancement is unclear due to the uncertainty with determinations of the spatial extent of wetlands that will be rehydrated with the available water. Although approximately 21 acres of low-quality wood stork habitat is proposed to be removed by installation of the Cutler Flow-way pipeline and spreader canal and 0.02 acres of dwarf mangrove habitat is proposed to be removed by installation of the L-31E culverts, the extent of habitat enhancement mentioned above should provide an overall benefit within the project area.

The Corps has agreed in its October 29, 2008, BA to include measures for the wood stork as outlined in the *Habitat Management Guidelines for the Wood Stork in the Southeast Region* (Service 1990) in the permit conditions. Particularly relevant for the BBCW Phase 1 Project are the management zones and guidelines for the protection of feeding sites. There should be no human intrusion into feeding sites when storks are present. Depending upon the amount of screening vegetation, human activity should be no closer than between 300 feet (where solid vegetation screens exist) and 750 feet (no vegetation screen).

Cape Sable seaside sparrow

The Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*) is a medium sized sparrow restricted to the Florida peninsula. It is a non-migratory residents of brushless, subtropical marshes (marl prairies) of interior southern Florida. These habitats remain dry most of the year but are seasonally flooded with entirely fresh to slightly brackish water. Cape Sable seaside sparrows nest in mixed marl prairie communities that often include muhly grass (*Muhlenbergia filipes*). These short-hydroperiod prairies contain moderately dense, clumped grasses, with open space permitting ground movements by the sparrows. They commonly feed on soft-bodied insects from low-lying vegetation and avoid sites with permanent water cover.

Alterations of their habitat have occurred as a result of changes in the distribution, timing, and quantity of water flows in south Florida. Water flow changes appear to be the leading contributor to the decline in Cape Sable seaside sparrow population, which subsequently threatens the subspecies with extinction (Service 1999). Competition and predation also

threatens the Cape Sable seaside sparrow. Raccoons (*Procyon lotor*), snakes, rice rats (*Oryzomys palustris*) and hawks may be the chief predators.

The known distribution of the Cape Sable seaside sparrow is restricted to two areas of marl prairies east and west of Shark River Slough in the Everglades, and the edge of Taylor Slough along the southern boundary of the water preserve area project at the Bird Drive Basin in Miami-Dade County. The closest Cape Sable seaside sparrow sub-populations lie miles to the west or south of the project area. Sub-population F of the Cape Sable seaside sparrow is located approximately 16 miles west of the Cutler Flow Way component. Sub-population C lies approximately 15 miles west of the L-31E Culvert component and Sub-population D lies approximately 10 miles southwest of the freshwater wetlands between C-103 and North Canal. Because the habitat in the project area is not suitable for this species, the Corps has determined the project will have no effect on the Cape Sable seaside sparrow. The Service concurs.

Cape Sable Seaside Sparrow Critical Habitat
There is no Cape Sable seaside sparrow critical habitat in the project area (Figure 3), and because the project is located downstream of the nearest sparrow critical habitat the project will not affect it.

Everglade Snail Kite
The Everglade snail kite inhabits relatively open freshwater marshes which support adequate populations of Florida apple snails (*Pomacea paludosa*), the primary forage species for the kite. Favorable areas consist of extensive shallow open water such as sloughs and flats, vegetated by sawgrass and spikerush (*Eleocharis cellulose*). The areas are often interspersed with tree islands or small groups of scattered shrubs and trees which serve as perching and nesting sites. Suitable snail kite habitat includes water levels that are sufficiently stable to prevent loss of the food supply through drying out of the surface. The Everglades snail kite is threatened primarily by habitat loss and destruction. Widespread drainage has permanently lowered the water table in some areas, including the BBCW project area. This drainage permitted development in areas that were once Everglades snail kite habitat.

Most wetlands affected by the BBCW Project components are tidally influenced with salinities ranging from fresh to hypersaline (salinities greater than full strength sea water, *i.e.*, greater than 40 ppt) conditions. The Florida apple snail is a freshwater species, so conditions in the project area are generally unsuitable for this forage animal. The exception is the freshwater wetland located west of L-31E between the C-103 and North Canal. Presently this part of the project area is dominated by hardwood trees and woody shrubs, and is generally unsuitable as apple snail habitat. Thus, the project area is currently unsuitable for the Everglade snail kite. However, the project objective for this part of the project area is to restore the wetland to graminoid marsh, which would be suitable to apple snails, and therefore, the Everglade snail kite.

Everglade Snail Kite Critical Habitat
There is no Everglade snail kite critical habitat in the project area (Figure 3), and because the project is located downstream of the nearest snail kite critical habitat the project will not affect it.

American crocodile

The American crocodile is one of the two species of crocodilians endemic to the United States. It is a large, greenish-gray crocodilian with adults reaching lengths of approximately 12 ft in Florida. The current distribution of the American crocodile in the United States is limited to extreme southern Florida. The American crocodile is found primarily in mangrove swamps and along low-energy mangrove-lined bays, creeks, and inland swamps (Kushlan and Mazzotti 1989). During the non-nesting season crocodiles are found primarily in the fresh and brackish waters in inland swamps, creeks, and bays. During the breeding and nesting season (spring and summer) adults use the exposed shorelines of Florida Bay. Natural nesting habitat included sites with sandy shorelines or raised marl creek banks adjacent to deep water. Crocodiles also nest on elevated man-made structures such as canals berms (Service 1999a). Habitat loss and fragmentation due to urbanization and agricultural land uses are the biggest threats to this species. In Florida, changes in the distribution, timing, and quantity of water flows have affected this species, although the specifics of these effects is not clear.

American crocodiles are occasionally found in the project area. Crocodiles have been documented to occur in wetland areas of central and southern Biscayne Bay at densities ranging from 0 to 0.29 crocodiles per kilometer of shoreline (Cherkiss 1999), which suggests a low probability of crocodiles occurring in the project area. Canal banks similar to the L-31E levee are generally suitable for nest sites, and the berms associated with the old east-west agricultural secondary canals may also be suitable for nesting. Thus, nesting habitat is available in the project area. However, nesting within the project area is not well documented. A nesting attempt was made on the bank of the L-31E near its intersection of the Goulds Canal (within one half mile of the L-31E Culvert Component) in 2005, but the nest failed (Michael Cherkiss, University of Florida, telephone communication, March 27, 2007). The nearest consistent nesting occurs at Chapman Field Park located approximately 1 mile north of the Deering Flow-way component. The other nearest known nest sites are located at the cooling canals of Florida Power and Light's Turkey Point Power Plant, which supports the most successful nesting population in south Florida (Mazzotti et al. 2002). The northern end of the cooling canal system is located approximately two miles from the southern end of the L-31E Culvert Component.

Recent studies indicate an increase in the number of nests occurring in the cooling canal area of the Turkey Point Power Plant since the early 1980s, while nest numbers at the Crocodile Lake National Wildlife Refuge have remained relatively stable (Mazzotti et al. 2002). Nesting success at the Turkey Point Power Plant may be responsible for an increase in the number of crocodile sightings occurring north of the plant (in the BBCW Project area), and may indicate an expansion of the animal's range. Crocodiles have been sighted as far north as Key Biscayne and the Miami River (Cherkiss 2007). Crocodiles also nest at Crocodile Lake National Wildlife Refuge, which lies just across the extreme southern segment of Biscayne Bay (Barnes Sound). Although nest numbers have remained relatively stable at the Crocodile Lake National Wildlife Refuge, the population in this area may be increasing, based on an increase in the number of crocodile sightings throughout the Florida Keys and an increase in the number of road kills occurring along U.S. Highway 1 and Card Sound Road over the past several years (Klett 2003).

Construction of culverts, risers, and pump stations on the levees in the project area will impact approximately 4.5 acres of levee that is potential crocodile nesting habitat. This is a relatively small footprint considering the approximately 720 acres of levee associated with the C-1, L-31E, C-102, Military Canal, C-103, and North Canal levees within the project boundaries. These levees are very likely sub-optimal nesting habitat, given that no successful crocodile nests have been documented on them in the project area. Also, at least 5.5 acres of new berm or levee associated with the spreader features will be created by the project, which should be suitable as crocodile nesting habitat. The spatial extent of new berm created by the project more than offsets levee area lost by installation of culverts, risers, and pump stations.

Because reptiles usually avoid areas of human activity, it is expected that the crocodiles would avoid the area during construction activity. However, the most likely potential effects on crocodiles will occur during project construction due to the temporary increase in human activity, including an increase in vehicular use, along the levee roads associated with the major conveyance canals (C-1, C-102, C-103, and North Canal) and L-31E Canal. Because of the possibility of crocodiles nesting or being present in the project area, and because vehicular traffic will temporarily increase during project construction, which may affect crocodiles if they are present, the Corps has agreed in their October 29, 2008, BA to include American crocodile construction protection measures as a permit condition (enclosured). At this time, the Service has no formal written guidelines for construction activities for crocodiles.

All three project components are anticipated to lower salinity in their respective areas. Reducing salinities in these wetlands would improve hatchling and juvenile crocodile habitat. Optimal salinity for juvenile crocodiles is 0 to 20 parts per thousand in the wetlands and coastal creeks during the wet season and partway through the dry season (approximately June through January) (Mazzotti et al. 2002). Presently, salinity along the nearshore area is generally above this preferred range (Biscayne National Park 2006). Thus, the project should provide ecological benefits to American crocodiles.

American Crocodile Critical Habitat

According to 50 CFR 17.95, the easternmost tip of Turkey Point defines the northern boundary of designated critical habitat for the American crocodile (Figure 3). Turkey Point is about 3 miles south of the southernmost culvert proposed for the L-31E Culvert component. It is unlikely the project will significantly affect bay waters more than a mile away from the project area. The effects of redirecting canal water through the wetlands should have a mostly localized effects on tidal wetlands and nearshore salinities that lie outside of the American crocodile critical habitat. Also, project implementation should enhance crocodile habitat within the project area.

Eastern indigo snake

Eastern indigo snakes occur throughout south Florida and use a variety of habitats including pine flatwoods, pine rocklands, tropical hardwood hammocks, a variety of wetlands types (including mangrove wetlands), and other developed and undeveloped cover types. Because these habitats are typical of the project area, the proposed project may affect eastern indigo snakes or their habitat. Anecdotal evidence suggests that indigo snakes use the L-31E levee for sunning and

resting (Dr. Jack F. Meeder, Florida International University, telephone communication, November 8, 2002). Indigos have also been reported in the Model Lands area west of the Florida Power and Light Turkey Point Power Plant utilizing roads and Australian pine duff for thermal refugia (Mr. Bill Maus, Themis Consulting, telephone communication, February 5, 2009). However, information on indigo snake population numbers and density does not exist for this geographic area and dominant habitat type (mangroves).

In attempts to document the presence of eastern indigo snakes in the project area, surveys were conducted by Service biologists on January 26 and March 30, 2009. The first survey was conducted between 10 AM and 1 PM along approximately 8 miles of levees in the project area shortly after a cold front had moved through south Florida, which is the optimal time to observed eastern indigo snakes in open areas. No snakes were observed. The second survey was conducted between 11:15 AM and 3:45 PM on March 30, 2009. Approximately 11.5 miles of levees were surveyed three days after the passage of a cold front. No eastern indigo snakes were observed. The lead Service biologist on the project has been on numerous other site visits in the project area (e.g., February 21 and 22, 2006; March 28 through 30, 2006; June 28, 2006; November 30, 2006; March 8, 2007; November 11, 2007; March 24, 2008; April 30, 2008; and others) and has not observed eastern indigo snakes on any of these visits. Although the snakes have been observed in the project area, as noted above, the wetlands habitat that dominates the project area is sub-optimal habitat for indigo snakes, as they prefer drier upland habitats. Also, the wetlands in the project area are bordered by urban development and nursery tree farms to the north and west, respectively, which is also sub-optimal eastern indigo snake habitat.

Although indigo snakes were not been observed during the Service's surveys and other field work in the project area, the anecdotal information described above indicates that indigo snakes likely occur in the project area. Thus, the Service assumes that these animals occur in the project area. Based on that assumption, the Service is concerned about project effects on indigo snakes. These concerns include: (1) construction of project features, (2) increased traffic during construction, (3) increased traffic after construction due to maintenance of culverts and pump stations, and (4) exotic plant removal if it is by mechanical means.

The Service does not believe that loss of habitat due to installation of project features will significantly impact indigo snakes. As previously noted, the levee habitat (presumably used by indigo snakes for sunning and resting) impacted by the installation of culverts, risers, pump stations is relatively small (4.5 acres) compared to the 720 acres of levee area available in the project area. Also, 5.5 acres of new berm area will be created which indigos can use for sunning, resting, and foraging. Construction of project features (primarily the spreader features) will impact 27.3 acres of native vegetation communities (most of which is mangrove wetland), 53.1 acres of non-native vegetation (Brazilian pepper and Australian pine), and 16.7 acres of native and non-native mixed communities (Table 1). These habitat types are sub-optimal for indigo snakes and the spatial extent of these displaced vegetation communities together comprise only 2 percent of the wetlands within project boundaries.

The Service anticipates that implementing the BBCW Phase 1 Project will have some beneficial effects to the eastern indigo snake. Rehydration of the coastal wetlands by diverting water from

conveyance canals may increase the forage base of the snake by improving the coastal wetlands habitat for the snake's major prey items, including fish, frogs, snakes, lizards, turtles, small alligators, birds, and small mammals. Also, as noted above, additional upland sunning and resting areas will be provided by the construction of berms associated with spreader features. Given the relatively small loss of sub-optimal habitat and anticipated increase in quality of remaining habitat resulting from project implementation, the Service believes the displacement of indigo snake habitat by spreader features, culverts, and pump stations is discountable.

The Corps states in its October 29, 2008, BA that the standard construction precautions for the indigo snake (i.e., the *Draft Eastern Indigo Snake Standard Protection Measures*) will be included in the environmental protection plan when the Corps proceeds to the plans and specifications phase for this project. Those measures include: (1) providing indigo snake educational materials to construction employees prior to project initiation; (2) if a live indigo snake is found, construction activities will cease until the snake has left the project area on its' own accord and the location of sightings will be reported to the Service; and, (3) if a dead indigo snake is found, the snake will be frozen as soon as possible and the Service will be contacted immediately for further instructions. Due to concerns about project construction effects on indigos described above, the Service recommended the following additional measures be included as permit conditions to reduce risk to indigo snakes: (1) have a trained observer on site during construction, (2) in the project design phase the Service and Corps will coordinate to determine culvert locations on the L-31E Levee to avoid burrows as necessary, (3) examine any burrows in the footprint of pump stations, (4) avoid removal of invasive non-native vegetation by mechanical means, and (5) manage construction site to promptly remove debris so it doesn't create shelter sites for indigos. The Service also recommended that the Corps conduct a comprehensive survey for indigos in the construction areas of the project. Through email correspondence dated September 24, 2009, the Corps agreed to include the above additional protection measures as permit conditions and has agreed to conduct the recommended survey when funding for such surveys becomes available after the project is authorized and appropriated by Congress. The Service and Corps will coordinate appropriate survey protocols at that time.

Sea turtles

Five federally listed sea turtle species, including the threatened Atlantic loggerhead sea turtle (*Caretta caretta*), endangered Atlantic green sea turtle (*Chelonia mydas*), endangered leatherback sea turtle (*Dermochelys coriacea*), endangered Kemp's ridley sea turtle (*Lepidochelys kempii*), and endangered hawksbill sea turtle (*Eretmochelys imbricata*) may be present in the nearshore waters in the project area. The green sea turtle may be present in the project area feeding on sea grasses. The leatherback may be present depending on the presence of jellyfish, and the loggerhead may be found foraging in the area for crustaceans or mollusks. The hawksbill sea turtle may also be found in the area as it feeds predominantly around coral reefs on sponges, which can be found on hardgrounds (limestone bottom colonized by sponges, small corals, and algae) located in the middle of Biscayne Bay. The Kemps Ridley sea turtle is least likely to be found here due to its rare occurrence in Florida's coastal waters.

The Service's jurisdiction over listed sea turtles is limited to beach and shoreline habitat above Mean High Water. Because suitable nesting habitat does not exist for sea turtles in the project

area, these animals will not likely be of concern to the Service with regards to this project. However, these animals should be considered in project design and implementation as they occur or potentially can occur in waters within the project area. National Marine Fisheries Service (NMFS) should be consulted as it has jurisdiction over sea turtles below Mean Low Water.

Implementation of the project is anticipated to increase freshwater flow to the salt water wetlands and nearshore bay areas which may result in changes in salinity. This in turn may affect sea grass thereby affecting herbivores like the green sea turtle. However, the sea grass change is most likely to species composition only, and no reduction in seagrass biomass is anticipated to occur.

Schaus Swallowtail Butterfly
The present distribution of the Schaus swallowtail butterfly extends from southern Miami-Dade County south to Lower Matecumbe Key in the Middle Florida Keys. Schaus swallowtail butterfly distribution is limited to tropical hardwood hammocks and is concentrated in the insular portions of Miami-Dade and Monroe counties, from Elliott Key in Biscayne National Park and associated smaller Keys to central Key Largo (Service 1999). Suitable habitat remaining from historical values for this species is estimated as 43 percent in Biscayne National Park and 17 percent for north Key Largo. The decline has been attributed primarily to habitat destruction (Service 1999).

Optimum habitat includes mature and well drained tropical hardwood hammocks with natural and manmade openings such as trails. In the project area, this habitat type is found only in the Deering Flow-way component. However, reintroductions of this species to the Deering Estate have not been successful. Rehydration of this project component area should assist in restoring and enhancing the natural vegetative communities associated with tropical hardwood hammocks, which might provide some benefits to the butterfly by enhancing hammock plant species that serve as cover and forage for both larvae and adult stages of this species.

b. State-listed Species

In addition to the federally listed species, the BBCW Phase 1 Project area also provides habitat for species listed by the State of Florida. These species are recognized as either endangered, threatened or as species of special concern, and are protected or otherwise given special consideration under Chapter 39-27.003, 39-27.004, and 39-27.005, Florida Administrative Code. Birds comprise the majority of the State-listed species associated with the project. Most of these are wading birds, which are generally dependent upon shallow open water for foraging on aquatic invertebrates and small fishes. The State does not list critical habitat for any of its species.

State-listed endangered species that may exist or potentially exist in the project area include the Arctic peregrine falcon (*Falco peregrinus tundrius*) and Florida mastiff bat (*Eumops glaucinus floridanus*). State-listed threatened species include the white-crowned pigeon (*Columba leucocephalus*), least tern (*Sterna antillarum*), rim rock crown snake (*Tantilla olitica*), and the Everglades mink (*Mustela vison evergladensis*). State-listed species of special concern include

the roseate spoonbill (*Ajaia ajaia*), limpkin (*Aramus guarauna*), little blue heron (*Egretta caerulea*), reddish egret (*Egretta rufescens*), snowy egret (*Egretta thula*), tricolored heron (*Egretta tricolor*), white ibis (*Eudocimus albus*), brown pelican (*Pelecanus occidentalis*), black skimmer (*Rynchops niger*), mangrove rivulus (*Rivulus marmoratus*), gopher tortoise (*Gopherus polyphemus*), American alligator (*Alligator mississippiensis*), and the Florida tree snail (*Liguus fasciatus*). The Service recommends that the Corps contact the Florida Fish and Wildlife Conservation Commission to solicit input for species under its jurisdiction that may occur in the BBCW study area or be affected by the project. We are particularly concerned about possible project impacts to the mangrove rivulus.

c. Other Fish and Wildlife Resources

In a PAR submitted to the Corps on May 13, 2004, the Service provided a comprehensive list of vertebrate wildlife that occur, or are anticipated to occur, in the BBCW Project area. This list was assembled by combining species lists from available surveys and reports conducted in or near the project area over the last two decades. Where available, habitat type and geographic location for each species were provided. Wildlife studies within the preliminary project boundary are generally lacking, and most of the studies from which the data appearing in the PAR were assembled were performed outside the project footprint, but within a few miles of the preliminary boundary.

The mainland coastal zone of central and southern Biscayne Bay, which defines the BBCW Project area, supports a high diversity of tropical and subtropical species of vertebrates. A minimum of 35 mammalian species, 294 avian species, 57 reptilians, 16 amphibian species, and 268 fish species have been observed in or near the project area. An additional 11 mammalian, 10 bird, 7 reptilian, 1 amphibian, and 9 fish species may exist in the area. The following subsections describe in greater detail the occurrence and habitat utilization in the project area of the five major classes of vertebrates.

Mammals

Mammals constitute a relatively small number of the vertebrate wildlife associated with the BBCW Project area. However, the few species that do exist are important to the overall ecology of the area. Species diversity is relatively low, with only 35 species having been observed in the project area. The most common large mammals observed in the project area are the West Indian manatee and the bottlenose dolphin (*Tursiops truncatus*). Both species are protected by the Marine Mammal Protection Act making it illegal to take, injure, molest, or kill any marine mammal. The bottlenose dolphin is common to inshore Florida waters, and normally forages in the open waters of the bay, feeding on mullet and other available fishes (Odell 1976). Biscayne Bay is considered important habitat for this species. White-tailed deer (*Odocoileus virginianus*) are likely found predominately in the Model Lands Basin portion of the project area. See Section V for more information on the endangered manatee and Florida panther.

Most of the mammalian species occurring in the project area are small to medium-sized. Probably the most common medium-sized mammal is the raccoon. They are often observed foraging throughout the wetland and upland areas. They are excellent climbers and use crevices

and tree cavities for shelter and for breeding sites. Another species often spotted in the project area is the river otter (*Lutra canadensis*), which uses the extensive and complex network of canals, drainage ditches, and mosquito ditches found in the project area for hunting fish and other prey. Some of the more common small mammals include the cotton rat (*Sigmodon hispidus*) and gray squirrel (*Sciurus carolinensis*).

Birds

Avifauna are particularly well documented in and around the BBCW Project area, and they represent the most diverse group of vertebrates that utilize the area. Over 290 bird species have been observed in or near the project area, and 10 additional species may exist. The species list includes a wide variety of bird groups including gulls, wading birds, water birds, raptors, warblers, woodpeckers, and thrushes. Many of the species are migratory birds and winter residents, which commonly swell the avian populations during the late fall to early spring months.

The most commonly observed birds are water and wading birds, such as the great blue heron, great egret (*Ardea alba*), brown pelican, double-crested cormorant, and osprey. Common grackles (*Quiscalus quiscula*) and boat-tailed grackles (*Quiscalus major*) are also highly visible birds in this area. Less noticeable, but also relatively common are the northern mockingbird (*Mimus polyglottos*), northern cardinal (*Cardinalis cardinalis*) and various warbler species during spring and fall migration periods.

Sixteen non-native avian species exist or potentially exist in the project area. These are comprised mostly of a variety of tropical species such as parrots and parakeets. For example, the monk parakeet (*Myiopsitta monachus*) is particularly common in south Florida. Other common non-native avian species include the Eurasian collared dove (*Streptopelia decaocto*) and the European starling (*Sturnus vulgaris*). These non-native birds are discussed in greater detail in Section VI.

Migratory Birds

Migratory birds are protected under the Migratory Bird Treaty Act. The south Florida ecosystem is located along one of the primary migratory routes for bird species that breed in temperate North America and winter in the tropics of the Caribbean and South America. Many species of neotropical migrants have been recorded in the south Florida region. A 1995 amendment to the Migratory Bird Treaty Act included a list of migratory nongame birds of management concern in the United States to stimulate a coordinated effort by Federal, State, and private agencies to develop and implement comprehensive and integrated approaches for management of these selected species. Forty-three of these species are found in the south Florida ecosystem. Other migratory species like tanagers (*Pirange* spp.), chimney swifts (*Chaeturaa pelagica*), tree swallows (*Iridoprocne bicolor*), nighthawks (*Chordeiles minor*), royal terns (*Sterna maxima*), and blue-winged teal (*Anas discors*) also have major migratory pathways through and to (as winter residents) south Florida. More than 129 bird species migrate to the south Florida region to overwinter. Another 132 bird species breed in south Florida. Because the south Florida is located near Cuba and the West Indies, it draws tropical species that rarely appear elsewhere in North America. Examples include the smooth-billed ani (*Crotophaga ani*), mangrove cuckoo

(*Coccyzus minor*), Antillean nighthawk (*Chordeiles gundlachii*), white-crowned pigeon (*Columba leucocphala*), gray kingbird (*Tyrannus dominicensis*), short-tailed hawk (*Buteo brachyurus*), Everglade snail kite, and black-whiskered vireo (*Vireo altiloquus*). The south Florida has an endemic race of the yellow warbler (*Dendroica petechia*) and contains the majority of the nesting locations for the reddish egret, roseate spoonbill, swallow-tailed kite (*Elanoides forficatus*), and short-tailed hawk (*Buteo brachyurus*) in the United States.

Shorebirds that migrate along the Atlantic coast of Florida on their way to and from South America use the beach dune community for food and shelter while songbirds use the coastal strand, maritime hammock, and mangrove communities. The FWC identified 26 species of shorebirds and 27 species of songbirds that use coastal barriers during migration as rare or declining species (Enge et al. 1997). Fifteen of these, 12 shorebirds and 3 songbirds, have also been identified as birds of conservation concern (Service 2002) and the Service is developing a strategy to protect breeding, migration, and wintering habitat for these species. As a public trust resource, migratory birds must be taken into consideration during project planning and design. For more information please see our website at http://migratorybirds.fws.gov/.

Fifteen species of herons, storks, and ibises nest in south Florida and are considered ecological indicators because of their wide foraging ranges, relatively narrow food requirements, and relatively specific habitat requirements. Their breeding success reflects the health of the wetland and coastal habitats of south Florida. Migratory songbirds, raptors, and wading birds utilize a variety of habitats within the BBCW Project area and represent noted trust resources for the BBCW Project area.

Reptiles

A total of 57 reptile species were observed in or near the project area. Another seven reptile species are anticipated to occur in the area. These numbers represent a relatively large fraction of the total number of reptile species present in the State of Florida, which likely is a reflection of the diversity of habitat types found in the project area. Of the 63 reptile species documented in or near the project area, seven are considered non-native to Florida. The Cuban brown anole (*Anolis sagrei*) and spectacled caiman (*Caiman crocodilus*) are likely the most abundant and problematic of these non-native reptiles in the project area.

The American alligator and endangered American crocodile are top predators in the project area and play important ecological roles. For example, alligators create "gator holes" that support a large variety of fauna. These small ponds provide habitat for aquatic organisms during the dry season and serve as staging areas for recolonization of the marshlands when the rainy season returns. Two additional high-profile reptile species that occur in the nearshore bay area are the green sea turtle and loggerhead sea turtle. These two species are the most common of the sea turtles inhabiting south Florida. The seagrasses and algae that are abundant along the shoreline of the project area represent suitable foraging habitat for the green sea turtle. Loggerhead sea turtles occupy a variety of habitat types, including sandy bottoms and clear water that can be found in the project area. Their diets consist primarily of benthic invertebrates and they prefer gastropod and pelecypod molluscs and decapod crustaceans, all of which occur in the nearshore waters of the project area. A third species of sea turtle, the hawksbill sea turtle, could utilize the

nearshore waters of the project area, as it has been documented to inhabit mangrove-fringed bays and estuaries, particularly along the eastern shore of continents where coral reefs are absent (Carr 1952). However, individuals of this species likely utilize the well-developed coral reefs found just seaward of Biscayne Bay in preference to the western bay areas.

Amphibians

The extensive degraded wetlands of the project area support a relatively large variety and number of amphibians. These include 16 species that have been observed and one species that is anticipated to occur in the project area. Of the observed species, three are non-native, including the Cuban tree frog (*Osteopilus septentrionalis*), greenhouse frog (*Eleutherodactylus planirostris*), and giant toad (*Bufo marinus*).

Amphibians associated with deep marsh systems observed in the project area include the pig frog (*Rana grylio*), which feeds extensively on crayfish, and the green tree frog (*Hyla cinerea*), which can congregate in large choruses of several hundred individuals. Other amphibians, such as the little grass frog (*Limnaoedus ocularis*) and eastern narrow-mouthed frog (*Gastrophryne carolinensis*) prefer the slightly drier shallow marsh and wet prairie systems.

Generally, most of the amphibians documented in or near the project area were observed in the Barnes Sound wetlands area or outside the project boundary. This finding is likely more a reflection of the lack of studies or surveys within other parts of the project area rather than a lack of these species in those areas. Also, little information is available from the specific habitat types in which the observed amphibians were found. Only two habitat types, tree islands and disturbed and filled areas were reported in the surveys.

Fish

The 2004 PAR noted that 268 species of fish have been observed in or near the project area and another nine species may exist there. Of these, 10 species are non-natives that primarily inhabit relatively deep freshwater habitats provided by conveyance canals. Non-native fishes include various cichlids, goldfish (*Carassius auratus*), walking catfish (*Clarias batrachus*), among others. There are two qualifiers when discussing information concerning fish species documented for the project area. First, a relatively large number of the species are primarily associated with coral reef habitats. Although hardgrounds, a type of submerged habitat that is usually comprised of a few scattered coral species, exists within the project area, the main reef tract is located well offshore of the barrier islands that separate the bay from the open ocean. These reefs are outside the influence of the project. Secondly, a number of other fish species that likely exist in the project area may not have been documented. DeSylva (1976) documented at least 512 species of fish occurring in Biscayne Bay. Both temperate and tropical species are represented, and somewhat seasonal fluctuations occur with tropical species more prevalent in the summer and temperate species partially replacing them in winter (Alleman et al. 1995).

Historically, bay waters in the project area would have supported primarily estuarine species. Recent studies have shown that estuarine fishes and shellfishes have precipitously declined in abundance within the project area due to loss of estuarine habitat along the bay's southwestern shore (Serafy et al. 2001). Abrupt canal-driven salinity fluctuations have also deleteriously

affected fish populations (Serafy et al. 1997). In southern Biscayne Bay, the salinity of marine waters (30 to 35 ppt) downstream of flood canal locks frequently drops 20 ppt within 60 minutes and returns almost as rapidly (Wang et al. 1988). As currently operated, these dramatic salinity fluctuations can occur several times per day during the wet season (May to October). Red drum (*Sciaenops ocellata*) and other species of sciaenids that rely upon estuarine areas were "abundant at all seasons" during the late 19th Century (Smith 1896) but are conspicuously absent today. Restoration of red drum to the bay failed due in large part to the release (stocking) of juveniles to areas that no longer contained suitable (consistently brackish) estuarine environments (Serafy et al. 1996). Still, seagrass beds and intertidal mangrove forests in the area support a variety of fish species, including recreationally or commercially important ones such as spotted seatrout (*Cynoscion nebulosus*), common snook, permit (*Trachinotus falcatus*), and various members of the grunt, snapper, mullet, and grouper families.

Small, minnow-sized fish species dominate most of the freshwater wetlands in the project area. This dominance is most likely due to the water level fluctuations and periodic dry downs that naturally and unnaturally occur in this area. Many of the small native fish are adapted for survival in shallow stagnant water that is typically low in oxygen and has relatively high temperatures, especially in summer months. A good example of this is the mangrove rivulus, which exists in mangrove habitats and spends most of its life in land crab burrows.

Several rare or endangered fish species may be present in the major conveyance canals and nearshore waters of the project area. NMFS lists the endangered smalltooth sawfish (*Pristis pectina*) and opossum pipefish (*Microphis brachyurus lineatus*) as potentially occurring in the project area waters. The mangrove rivulus is listed by NMFS and FWC as a Species of Special Concern. Other rare fish that may be found in the project area include the bigmouth sleeper (*Gobiomorus dormitory*), river goby (*Awaous tajasica*), mangrove gambusia (*Gambusia rhizophorae*), spottail goby (*Gobionelles stigmaturus*) and mountain mullet (*Agonostomus monticola*) (Gilbert 1992).

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801-1882, as amended 1996) calls for direct action to stop or reverse the continued loss of fish habitats. Toward this end, Congress has mandated the identification of habitats essential to managed species and measures to conserve and enhance this habitat. Achievement of the mandate requires cooperation among the National Marine Fisheries Service (NMFS), the Fishery Management Councils, and Federal agencies to protect, conserve, and enhance essential fish habitat. Congress has defined essential fish habitat for federally managed fish species as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

Aquatic habitats within Biscayne Bay, including those within the project area, have been identified as essential fish habitat. These habitats have been altered through watershed modifications that have affected freshwater delivery to the bay. Nevertheless, the bay continues to support fishery resources of recreational or commercial importance. Seagrass communities within Biscayne Bay provide critical refugia for juvenile fish such as red drum, tarpon, common

snook, and spotted seatrout, as well as invertebrates such as pink shrimp (*Farfantepenaeus duorarum*). The decline in juvenile abundance and distribution of these and other species, along with an overall decrease in species richness may be related to the loss of seagrass habitat and a result of alterations in the salinity regime and the timing of the freshwater discharges from the major conveyance canals the lie within the project area.. The "without project" condition would impact essential fish habitat by projected further disruptions in the distribution, timing and quantity of water flows into central and southern Biscayne Bay.

Non-native Wildlife

The BBCW Project area is known to provide habitat for non-native vertebrate wildlife species. Many of these species have been introduced to the area through accidental release from fish wholesale houses into south Florida canals while others are intentionally released as unwanted pets. In many cases, these animals have adapted to the subtropical environment of south Florida and have established themselves as breeding residents. Whereas some species pose little or no known threat to natives, others are particularly invasive, presenting a predatory threat or competing with indigenous species for food, territory, nest sites, or other resources. Feral hogs (*Sus scrofa*), for example, destroy native vegetation (Singer et al. 1984) and may disturb sea turtles, gopher tortoises, and shorebird nests (Cuthbert 2002). They may also transmit diseases, such as pseudorabies, eastern equine encephalitis, and bacterial brucellosis, and trichinosis. Despite these negative attributes, hogs are a common prey item for the Florida panther (Maehr 1990; Dalrymple and Bass 1996). Other non-native mammals, the Norway rat (*Rattus norvegicus*) and the black rat (*Rattus rattus*), are vectors of murine typhus, salmonellosis and leptospirosis. Black rats are also known to prey on native birds and bird eggs.

Non-native bird species carry diseases and often compete with native species for nest sites. The European starling, for example, competes aggressively with native species for tree cavities. The monk parakeet has been established in Miami-Dade County for over 30 years. This parrot feeds on fruits, seeds, and insects, and its effect on native species is unknown. In one instance in the 1990s, however, a bald eagle nest failure was attributed to a disease transmitted by a monk parakeet colony (Buhler et al. 2001). Several other non-native birds have been observed in the vicinity of the project area. These birds (*e.g.,* orange-winged parrot [*Amazona amazonica*], blue and gold macaw [*Ara ararauna*]) are not considered established or breeding within the project area. Many of these birds are released unwanted pets or unintentional releases from zoos and pet stores resulting from Hurricane Andrew, which made landfall in south Miami-Dade County in August 1992. As many parrot and parakeets are such long-lived species, these individuals may be present for many years and some may have the potential to establish breeding populations.

Several non-native reptilian species are of particular concern in the project area. The spectacled caiman and green iguana (*Iguana iguana*) are known to exist in the project area. The spectacled caiman has a wide-ranging diet (Ellis 1980) and may compete with the American alligator for food and territory. Cuban brown anoles (*Anolis sagrei*) are present in the project area and evidence suggests that brown anoles displace and prey upon native green anoles (*Anolis carolinensis*) (Gerber 1991; Echternacht 1999; Campbell 2000). The tropical house gecko (*Hemidactylus mabouia*) is also known to prey upon native anoles (Bartlett and Bartlett 1999). The common boa (*Boa constrictor*) readily feeds upon native birds, mammals, and other reptiles.

Between 1989 and 2005 96 boas, including gravid females and neonates, were collected at the Deering Estate at Cutler, which is in the northern part of the project area (Snow et al. 2007). Of particular interest in recent years in south Florida is the spread of Burmese pythons (*Python molurus bivittatus*) in natural areas (Snow et al. 2007). Burmese pythonds are widespread throughout ENP and they have also been reported in the project area (Skip Snow, Everglades National Park, email exchange, April 12, 2010), as has the Nile monitor (*Varanus niloticus*).

Native amphibian populations are at risk due to the Cuban tree frog (*Osteopilus septentrionalis*) and the giant toad (*Bufo marinus*). The Cuban tree frog has been known to prey upon the southern toad (*Bufo terrestris*), the narrow mouthed toad (*Gastrophryne carolinensis*), the southern leopard frog (*Rana sphenocephala*), the green treefrog, and the squirrel treefrog (*Hyla squirella*) (Austin 1973; Dalrymple 1994; Meshaka 1994). The prolific breeding strategy of the Cuban tree frog may disrupt the breeding ecology of native anurans. Toxic skin secretions may deem it undesirable as prey to both birds and snakes (Dalrymple 1994), though a variety of birds, mammals, and snakes can eat them (Bartlett and Bartlett 1999). Besides eating invertebrates, this species will prey on smaller frogs (Allen and Neill 1953; Austin 1973) and other vertebrates. Like the Cuban tree frog, the giant toad secretes toxins through the skin which can be fatal to animals attempting to feed on them (including native snakes, birds, and mammals). The giant toad preys aggressively upon small vertebrates and competes with native anurans for food resources and breeding areas. In addition, the consumption of giant toad eggs causes mortality of tadpoles of native anurans (Punzo and Lindstrom 2001).

In 1996, 75 non-native fish species had been collected in Florida, 23 were reproducing, and 18 were reported as "established" (Shafland 1996). There are now 32 species of non-native fish known to be reproducing within freshwater systems in Florida, and 22 of these are considered to be established (Shafland et al. 2001). Some reports indicate that over 120 non-native fish species have been documented in Florida waters (Benson et al. 2001; USGS 2004), though information is lacking on the current status of most of these. All of these reports indicate that introduction, establishment, and dispersal of non-native fish species have continued to increase over time. There are no indications that the number of new species introduced to Florida will decline or cease.

Increasing abundance and biomass of invasive non-native species are probably also occurring. Recent reports indicate non-native fish populations within the Water Conservation Areas (WCAs) are well established and occur both within canals and the adjacent marsh (Fury et al. 1995, 1998). The biomass of non-native species within canals has exceeded 80 kilograms per ac (Fury et al. 1995). Sampling within marshes of ENP has indicated variable abundance of non-native species, but some samples have included as much as 40 to 60 percent non-native species (Kline and Perry 2003). Volin et al. (2003) report that non-native species composed from 10 to 12 percent of the fish in native wet prairie and cypress habitats within one year, and non-native fish may be proportionally more abundant in larger size classes. Gill net samples of fish too large to be captured in minnow traps yielded over 20 percent non-native species. Volin et al. (2003) also report that over 60 percent of the fish sampled at a canal outflow culvert were non-natives.

Non-native fish species have inhabited the canal systems in south Florida for several decades. The impact of these species is largely unknown. Non-native species are often more tolerant of fluctuating salinity and low dissolved oxygen levels. They may compete with native fishes for food resources and spawning areas. Some non-natives that are firmly established in south Florida include the butterfly peacock (*Cichla ocellaris*), spotted tilapia (*Tilapia mariae*), pike killifish (*Belonesox belizanus*), and the oscar (*Astronotus ocellatus*). A more recent non-native fish species introduction to south Florida is the Asian swamp eel (*Monopterus albus*). Its introduction into Florida was probably the result of either an aquarium release or a fish farm escape or release, or a combination of the two. The impact of this species to the local ecology is presently unknown. The distribution, biology, and impacts of Florida populations are being investigated by U.S. Geological Survey researchers in conjunction with university biologists. Because they are generalized predators, the Asian swamp eel is a potential threat to native fishes, frogs, and aquatic invertebrates. This eel is a voracious piscivore capable of living out of water for a considerable length of time (Day 1958).

IV. FISH AND WILDLIFE RESOURCE CONCERNS

A. Introduction

The impacts to fish and wildlife resources as a result of this project are anticipated to be mostly beneficial through the restoration of estuarine, tidal wetland and freshwater wetland habitat types. The project should benefit the nearshore bay areas by maintaining a lower salinity that should result in a healthier coastal estuarine community. Rehydration of tidal and freshwater wetlands is anticipated to restore and enhance these wetland community types. However, negative impacts to fish and wildlife resources may be possible due to the quality of water that will be diverted to the wetlands or residual agricultural contaminants in the soil.

The intent of this section is to describe fish and wildlife resource issues and concerns that currently exist in the project area and concerns that are generated by the proposed project. This analysis is supported by several regional plans, including the Multi-species Recovery Plan (Service 1999a), as well as documented scientific research performed in or near the project area. The major fish and wildlife resource concerns for the proposed project are: (1) altered hydrology and resulting effects, (2) Biscayne Bay water deficit, (3) water storage, (4) maximizing beneficial use of available water, (5) water management operations, (6) contaminants, (7) water quality, (8) wastewater reuse, (9) Model Lands restoration, (10) migratory birds, (11) hydrologic modeling issues, (12) invasive species control, (13) implementation of ecological and adaptive management plans, and (14) integrating the project with CERP efforts.

B. Resource Concerns

1. Altered Hydrology and Resulting Effects

The C&SF Project and the South Dade Conveyance System have altered hydrology in the BBCW Project area, which has resulted in the degradation of the coastal wetlands and nearshore areas of western Biscayne Bay. Details on the causes and effects of altered hydrology in this

area were well described in Appendix B of the Service's FWCA Report that appeared as part of the Restudy (Service 1999b), all of which remain relevant to the BBCW Project area today. Some of the more significant hydrologic changes and resulting ecological effects are summarized below.

Prior to the alteration of system by human activities, Biscayne Bay received extensive freshwater input as both overland and groundwater flow. The bay served as the eastern outlet for freshwater from the southern Everglades and provided estuarine and freshwater nursery habitat (Smith 1896; Davis 1943; Kohout and Kolipinski 1967; Buchanan and Klein 1976). Hydrologically, freshwater inflow to the Bay was controlled by water levels in and behind the coastal ridge and overflow through the coastal ridge from the Everglades (Parker et al. 1955; Kohout 1960; Kohout and Kolipinski 1967). Historically, water flowed from the Everglades through the coastal ridge toward central and south Biscayne Bay through broad natural flow channels that are frequently referred to as transverse glades (Davis 1943; Buchanan and Klein 1976). After passing through the ridge, freshwater found its way to the bay through a complex network of coastal creeks. Central Biscayne Bay received enough groundwater and overland surface water flow to maintain mesohaline conditions (*i.e.*, 5 to 18 ppt salinities) even though it has the largest natural direct connection with the ocean and receives extensive ocean circulation at the area known as the Safety Valve. Mesohaline conditions existed in Manatee Bay in extreme South Biscayne Bay at the beginning of the 20th century (Ishman et al. 1998). The western shoreline of Biscayne Bay south of the Rickenbacker Causeway received sufficient freshwater to maintain extensive freshwater swamps and marshes with only a narrow fringe of mangroves (Reark 1974; Thorhaug et al. 1976; Harlem 1979). These coastal freshwater marshes were drained and farmed during the first half of the 20th Century (Reark 1974), until overdrainage, salt intrusion, hurricane storm surges and new opportunities to farm in the rocky uplands resulted in wholesale abandonment of coastal farmland (EPA 1994).

Biscayne Bay, along with its associated coastal and freshwater wetlands, has been affected by a reduction in overland flow and groundwater seepage, caused by the construction of roads and canals as well as by the general lowering of the water table on the east coast ridge. The altered hydrology has lowered the water table east of the coastal ridge by 5 to 6 ft (Leach et al. 1972), thus lowering the hydraulic head between the water table and the bay, which resulted in reduced groundwater flow to the bay. Alterations to central and south Biscayne Bay included regional drainage activities that essentially eliminated inflow from subterranean springs by the 1940's (Reark 1974) and channelized remaining overland and groundwater flow into canals such as the Goulds, Mowry, North, and Florida City Canals. Freshwater flow to Biscayne Bay decreased between 1953 and 1976 by 20 percent (Buchanan and Klein 1976), wetland hydroperiods decreased, and the patterns of freshwater discharge changed from long, slow releases over a broad front to "pulse" releases from canals following rain events. Currently, the water that formerly flowed through the major coastal creek systems is drained through large conveyance canals and discharged through water control structures. All four primary conveyance canals in the project area (C-100, C-1, C-102, and C-103) were constructed in the footprint of historic transverse glades and their associated major creeks.

One impact from hydrologic alteration was the regional increase in salinity, which has resulted in the slow conversion of a productive brackish estuary into a more marine and occasionally hypersaline environment (Alleman et al. 1995). Some of the additional ecological effects of reduced freshwater flow to the bay, particularly during the dry season, and a lowering of the water table east of the coastal ridge include: (1) pulsed discharges through the canals that create large fluctuations in salinity at canal mouths which severely impacts or kills attached or rooted benthic organisms and plants as well as impacts fish communities (Brooke 1982; Montague and Ley 1993; Irlandi et al. 1997; Lorenz 1997; Serafy et al. 1997); (2) loss of recreational and commercially important fishery species, such as red drum, due to disruption of the historic salinity regime; (3) loss of oyster bars, and their associated faunal communities, due to salinity changes; (4) displacement of oligohaline (salinity between 0 and 5 ppt) graminoid marshes by mangrove wetlands and forested/shrub wetlands; (5) expansion and landward intrusion of the "white zone" (the area of stunted mangroves and sparse sawgrass and spike rush that is caused by combination of increased salinity and decreased nutrients) in the Model Lands Basin (Ross et al. 2002); (6) intrusion of saltwater into coastal well fields; (7) loss of species that depend on stable salinities for survival; (8) decrease in freshwater fish biomass in those wetland areas that have experienced a transition from zero or low salinity conditions to higher salinity conditions; (9) reduced wading bird habitat in the coastal ecotone as a result of the reduction in prey fish productivity and availability; and, (10) reduction in water quality as water from the watershed empties directly into the bay without the benefit of treatment provided by the historic broad sheetflow through the coastal wetlands.

2. Biscayne Bay Water Deficit

The Service is concerned that adequate freshwater may not be available to fully restore the project area, especially during the dry season. The need to increase freshwater flows to improve ecological conditions in Biscayne Bay has been well documented. The Restudy's Draft Integrated Feasibility Report and Environmental Impact Statement (Corps 1998) and the Service's Restudy FWCA Report (Service 1999b) described the need and justification for additional water for the bay. In response to this concern, Scenario D13R4 (also known as the 245K Scenario) was developed which included an additional 245,000 acre-feet (ac-ft) of water for Biscayne Bay and ENP, which was obtained from urban stormwater sources in Palm Beach and Broward counties. Evaluation of this alternative revealed that although the additional water would be beneficial to Biscayne Bay, Florida Bay, Shark River Slough, and Taylor Slough, the routing of the additional water could cause harm to other natural areas of the Everglades ecosystem, such as WCA 2A and WCA 3B.

The Water Resources Development Act of 2000 addressed the D13R4 Scenario in Section 601(g)(1), which states that any project designed to capture and use the 245,000 ac-ft of additional water identified in Scenario D13R4 may not be implemented until, among other requirements, a project-specific feasibility study is completed. Consistent with this requirement, the Corps initiated a feasibility study to fully investigate the need for, quantity needed, possible distribution schemes, and potential impacts and benefits associated with providing additional water to ENP and Biscayne Bay in association with CERP. Results of the reconnaissance phase of this feasibility study appear in the December 2002 Preliminary Draft 905(b) report for the

Additional Water for ENP and Biscayne Bay. The report confirmed the Federal interest in providing additional water to ENP and Biscayne Bay, and it described and evaluated conceptual alternatives, including D13R4. All alternatives evaluated considered additional urban water originating from Palm Beach and Broward counties only. The reconnaissance study recommended proceeding with the feasibility phase after completion of the modeling work associated with the Initial CERP Update and a commitment from a non-Federal sponsor to cost-share the study.

The Corps' commitment to providing adequate water requirements to Biscayne Bay is documented in the PMP for the BBCW. The PMP states that the "PDT will establish the optimal water requirements and identify unmet requirements" for the project, and that "RECOVER will recommend potential supplemental water supply options to meet the unmet demands." These tasks also appear as line items under "Water Availability Assessment" in the PMP's Work Breakdown Structure.

Planning the BBCW Project has required estimates of the quantity of freshwater needed to restore the wetlands and nearshore areas of western Biscayne Bay. The District (Alleman 2003; Alleman and Parrish 2005), Corps (Corps 2003), National Park Service's South Florida Natural Resource Center (SFNRC 2006), and researchers at Florida International University (Meeder et al. 2002) have provided independent estimates of the freshwater volumes needed to meet nearshore ecological targets. Though the geographic area to be restored (from 3,200 to 10,000 ac) and the total recommended volumes needed for restoration (240,000 to 1,100,000 ac-ft per year) differ, they all are in agreement that approximately 110-150 ac-ft per year per acre of restored bay bottom is required to successfully restore mesohaline conditions. An analysis of current water practices from 1985 to 2005 shows that annual freshwater flow volumes for the BBCW target area is well below the aforementioned volumes determined by the salinity requirements to reach the ecological targets. The mean annual volume of fresh water flow during that time was 178,000 ac-ft per year between the Deering Estate and Convoy Point (combined outflow from all major conveyance canals within the project area). Using the conservative end of the spatial extent target of the current BBCW performance measure for restoring nearshore salinities (3,462 ac of nearshore bay habitat) and the average volume of freshwater required to meet those salinity targets of 130 ac-ft per year per acre yields an average need of 450,000 ac-ft of freshwater per year. This would indicate that the BBCW Project needs about two and a half times as much flow on an annual basis than is presently available to reach its full restoration goals. During the dry season, the monthly need may be as high as three times the average existing flows.

The historical record of salinity in southwestern Biscayne Bay also indicates that the current timing and distribution of canal discharge waters is largely ineffective at preventing hypersalinity during the dry season. Without the pre-drainage groundwater flows and historic creeks that used to provide waters to southern Biscayne Bay during the dry season, there is not enough flow to prevent evaporation-driven hypersalinity. The elimination of such hypersalinity events has been noted by the BBCW PDT as a goal to be reached as the project reaches further towards full restoration.

A South Florida Natural Resource Center report (SFNRC 2006) provides more information on estimates of additional water needed for the BBCW Project. Given that the BBCW Project EPP or the TSP has limited freshwater storage capability, the need for additional water during the dry season cannot be overemphasized.

3. Water Storage

Another Service concern is the lack of project features to store water during the wet season for use during the dry season. The anthropogenic modification of greatest impact to the Biscayne Bay watershed has been the disruption of dry season flows to the coastal areas. Since the water table must be kept 5 to 6 ft lower than historical levels to maintain flood protection for the urban area, there is essentially no local storage available for rainfall. Any rain falling on the lands upstream of the BBCW Project area are shunted through the canal system and out into Biscayne Bay. While this helps maintain mesohaline conditions in the nearshore region during the rainy season, during the dry season there are no flows emanating from behind the coastal ridge. Coastal wetlands dry down and the salinities in the nearshore region of southern Biscayne Bay rise as the dry season progresses, due to the complete cessation of freshwater flows. The conditions that result severely limit the ecology of the BBCW area.

The BBCW Project attempted to address this problem in some project alternatives, but the costs associated with building local reservoirs were prohibitive. Storage features were required to be close to the project area (east of the coastal ridge) since the conveyance of stored waters eastward across the developed urban area was not practical. Due to the flat and porous terrain, storage reservoirs would have to be lined and bermed which carries considerable cost. The required minimum size of these storage features – many tens of thousands of ac-ft – also added to the potential cost. Project alternatives with storage features were eventually screened out as too expensive for CERP. The BBCW PDT was instructed that if local storage features could not be included in the project design, the other CERP projects or RECOVER would be responsible for providing the necessary dry season flow volumes.

Without dedicated reservoirs or modifications to current operations, the only storage available to BBCW would be Lake Okeechobee, WCA-2 and WCA-3, as well as a limited amount of groundwater storage. The latter is the most practical, but is severely limited by the low stages required in the urban area for flood control and farm crop support. The former is limited by transmission capabilities, both through the agricultural areas south of the Lake and through the urban area from west to east.

4. Water Assurances

The Service is concerned about the volume of water that is being reserved or allocated for the natural system in the BBCW Project area by the State in accordance with section 601 of WRDA 2000. It appears for the BBCW Project, the water to be reserved or allocated for the natural system was defined as the volume of water that is "made available" by the project and was determined by calculating the quantity of water diverted by all the project features (i.e., water diverted from canals) on a daily basis. In general, the features in Phase 1 use just a portion of the

total amount available on any given day. This is especially true in the wet season when runoff is greatest. The fraction of available water that the Biscayne Bay Coastal Wetlands Project Phase 1 diverts ranges from about 48 percent to 88 percent in a given year. The project features are not designed to capture all water available because it would be impractical to install pumps large enough to capture all peak flows. The Service believes that all of the existing water currently flowing to Biscayne Bay is required to protect the natural system and must be protected by the State of Florida from consumptive use, as the water currently flowing to Biscayne Bay is not sufficient to restore desired target ecological hydrologic conditions.

5. Maximizing Beneficial Use of Available Water

Although the need for additional water for the BBCW Project area has been well documented, the preferential use of available water in the project area has received limited attention in the CERP planning process. The Service addressed this concern in a PAL dated September 26, 2006. In this letter, the Service expressed its belief that if sufficient water is not available for full restoration, then specific areas should be given priority over other areas; namely, the historic primary creek systems found within the project area as identified by Meeder and Harlem (2004). The following provides some background and justification for this recommendation.

As described above, freshwater historically flowed into central and southern Biscayne Bay through a series of small creeks (Meeder et al. 1999; 2000; 2001), which provided many benefits to fish and wildlife in this region. The creek systems occurred all along the western shore providing freshwater to the bay across a relatively broad front. This resulted in a relatively stable mesohaline salinity regime along the western shore of the bay, providing habitat for many estuarine organisms, including spotted seatrout, red drum, common snook, pink shrimp, and various species of seagrasses such as widgeon grass, shoal grass, and turtle grass. The creeks themselves provided unique habitat for other flora and fauna. The creeks provided deep water refugia and low salinities required by the American crocodile. Salinity regimes near the mouths of creeks apparently provided the only suitable living conditions for the eastern oyster in Biscayne Bay, as evidenced by relic oyster reefs found near the mouths of historic creeks by Meeder et al. (1999). These oyster reefs, in turn, provided habitat for a plethora of estuarine organisms.

The channelization of the watershed over the last century has resulted in a disruption of the natural flow of freshwater across a broad front through the myriad of former creeks. Restoration of the coastal wetlands and the re-establishment of more natural salinity levels in the nearshore water of western Biscayne Bay depend on the redistribution of freshwater from the conveyance canals into a recreated system of the coastal creeks. Meeder et al. (1999, 2000, 2001) have identified the locations of the historic creeks through analysis of historical photographs, satellite imagery, ground survey, and soil analyses. The creeks were classified according to source water and morphology. Major creeks drained surface water passing through the transverse glades of the coastal ridge, and were distinct from the more numerous and shorter tidal creeks. These studies have identified a total of 48 creeks that drained the coastal wetlands between Shoal Point and C-103, including 21 major creeks that connected to the historic transverse glades. More recently, Meeder and Harlem (2004) identified eight major coastal creek systems in the project

area between Shoal and Turkey points, that they deem critical to the restoration of this area. These eight creek systems are listed from north to south below with creeks numbers corresponding to the numbering system appearing in Meeder et al. (1999)(Figure 4).

1. Shoal Point (Creek numbers 47 and 48, creeks on Deering Estate)

2. Saga Bay Point (Creek number 42)

3. Black Point (Creek numbers 37 and 41)

4. Creek number 30 (only major creek between C1 and C-102)

5. Fender Point (Creek numbers 18 and 19)

6. Historic Creek Study Site (Creek numbers 11-13, located at point just north of Military Canal)

7. Creek number 6 (just south of Military Canal)

8. Convoy Point (major creek on north end of block defined by C-103 and North Canal, no creek number)

Re-establishing appropriate flows into these creek systems to restore oyster reefs and nearshore estuarine habitat is critical to the success of the BBCW Project. Major community components in this system (*i.e.,* freshwater wetlands, mangrove wetlands, and nearshore estuarine habitats) are closely linked, and to achieve full project success all of these components must be restored by reestablishing appropriate hydropatterns, flows, and salinity regimes. However, if the available water is not sufficient to restore all of the creek systems occurring in the project area or other community components such as some of the freshwater marsh areas, the eight primary creek systems described above should be given the highest priority for available water.

6. Operations

The operation of the water management structures (primarily the coastal water control structures) of the C&SF Project in the BBCW area is constrained primarily by urban flood protection, the inhibition of saltwater intrusion into the Biscayne Aquifer, and support of local row crop and tree nursery production. There is limited concern regarding water supply since there are no longer any coastal production wells, and the production wells in existence in Miami-Dade County south of the C-100 system are located far from the coastline in the Homestead-Florida City area.

The Service is concerned that the low groundwater stages required by urban and agricultural development are in direct conflict with restoration activities throughout Miami-Dade County. As at the western edge of the urban area where the low groundwater stages required by urban and agricultural development are in direct conflict with the restoration of ENP, the eastern edge of the urban area also would require far higher groundwater stages to be of substantial benefit to

the nearshore area of Biscayne Bay. Akin to the L-31W levee and canal in western Miami-Dade and Broward counties that separates the Everglades from the urban area, the L-31E is a storm surge protection levee, which runs almost the entire length of the BBCW Project area from the Northern Cutler Wetlands to Card Sound Road. Behind this levee is a 15 to 20 ft deep canal that connects the C-103, Military, C-102, and C-1 canals and defines not only the separation between natural and urban area, but also the separation between the freshwater and saltwater systems. Stages are managed in the L-31E canal to minimally prevent saltwater intrusion, but this management practice is compromised each fall, at the seasonal sea level maximum, by the lowering of stages by 0.8 ft in the canal to aid in the early planting of row crops and tree nurseries in the C-102 and C-103 basins. This drawdown has resulted in an average of 64,876 ac-ft of freshwater being released each year between 1995 and 2006 from the Biscayne Aquifer via the C-102 and C-103 canals (Renshaw et al. 2008).

The drawdown has a negative impact on the timing of flows to Biscayne Bay and on the hydropatterns in the adjacent coastal wetlands. Without the rapid drainage of freshwater resulting from the drawdown, these large volumes of water would gradually leak into Biscayne Bay and the adjacent coastal wetlands through groundwater and creek systems, providing needed freshwater well into the dry season. It is estimated that the water discharged through the coastal structures during the drawdown could potentially maintain freshwater discharge to the bay for approximately 3 to 4 months if it were allowed to seep under and through the L-31E levee and into the historical creeks in the coastal wetlands east of the levee. However, the drawdown release results in an artificially early start to the dry season, and the dry season is unnaturally dry, leading to long periods of dry marshes and high salinities (including frequent and persistent hypersaline events) along the shoreline. The result is a loss of productive estuarine fish and shellfish habitat (*e.g.,* eastern oysters), increased predation of nearshore species by marine fish, establishment of non-native plant species in the wetlands, and loss of wading bird foraging habitat during the nesting season.

Elimination of the drawdown would bring many environmental benefits to Biscayne Bay and its associated fisheries and coastal wetlands, and it is an inexpensive operational change. Species that would benefit include the West Indian manatee, American crocodile, oysters, spotted seatrout, and pink shrimp, as well as forage base species, such as mojarras (*Diaterus* and *Gerres* species) and silver perch (*Bairdiella chrysoura*). The West Indian manatee and American crocodile are highly dependent on the availability of freshwater in the coastal zone and the maintenance of estuarine conditions during the dry season, so the elimination of the drawdown would benefit these federally listed species. Also, the elimination of the seasonal drawdown would impede saltwater intrusion in southeast Miami-Dade County.

Also, a recent report to the Miami-Dade County Commission (Miami-Dade County Climate Change Advisory Task Force 2008) has noted that "As sea level rises, there will be further incursion of brackish water into the Biscayne Aquifer and into freshwater wetland systems. Incursion of brackish water into the Biscayne Aquifer will not only cause a change in habitats from fresh to brackish systems, and potentially cause degradation of habitats through colonization by invasive plant species, it will also endanger the potable water supply of Miami-Dade County. This will be exacerbated by brackish or salt water flowing into canals emptying

into coastal waters. In addition, over-drainage of areas via secondary and tertiary canals will reduce the freshwater that is available to recharge the aquifer. Water conservation measures will also need to be part of the strategy. Reduced draws on the Biscayne Aquifer will allow more freshwater head pressure in the aquifer, slowing brackish water intrusion." Based on this rationale, the report recommends a "review of current stormwater management operations, including the operation of canals and structures, in order to eliminate unnecessary over-drainage and limit the extent of saltwater intrusion into ground and surface water resources."

Systematically removing the available groundwater storage at the start of the dry season is detrimental to the natural areas of southeastern Miami-Dade County. Raising stage at the end of the wet season to take full advantage of the storage afforded by the surficial aquifer while incurring little risk of increased flooding in the absence of rain events would be a practical and ecologically-preferred practice. Each 0.1 ft of increased stage could provide another 2 to 4 weeks of flows to the nearshore zone without the construction of expensive project features. Modern local management of water levels in those remaining fields (*e.g.,* pumping within fields to maintain desired stages) may be a better option to provide agricultural benefits in lieu of damaging an entire coastal ecosystem through current regional water management practices.

All BBCW Project alternatives include a water management operational change that would eliminate this seasonal drawdown for agriculture. During the process of determining possible flood impacts to the project (under CERP Guidance Memorandum 3) the District determined that the elimination of the drawdown would adversely affect agricultural interests in the project area, so this operational change was eliminated from the Environmentally Preferred Plan (i.e., Alternative O). However, the District recognizes the potential ecological benefit to coastal wetlands and reduction in saltwater intrusion that would be provided by the elimination of the seasonal drawdown, and they initiated a study in Fiscal Year 2009 to explore effects of the drawdown and options for changing water management operations. It is noteworthy that the once prevalent row crop agriculture in and near the project area has been mostly supplanted by nursery farms that are more tolerant of higher water levels and by urban development. The Service commends the District for initiating the drawdown study and recommends that the study be expedited to the extent possible.

The use of existing connections (*e.g.,* S-122) between the C-100 and C-1 canal basins has not been exploited as part of current water management practices. Shunting water to the coast north of C-1 could provide greater benefits than may otherwise be realized. The BBCW PDT placed a high value on the ability to manage waters in this fashion as part of the restoration project and would encourage investigating such operational opportunities.

Due to difficulties in delivering new waters to the Model Lands, operational changes to the S-20 structure in the southern Model Lands could be employed to better use the local rainfall and groundwater resources in the area. Increased trigger stages at S-20 could prevent the point source discharge of approximately 20,000 ac-ft per year through the Sea Dade Canal and promote longer hydroperiods, overland flow through culverts being installed in the L-31E levee by FPL, and provide more (but limited) storage for dry season flows. The C-111 SC Project

includes this operational change at the S-20 structure in its PIR Phase 1 Project. However, including this operational change in the BBCW Project would be a prudent.

7. Contaminants

Most of the project lands west of L-31E are, or were at sometime in the last half century, in active agricultural production. Historical management practices, especially those associated with row crop farming, typically involved the application of OC pesticides for insect control. Most of these pesticides are no longer registered for use in the United States due to environmental concerns. However, from the 1940s to the mid 1980s, frequent applications of 4,4'-dichlorodiphenyltrichloroethane (DDT), chlordane, toxaphene, and other OCs were common in agricultural areas of south Florida, leaving residual concentrations of these toxic substances and their degradation by-products bound to and sequestered in the topsoil. Soils in the project area are saturated during the wet season, and dry out to varying degrees during the dry season. It is unclear if increasing the hydroperiod or water depth as a result of the BBCW Project will promote the release of these residual pesticides (along with other common contaminants such as mercury, selenium, and copper) into surface waters.

Since the mid 1980s, agricultural practices have employed a different suite of pesticides, including organophosphates, carbamates, and a variety of herbicides and fungicides. Although generally not as persistent as OCs, many of these modern pesticides are highly toxic to wildlife. Without appropriate risk management and attention to design alternatives, the subsequent release of these pesticides and trace metals into wetlands will provide exposure pathways to the fish and wildlife communities in the area.

As of the date of this report, EAs and ESAs have been conducted on properties acquired by the District in the BBCW Project area. All assessments were conducted by environmental consultants hired by the District. The Service's Environmental Contaminants staff reviewed all reports and provided comments and recommendations to the District. A summary of the Service's reviews and recommendations is provided in Section II.B of this report.

8. Water Quality

The Service is concerned about the effects of water quality after freshwater has been diverted from the conveyance canals to the adjacent wetlands with project implementation. Watershed land use changes have resulted in concurrent changes to the water quality of the surface and groundwater flows to Biscayne Bay. Although overall water quality in Biscayne Bay has improved in recent years (Alleman et al. 1995), water quality is still a substantial concern in the watershed. The quality of water that will be diverted from the canals in the project area will likely change in the future as agriculture is displaced by urban development, and as land management practices improve. This should result in a lowering of nitrate concentrations in the C-102 and C-103 to levels similar to those observed in the C-100 and C-1 basins whose land use is now mostly urban. However, phosphorus loading may increase to levels observed in the northern part of Biscayne Bay, which is also heavily urbanized.

The extensive agricultural endeavors in the watersheds of south Miami-Dade County include widespread use of various crop-protection chemicals, such as herbicides, insecticides, and fungicides. A 1991-95 survey of 27 stations in south Florida canals (Miles and Pfeuffer 1997) reported that atrazine, ametryn, bromacil, simazine, and norflurazon were the most frequently detected pesticides in surface water and DDE, DDD, and ametrym in sediments. Studies suggest that exposure to contaminants in the environment could have many sublethal effects on wildlife, including impaired hormone reproduction, erratic adult sexual behavior, reduced fertility and hatchability of eggs, and undesirable levels of offspring survival (Gross et al. 1994; Guillette et al. 1994; Sepulveda et al. 2001). Key et al. (2003) reported that atrazine, metolachlor, and three organophosphates (chlorpyrifos, malathion, diazinon) have been consistently detected in south Florida canals draining into Biscayne Bay and that their occurrence has been correlated to reduced levels of enzymatic activity in grass shrimp.

Of particular concern to the Service regarding water quality is the change in how freshwater runoff will enter the bay with project implementation. Presently, runoff is introduced to the bay via major conveyance canal discharges, which sends the water 0.5 to 1 mile out into the bay where it relatively quickly mixes with bay water. With construction and implementation of the EPP and TSP, the diverted canal water will enter the bay more slowly and under less velocity so it will be retained along the nearshore area and not mix as quickly with bay water as under existing conditions. This will improve salinity conditions, but it will increase nutrient, metal and chemical concentrations in the nearshore, at least temporarily until the runoff water mixes with bay water. Downstream communities are directly impacted by water quality changes, although the spatial extent over which a specific water quality parameter exerts influence is a function of its solubility and biological activity. The inflow of nutrients can result in shifts in benthic productivity and species composition. Contaminants could enter the bay environment and cause different impacts, depending on whether the level of exposure is acute or chronic. Major cumulative impacts to the submerged communities of Biscayne Bay could result from chronic exposure to reduced water quality. It is unclear how these temporary decreases in water quality will affect fish and wildlife resources in the coastal wetlands and nearshore areas.

9. Wastewater Reuse

One alternative proposed in the Restudy for providing additional water to central and southern Biscayne Bay and the BBCW Project is through the treatment and distribution of wastewater. Provision of reuse water was proposed through CERP's South Miami-Dade Wastewater Reuse Project (Corps 1999). This project proposed to provide high quality reused wastewater through additional treatment to the existing South District Wastewater Treatment Plant secondary effluent. For various reasons the project was removed as a CERP component, but it is presently being planned and funded by the Miami-Dade County Water and Sewer Department and is named the Biscayne Bay Coastal Wetlands Rehydration Pilot Project (BBCWRPP).

The BBCWRPP will be initiated as a pilot study that will produce 100,000 gallons per day of treated waste water. The project will emphasize the removal of nutrients and microconstituents, also known as emerging pollutants of concern (EPOCs). EPOCs include endocrine disrupting compounds, pharmaceuticals, hormones, and personal care products. The treated water will be

tested through a series of meso-scale toxicity experiments. By 2011 the Miami-Dade County Water and Sewer Department anticipates having enough information from the pilot project to design and build the full-scale project, which will produce 112 million gallons per day (mgd).

The water of Biscayne Bay and BNP are listed as Class III and Outstanding Florida Waters by the State of Florida. Table 5 lists the water quality standards for Class III water, which are also the anticipated target levels for the wastewater reuse project. In the absence of standards for microconstituents, the BBCWRPP will evaluate the microconstituent concentration levels of effluent water and a suite of toxicity tests on selected microorganisms to assess environmental impacts. If these concentration levels are achieved, the Biscayne Bay Coastal Wetlands Project will greatly benefit by blending poor-quality canal water with highly treated wastewater.

The Service has concerns, though, about the introduction of reused wastewater to the coastal wetlands and nearshore areas of Biscayne Bay. For example, the potential exists to increase nutrients, particularly phosphorus, loading to southern Biscayne Bay as a result of this component. If water quality is not consistent with ambient water quality of the mid-portion of south Biscayne Bay, then the wastewater reuse component could have a negative impact on submerged aquatic vegetation. Sea grasses would potentially become overgrown with epiphytes and in some areas undesirable planktonic or benthic algae may encroach.

Another concern regarding the use of reused wastewater is the ecological and human health impact of EPOCs in wastewater effluent (EPA 2010). EPOCs include: steroids and hormones, veterinary and human antibiotics, prescription drugs, non-prescription drugs, and other wastewater related compounds. Many of these compounds can be found at low concentrations in treated wastewater, and sometimes in potable water (Barnes et al. 2008, Focazio et al. 2008, Snyder 2008). Although the science is relatively new, there is evidence that exposure to EPOCs can cause cancer as well as physiological changes to humans and animals (Kidd et al. 2007, Gaworecki and Klaine 2008, Sowers et al. 2009). In the future, it is likely that wastewater reuse applications will be evaluated relative to the impact of discharging trace levels of the EPOCs. Of particular concern is human and animal exposure to endocrine disrupting chemicals (EDCs). Recent Safe Drinking Water Act amendments in 1996 include requirements to test drinking water supplies for EDCs.

It is unclear at this time if EPOCs can be removed by standard or advanced waste water treatment technology (Snyder et al. 2006, Snyder et al. 2008). Also, treatment of waste water to a level acceptable for use in the BBCW may be cost prohibitive. Channeling water to the BBCW Project area from CERP projects upstream may be a more practical and less costly solution than attempting to clean wastewater to acceptable standards. If upstream water is available, we recommend treatment for nutrients to the extent possible prior to being introduced to the coastal wetlands and Biscayne Bay. Treated upstream water may be of higher quality than treated waste water as it would probably contain lower levels of EPOCs. This is an important issue that should be addressed if any additional water in made available for the project as it will eventually enter BNP or the Biscayne Bay Aquatic Preserve.

The Service is also concerned about the availability of water from this Miami-Dade County wastewater reuse project. It is the Service's understanding that approximately a third of this water has already been permitted for non-environmental use. Although the remainder may be available for use by the natural environment, this usage has not been committed. The 42 mgd day of reuse water that may be available for the natural system converts to 47,040 ac-ft per year, which is approximately one third the additional water estimated to be needed to fully restore the BBCW Project area.

10. Model Lands Restoration

The Service is concerned that the BBCW Environmentally Preferred Plan is limited in its ability to provide benefits to the Model Lands and the Tentatively Selected Plan (Phase 1) has no features that address this area. The Model Lands include approximately 46,000 ac of fresh and saltwater wetlands and this area was within the preliminary project boundary for the BBCW Project. The wetland communities located within the Model Lands and the C-111 Basin (also called the Coastal Everglades or Southeastern Everglades) have been recognized as the only significant remaining area of short hydroperiod wetlands east of ENP, and which fulfill a "critical function for wading birds and other wildlife" (National Audubon Society 1997). The restoration of natural flow patterns to both Biscayne and Florida Bays is essential to restoring the high intrinsic value of these wetland communities.

Given the shortage of waters for the primary project target area between Shoal Point and Convoy Point, and the large volumes of water required to maintain adequate hydroperiods throughout the Model Lands, full restoration of the area is unlikely under the BBCW Project. The EPP has targeted several historical flow-ways that extend into the northern Model Lands, directing those few available flows to areas which are most likely to realize restoration benefits. For Phase 1, many members of the BBCW PDT recommend incorporating a 0.5 ft increase in S-20 stage triggers to (a) increase hydroperiods in the central Model Lands and, (b) promote overland flow to Card Sound through 40 culverts that FPL is installing in the L-31E levee between S-20 and Card Sound Road. The Service supports this recommendation, and it is consistent with restoration planned by the adjacent C-111SC project.

11. Migratory Birds

The BBCW Project area includes a 50-acre mitigation site established by the Lennar Corporation that is located northwest of the South Dade Waste Water Treatment Plant. Since its establishment, this site has become an active stop over for migrating shorebirds. The site also provides habitat for wading birds, waterfowl, raptors, and songbirds. Members of the local Audubon Society chapter and other local birders have monitored this site for the past four years, and to date, they have identified at least 113 species of birds, including at least 27 shorebird species (Torres 2008). Some of the rare shorebirds observed using this site include the red knot (*Calidris canutus*), Hudsonian godwit (*Limosa haemastica*), buff-breasted sandpiper (*Tryngites subruficollis*), and Wilson's phalarope (*Phalaropus tricolor*). On August 23, 2007, a Service biologist surveyed the site with local birders. Twenty-eight species were identified, including thousands of shorebirds such as short-billed dowitchers (*Limnodromus griseus*), ruddy turnstones

(*Arenaria interpres*), Wilson's phalarope, semipalmated plovers (*Charadrius semipalmatus*), and five species of sandpipers.

The Service is concerned that habitat conditions at this site may change as a result of the BBCW Project, and that these changes may degrade the site for use by migrating shorebirds. For example, if too much water was diverted to this site, particularly during the fall migration (mid July through September), then water on the site may be too deep for the shorebirds to forage. Alternately, without appropriate management, this site could become overgrown with undesirable vegetation, such as woody shrubs or non-natives such as Brazilian pepper or napier grass (*Pennisetum purpureum*), which would reduce or eliminate the habitat value of this site for shorebird usage. Maintaining this site as high-quality habitat for shorebirds is important given that the tip of the south Florida peninsula is the last fuel stop on the Eastern Flyway in North America before the shorebirds migrate south across the Caribbean Sea or the Gulf of Mexico in the fall, and the first fuel stop on the continent as the birds migrate north in the spring. Also, the fact that much of the migratory shorebird habitat in south Florida has been lost to urban or agricultural development over the last century underlines the importance of preserving and maintaining viable shorebird habitat in this area.

12. Hydrologic Modeling Issues

Because the BBCW Project area includes coastal wetlands within several watershed basins and adjacent submerged habitat of western Biscayne Bay, the BBCW PDT was to rely on both a hydrologic model for the watershed and wetlands and a hydrodynamic model for the bay for evaluating project alternatives. The hydrologic model chosen for development for the project was the Watershed Systems of 1-D Stream-River, 2-D Overland Regimes, and 3-D Subsurface Media (WASH123D123D) model; the hydrodynamic model chosen for Biscayne Bay analysis was the TABS-MDS Multi-dimensional Sediment (TABS-MDS) model. Both models were developed by the Corps' Engineer Research and Development Center (ERDC) at the Waterways Experiment Station in Vicksburg, Mississippi. The TABS-MDS model is closely tied to the WASH123D model because output from the eastern boundary of the WASH123D model feeds directly into the TABS-MDS model (*i.e.,* the WASH123D output across its eastern boundary serves as western boundary conditions for the TABS-MDS model). The output from both models was to be used to quantify project performance measures for evaluating and ranking project alternatives.

For various reasons, the WASH123D model did not provide realistic simulations of surface and groundwater flows, despite a series of revision and calibration efforts. The Service documented some of our concerns with this model in PALs dated December 24, 2002; June 21, 2004; January 20, 2006; and September 25, 2006. The most current version of the WASH123D model continues to provide suspect surface and groundwater flows. Some examples of potential errors or of suspect output include: (1) excessive ground-water flows toward the bay, (2) too much or too little water in certain basins (*e.g.,* too much water in the C-100 basin and too little water in the C-103 basin), (3) more ground and surface water flowed toward the bay during the dry year compared to the wet year, (4) use of varying water budgets among alternatives, and (5) large fluxes of surface water out of Card and Barnes Sounds to the north across the Model Lands.

Also, the modelers used modified operational triggers for coastal structures to drive the WASH123D model runs more towards observed conditions, which is not a desirable procedure. Further, the modelers did not provide a water budget so it was impossible to compare water volume flux across the WASH123D western boundary with downstream flux across the model's eastern boundary, which is a fundamental step for checking model calculations.

The Service concerns with the WASH123D model were shared by other PDT members, including some Corps and District staff and other agency team members. As a result, the model was determined to be unsuitable for quantifying performance measures developed to determine ecological benefits for the suite of project alternatives. Because the WASH123D model provides the western boundary conditions for the TABS-MDS hydrodynamic model for Biscayne Bay, the Service has concerns about using the TABS-MDS model for planning the project (as noted in our January 20, 2006 PAL). However, the Service and other agencies on the PDT believe that the TABS-MDS model provides realistic output if reasonably accurate boundary conditions are used as input. For example, the Corps provided ten preliminary runs of the TABS-MDS model in 2004 that utilized observed flows from conveyance canals as a western boundary condition. Results of those runs have greatly aided the team in planning the project and some of those results are used in the evaluation section of this report (Section IX.B).

13. Invasive Species Control

a. Non-native Vegetation

The long-term goal of the BBCW Project is to return the hydrology of the area downstream of the spreader features to a condition comparable to that which existed prior to drainage. Of particular importance for restoring the wetlands will be to re-establish hydroperiods and water levels that are suitable for native freshwater marshes. Hydroperiods and water levels appropriate for native marshes are not conducive to the survival and proliferation of the seedlings of many nuisance non-native species, such as Brazilian pepper and Australian pine. However, the restoration of more natural hydrology alone will likely not suffice to eradicate established stands of mature Brazilian pepper. It will likely be necessary to physically remove this vegetation. The Service is concerned that resources may not be available through this project to conduct the eradication of mature stands of non-native vegetation. It is also anticipated that a return of a more natural fire regime will be required to maintain the desired vegetation communities, which will likely require the implementation of a fire management program. The Service is concerned that the reestablishment of a more natural fire regime may be challenging given the extent of urban development in the BBCW Project study area. E xperiences from National Wildlife Refuges in urban settings indicate that, given sufficient attention, fire management programs near urban settings indeed can be successful.

South Florida's subtropical climate provides an excellent growth environment for the spread of non-native plants that can cause extensive alterations to an area's natural ecosystems. Environmental changes caused by hydroperiod alterations in the project area have been important factors in non-native plant invasion. Invasive non-native plant species are associated with drained or disruptive fire and hydrologic regimes. Non-native plant invasion can result in

partial or total displacement of native plants, loss of wildlife habitat, and the degradation of public use areas. Non-native plant or animal species that persist in the project area may harm or displace native species and alter ecosystem functions. Brazilian pepper and Melaleuca are among the most prolific invasive species, although other introduced plant and animal species may locally or regionally imperil fish and wildlife resources. Increased nutrient loads may lead to the proliferation of nuisance species such as cattails or primrose willow (*Ludwigia peruviana*).

As noted in section III.B.5.e above, non-native vegetation occurs over a large spatial extent within the BBCW Project area. Of particular concern is Brazilian pepper and Australian pine, but shoe button ardesia (*Ardesia elliptica*) is also spreading in the project area. Brazilian pepper does not become established in deeper wetland communities and rarely grows on sites inundated longer than 3 to 6 months (LaRosa et al. 1992). Results of experiments conducted by the Sanibel-Captiva Conservation Foundation on Sanibel Island, Florida (1990-1991), and the effects of a substantial rainfall in 1995 suggest that Brazilian pepper can be stressed or killed by flooding. Successful invasion appears to be a function of seed access to an area, germination of introduced seeds, and seedling survival (Ewel et al. 1982).

b. Non-native Fish and Wildlife

The Service's PAR dated May 13, 2004, noted that 10 species of non-native fish have been documented to occur in or near the project area are non-natives. These species include various cichlids, goldfish, and walking catfish, among others, and they primarily inhabit relatively deep freshwater habitats provided by conveyance canals. The Service is concerned that most of the non-native fish in the project area will continue to persist in the existing conveyance canals and will likely spread to the proposed spreader features described in the EPP. Because of the potential current and future threat resulting from non-native fishes and the broad policy-level support for action against invasive species, project monitoring plans should identify non-native fishes and the extent to which these fishes invade adjacent restored habitats to determine if control measures are necessary. Federal agencies have been provided a mandate to address invasive non-native species under Executive Order (E.O.) 13 112: Invasive Species. Under this E.O., Federal agencies are directed to identify appropriate control practices and means to reduce the spread of non-native species, and use relevant programs and authorities to prevent, control, monitor, and research invasive species.

The Service recognizes non-native fish species, as well as non-native plants and other non-native animals, as a potential obstacle to achieving restoration. The Service has participated in discussions with personnel from other agencies, researchers, and the public about this issue, and continues to consider it an urgent problem. However, it remains difficult to assess the threat from non-native fish and measure ecological impacts due to variability in occurrence, density, and biomass within different habitats and geographic areas over time (Trexler et al. 2000). Canals, canal sections, or deeper ditches that remain in the BBCW Project area will provide permanent habitat for predatory species of native and non-native fish. Predatory fish prey upon smaller fish species that provide forage base for wood storks and other wading birds. Wet season rainfall could disperse predatory fish to isolated wetlands where increased predation on small fishes could reduce the forage base for wading birds and wood storks.

Non-native amphibian, reptile, and mammal populations which may be present in the project area can change complex ecosystem relationships or reduce the food supply for native predators (FDEP 1994). Feral hogs in the BBCW area degrade wildlife habitat, compete directly with native wildlife for food, and act as a reservoir for diseases communicable to man and domestic animals. Feral hog habitat includes the flatwoods, freshwater marshes, ponds, sloughs, and cabbage palm hammock plant communities. In general, most low and medium hog populations occur where habitat quality is limited. The detrimental effects of wild hogs are multi-faceted and result from their movements, habitat utilization, and food habits. Their rooting disrupts vegetative communities and successional patterns, as well as altering nutrient cycling. Therefore, they can have both direct and indirect effects on some fauna either through predation or alteration of the forest floor habitat (Tate 1983). It is hypothesized that the wild hog is an important competitor for food with a number of other wildlife species such as white-tailed deer, turkey (*Meleagris gallopavo*), squirrels, and even waterfowl (Thompson 1977). Trapping, sport hunting, and agricultural depredation control measures have been implemented to suppress populations in some areas of Florida where feral hogs are having detrimental effects.

14. Impingement and Entrainment of Fish

The Service is concerned about the impingement and entrainment of fishes in the project pumps that will divert water from the major conveyance canals (C-100, C01, C-102, and C-103) into the freshwater and tidal wetlands. As noted in Section III.B.6.c above, both native and non-native fish species inhabit the major conveyance canals of south Florida, including those in the project area. The fishes inhabiting the major canals in the project area may include rare and endangered species, such as opossum pipefish, bigmouth sleeper, mangrove rivulus, smalltooth sawfish, and mountain mullet. Recreationally important gamefish also inhabit the canals.

15. Implementation of Ecological Monitoring and Adaptive Management Plans

The Service has played a lead role in the development of an Ecological and Water Quality Monitoring Plan for the BBCW Project. The intent of the plan is to determine if the anticipated hydrologic, vegetative, wildlife, and estuarine benefits of the project are being achieved and to support the adaptive management process over the life of the project. This plan would provide for baseline, construction, and post-restoration monitoring of water quality, ground and surface waters, salinity, wetland vegetation and periphyton, submerged aquatic vegetation, aquatic fauna, oysters, and crocodiles. This plan has been integrated and coordinated, to the extent possible, with the RECOVER Monitoring and Assessment Plan. An adaptive management plan for the project has also been developed, which is critical to defining steps that can be taken in the event that expected restoration results are not realized. This plan helps assure that anticipated project benefits will be realized.

The Service is concerned that the recommended ecological monitoring plan and adaptive management plan will not be fully implemented due to lack of dedicated funding at the project level. Also, RECOVER has determined that the RECOVER Monitoring and Assessment Plan will not incorporate all monitoring parameters recommended for the project by the PDT. Given

the lack of modeling and the high level of uncertainty in the realization of restoration goals and objectives for this project, the implementation of sound monitoring and adaptive management plans are vital to project success.

Additional justification for implementing a robust monitoring and adaptive management plan can be found in the Restudy Chief's Report (Corps 1999). Section nineteen of the report states: "The reporting officers recommend the authorization of an extensive Adaptive Assessment Program, which includes a system-wide monitoring program which will be conducted to support the ecosystem restoration objectives of the Comprehensive Plan. The monitoring program is a necessary component of the Comprehensive Plan to assure that ecosystem benefits are achieved in ENP, Biscayne Bay, Big Cypress National Preserve, the Loxahatchee National Wildlife Refuge, as well as other natural areas."

In early 2010 the draft PIR was subject to a review by an independent external peer review panel of experts. One of the primary recommendations of the panel was to expand and enhance the ecological monitoring plan. Also, the Corps has issued recent new guidance (Memorandum for Commanders, Major Subordinate Commands, dated August 31, 2009) that extends the time period for ecological monitoring to ten years, if necessary, for ecosystem restoration projects. Based on these two recent developments, the Corps requested that the PDT monitoring sub-team expand and enhance the water quality, ecological, and hydro-meteorological monitoring plans. The PDT sub-team is currently in the process of revising these plans to comply with the independent external peer review recommendation and the recent Corps guidance on monitoring ecosystem restoration projects. The Service supports the parameter and temporal enhancement of the BBCW Project monitoring plan.

16. Integrating the Project with CERP Efforts

The BBCW Project is highly dependent upon the regional water management system, adjacent CERP projects, and restoration efforts centered upon Lake Okeechobee to realize full restoration benefits. The large amount of water required to attain nearshore salinity goals and the associated ecological benefits, particularly in the dry season, is only found in Lake Okeechobee. Current flows to the St. Lucie and Caloosahatchee canals are much greater than necessary and cause severe ecologic disturbance to the estuaries at their mouths. If water quality standards could be met, flows out of Lake Okeechobee should be directed southward to CERP projects in south Florida. Impediments to the delivery of these flows are a severe limitation on the possible degree of success that can be achieved by the BBCW Project. It is hoped that the River of Grass initiative will alleviate these concerns.

a. C-111 Spreader Canal Project

The C-111SC project and the BBCW Project overlap in the Model Lands, as well as in Card and Barnes Sounds. Both seek to provide benefits to the Model Lands, and to provide ecologically beneficial flows to Card and Barnes Sounds, but both also have other restoration priorities upstream of the area. Thus, without substantial increases of water to southern Miami-Dade

County via the regional system, the benefits in the area will be limited to what can be done with the available water from the local rain-driven system.

In some project scenarios, the spreader feature associated with the C-111SC project has been envisioned to connect to the BBCW Project in the general area of Tallahassee Road in the northern Model Lands. In an ideal situation, this would permit flows to be moved from basin to basin in response to restoration needs. The BBCW PDT endorses this idea.

There is a perception that the C-111SC project and BBCW Project are competing for the same water. This is true in the regional water availability scenario only, in that flows that used to pass through Miami-Dade County from the formerly natural areas to the north (now Broward and Palm Beach counties) are no longer permitted to flow. Under the current water management scenario there are few water deliveries to southern Miami-Dade County from the regional system and the waters in the basins are mostly rain-driven. In this rain-driven system, both projects seek only to redistribute local rainfall most effectively to meet restoration goals. During the dry season, both projects are similarly seeking more water to meet restoration flow targets.

b. Everglades System-wide Effort

The BBCW Project is on the receiving end of flows from the system-wide CERP effort, and as such is depending on CERP to provide those flows necessary to restore the natural system. While the recipient of a large amount of rainfall in the wet season, the BBCW Project PDT determined that under current financial limitations, local facilities (primarily reservoirs) of a sufficiently large scale to provide storage of wet season rainfall in order to provide dry season flows to the project would be unaffordable. Thus, the regional system is the most logical source for providing these dry season flows, and the regional system is largely dependent upon the CERP effort to enable such flows. These flows should be of sufficient volume and quality to meet BBCW Project targets, and should be delivered at the appropriate times, with special emphasis on the dry season.

If CERP can deliver more flows out of Lake Okeechobee or elsewhere upstream of the BBCW Project area, then the BBCW Project will still be dependent upon the regional water management system to deliver these flows to the project area in southeastern Miami-Dade County. Existing infrastructure (C-100, C-1, C-102, and C-103) may be able to deliver some limited amount of the required flows from west to east through the urban area, but some modifications may be required to move sufficient volumes of water and still avoid flooding impacts on the urbanized area. The BBCW Project will then redistribute this water north and south along the BBCW footprint in order to meet restoration goals.

C. Summary/Planning Objectives

In summary, the Service has concerns that due to a shortage of available water and lack of storage, appropriate hydropatterns cannot be maintained in the freshwater wetlands and target salinities cannot be maintained in the tidal wetlands or nearshore areas during the dry season. We are concerned that the eight primary historic creek systems in the project area may not be

given the highest priority for available water and we are concerned that the operational needs for water supply and flood protection for agriculture conflicts with operational needs for fish and wildlife resources. Regarding water needs, the Service believes that all of the existing water currently flowing to Biscayne Bay is required to protect the natural system and must be protected by the State of Florida from consumptive use. Currently, only a relatively small fraction of that water is protected through the WRDA 2000 Water Assurances process.

The Service is also concerned about impacts from residual agricultural chemicals in the soil or nutrients and other harmful chemicals in the water diverted from conveyance canals into the coastal wetlands. The Service is concerned that the BBCW Project's Environmentally Preferred Plan and Tentatively Selected Plan has limited capability to provide benefits to approximately 46,000 ac of wetlands in the Model Lands component of the project area. We have concerns that habitat conditions at the Lennar mitigation site, which has become an important migratory birds fueling and resting site, may be impacted by project implementation. We want to reiterate that the PDT's concerns and issues with the project modeling have not been adequately addressed. However, we are satisfied that the WASH123D model has been deemed inappropriate, in its present form, to evaluate the project. The Service is concerned about the BBCW Project's ability to eradicate and control invasive non-native vegetation without initial physical removal of established stands of mature non-native species. We are also concerned that most of the non-native fish in the project area will continue to persist in the existing conveyance canals and will likely spread to the proposed spreader features described in the EPP.

The Service believes that coordination and integration with other CERP projects in general, and the C-111 Spreader Canal project in particular, is critical to the overall success of the BBCW Project. The Service is also concerned with the possible impacts to the BBCW Project from the planned FPL plant expansion. Lastly, the Service is concerned that the recommended project-level ecological monitoring plan and adaptive management plan developed for the project may not be fully implemented due to lack of dedicated funding. Given the shortfalls in the modeling and the high level of uncertainty in the realization of restoration goals and objectives for this project, the implementation of sound monitoring and adaptive management plans are critical to project success.

V. EVALUATION METHODOLOGY

The evaluation section of this report (Section X below) will focus on two primary sources of available information that can be used to examine ecological benefits for and impacts to the BBCW Project. This includes (1) the method used by the PDT to quantify benefits of each project alternative, and (2) the relevant output from the TABS-MDS model to document beneficial changes to the nearshore salinity regime from redirecting water through the coastal wetlands, benefits from the ability to store water, and benefits of introducing additional water to the system.

A. Criteria-based Ecological Evaluation Method

As noted in section IV.B.12 above, the shortcomings of the hydrologic model created for this project prevented the quantification of ecological benefits and impacts using the original suite of performance measures. The BBCW PDT instead used a benefits evaluation method that was based on portions of what was deemed reliable model output, Geographical Information System evaluations, and best professional judgement. This method is referred to as the Criteria-based Ecological Evaluation Method (CBEEM) and is based on a well documented method known as the Multi-Criteria Decision Making (MCDM) approach. MCDM is a holistic decision making tool utilizing measures and procedures that aim to combine multiple criteria, which can be either conflicting or supporting, and provides credence to investment decisions. The CBEEM was developed by a PDT subteam of ecologists and scientists familiar with the study area and knowledgeable about the ecological stressors the BBCW Project seeks to influence.

The CBEEM was developed to assess the relative ecological benefits and consequences of BBCW Project alternatives to guide selection of the recommended restoration plan. It is a Microsoft Excel spreadsheet tool that utilizes hydrologic modeling results, management measure size and operation, and available hydrologic data to calculate a habitat unit (HU) score for each alternative. CBEEM is used to evaluate ecological benefits for each of the three major ecological zones present within the project area separately using performance measures (PMs). The three ecological zones include the near shore bay estuarine zone, the saltwater or tidal wetlands zone, and the freshwater wetlands zone. Each PM addresses project objectives, relates to conceptual ecological models that have been developed for Biscayne Bay and the adjacent mangrove transition zone, and quantifies to the extent possible the ecological benefits provided by the measure. The PMs include: (1) restoration of near shore salinity regime, (2) restoration of tidal wetland salinity regime, (3) reduction in harmful point source canal discharges, (4) potential wetland rehydration, (5) reduction in nitrogen concentrations, (6) reduction in phosphorus loading to Biscayne Bay, and (7) reduction in non-native vegetation. Complete documentation for each of the performance measures that are used in the CBEEM appear in Appendix A below.

The CBEEM evaluation is accomplished in four steps: (1) calculate PM output, (2) normalize PM output, (3) compute quality index, and (4) compute habitat units. PMs are quantified to the extent possible using model output, hydrologic data, project feature operation, and GIS data. Numeric targets for evaluation metrics were established whenever possible. For these metrics, the scores were converted to percent of target achieved to compare and contrast between and among evaluation metrics, and to normalize the output. Establishing targets for some metrics was not possible. In these cases, scores were normalized against the alternative with the highest score. Normalizing output allowed evaluation metrics to be combined to produce an ecological benefits index for each ecological zone. For this project, the scores from all the evaluation metrics applicable to a given ecological zone were simply averaged to provide a single index value for that zone (*i.e.,* all PMs were equally weighted). The indices were then applied to the total spatial extent of each ecological zone (in acres) to produce habitat units. Thus, habitat units were provided separately for the near shore, saltwater wetlands, and freshwater wetlands zones. The Cost Effective/Incremental Cost Analysis was performed separately for each of the three ecological zones so select the preferred alternative.

B. TABS-MDS Model Output

In 2003 the Corps' ERDC conducted 10 preliminary runs of the TABS-MDS model to provide guidance to the BBCW PDT for planning the project and developing alternatives (Corps 2003). These runs were helpful in providing insight to the effects on the salinity in nearshore waters to water redistribution, upstream storage, and additional water. The Service has reasonable confidence in the information provided by these runs because they did not use output from the WASH123D model as a western boundary condition. These results have proven valuable to the planning of the BBCW Project over the past 5 years. Pertinent results from this effort appear in the Evaluation section below (Section IX.B).

VI. FISH AND WILDLIFE RESOURCES WITHOUT THE PROJECT

The Service has adopted, with some modification, the Future Without Project Condition analysis as contained in the AFB document. Analysis of the listed species under the "without project" condition has also been modified from the AFB text.

A. Introduction

The study area for the proposed BBCW Project is composed of a variety of privately-owned, local, state, and federally-owned lands. Privately-owned natural lands in south Florida have become scarce due to development; therefore, the Service anticipates that these lands will be developed in the near future. For example, native forested-shrub wetlands and graminoid marshes east of Card Sound Road not in public ownership will likely be developed, especially the areas north of Turkey Point. Future development would also have secondary effects. The wetlands in the northern part of the sawgrass marshes in the Model Lands could transition from a sawgrass-dominated marsh to cattail-saltbush-dominated wetlands due to poor water quality from residential runoff and decline of available freshwater. Fish and wildlife habitat within the study area would be adversely impacted by any or all of the following: future residential, commercial, and industrial development. Further development and creation of impervious surfaces would lead to increased runoff velocity and more frequent and higher freshwater discharges through canals that would exacerbate the ecological damage to nearshore areas of Biscayne Bay. Increased development within this area would also lead to habitat fragmentation, and a loss of wildlife corridors that are critical for larger animals such as the Florida panther. A reduction of the wetland function and value of coastal and inland habitats within and adjacent to the BBCW Project area associated with the spread of development and land conversion will result in an overall loss of fish and wildlife resources within the project area in the future.

Residential development within the project area would require the dredging and filling of wetlands. The creation of stormwater detention areas and drainage infrastructure would have a detrimental effect on groundwater flow into Biscayne Bay. Freshwater groundwater flow into Biscayne Bay is necessary to maintain existing salinity regimes in the dry season and reduce hypersalinity levels that already exist. Additionally, foraging opportunities for wildlife would be reduced as native plant communities would be replaced with ornamental species in developed areas.

Urbanization is normally accompanied by an increase in runoff of a wide range of pollutants including herbicides, pesticides, fertilizers, aromatic compounds (oils, gas), heavy metals, and other EPOCs (hormones, organic, and inorganic compounds). In urban developments near wetlands, residents often request and obtain mosquito spraying. Agricultural development is also typically accompanied by the use of herbicides, pesticides and fertilizers. The increased release of pollutants into the natural environment would result in the decline of macroinvertebrates (insects, snails, etc.), which in turn would adversely impact native resident and migratory birds, as well as other insectivores.

Aerial photographs and surveys indicate that parts of the project area have high all terrain vehicle (ATV) usage (DERM 2004), and this is likely to increase in the future without project scenario. The impacts resulting from unauthorized ATV usage in the natural areas include disturbing the vegetation and microtopography of the area. This has implications for the hydrology and vegetation, which are sensitive to slight changes in topography on the scale of inches. ATV usage, and its associated detrimental effects to the environment, will likely increase with the anticipated increase in population in or near the project area.

Changes in availability and distribution of freshwater and further disruption of natural sheet flow from discontinuities in hydrology due to levees, roads, and canals will further exacerbate the changes occurring in the natural freshwater graminoid marshes, forested-shrub wetlands, marl prairie, tree island, and mangrove ecotones. Disruption of the natural hydrology has resulted in aquatic vegetation community changes and a resultant disruption of aquatic productivity and function that has had repercussions throughout the food chain, including effects on wading birds, raptors, larger predatory fishes, large reptiles, and mammals. Productivity of native fish species, which serve as prey species for wading birds has been, and will continue to be, depressed due to water management practices (Ogden 1994) and other factors previously discussed. These effects will worsen given demands associated with environmental changes for the next 50 years.

Sea level rise will create the potential for further expansion of salt tolerant plant species, especially mangroves, into the freshwater marsh areas. Disruption of natural fire cycles and extent can have several effects that will increase in the future without project scenario. Control of fire intensity and extent due to potential for impacts on human infrastructure can encourage establishment of woody plant species that would normally be eliminated as well as selection against more fire tolerant species such as sawgrass and muhly grass. Reduction of water availability can cause fires to burn more intensely than natural, killing plant species that would normally survive a more natural "cool burning" fire as well as permitting organic soils to burn. Concurrently, unnatural flooding can inhibit fires and beneficial vegetation changes. All of these processes will be exacerbated due to increased urbanization in the future.

B. Threatened and endangered species

Without the environmental benefits of the BBCW Project, urbanization, water demands, direct loss of habitat, and other demands for land, as well as degradation of existing habitat function

will likely result in a continued decline in populations of threatened, endangered, and state listed species of special concern in the project area during the next 50 years.

The major threats faced by the West Indian manatee today and continuing into the future are from two primary anthropogenic causes—collisions with watercraft and entrapment in water control structures. The future without the BBCW Project will likely witness an increase in boat-related manatee mortality due to increased human resident population and a corresponding increase in boating. Direct manatee mortality rates from water control structures would likely be similar to current figures. There are also threats to habitat caused by coastal development throughout much of the manatee's Florida range. Nutrient loading from residential and agricultural sources is promoting the growth of algae and clouded water columns, reducing available forage in seagrass beds and refuges. There are also threats from natural events such as red tide and cold events. Survival of manatees will depend ultimately on maintaining the integrity of ecosystems and habitat sufficient to support a viable manatee population.

Florida panther habitat in the BBCW Project area includes habitat designated as primary zone in the Landscape Conservation Strategy for the Florida Panther in south Florida (Kautz et al. 2006). The primary zone is considered to be the most important area needed to support a self-sustaining panther population. Environmental factors affecting the panther include: habitat loss and fragmentation, contaminants, prey availability, human-related disturbance and mortality, disease, and genetic erosion (Dunbar 1993). Present and probable future population growth, urban expansion, and agricultural expansion in south Florida, including the project area, may compromise the ability of natural habitats to support a self-sustaining panther population. A future without BBCW Project scenario for the Florida panther for the next 50 years would not be conducive to Florida panther recovery and the Landscape Conservation Strategy for the Florida panther in south Florida.

The prognosis of the United States' wood stork population over the next 50 years is partially dependent on the success of CERP. In a future without project condition, wood stork habitat will be eliminated by development or will continue to be degraded as foraging habitats in much of the remaining wetlands. As noted earlier, the CFAs of three wood stork colonies overlap the northern part of the project area, including the Deering Estate and parts of the Cutler and Black Creek wetlands. Continued urban development in this part of the project area under a future without project scenario will reduce or possibly eliminate this foraging area for wood storks. For wading birds in general, a long term scenario that does not include habitat restoration components of CERP currently being evaluated would result in a continued overall decline due to continued habitat encroachment and anthropogenic influences on water supply.

The future of federally listed reptiles with the BBCW Project is uncertain. As noted above, habitat loss due to development and water management practices along coastal areas has been and continues to be the primary factors endangering the American crocodile (Service 1999). A future without project scenario would likely result in no improvement of juvenile crocodile habitat, and may result in further degradation. Collisions with automobiles continue to be the major documented cause of mortality of crocodiles in Florida. A future without the BBCW Project would likely witness continued mortality from automobile collisions, and the relative

proportion of this type of mortality may increase due to higher traffic volumes associated with an increased south Florida population. Some of the BBCW Project alternatives incorporate wildlife corridors under the two major problem roadways, which should reduce crocodile road kill.

Because of its relatively large home range, the eastern indigo snake is especially vulnerable to habitat loss, degradation, and fragmentation caused by residential and commercial construction and agriculture, and (Lawler 1977; Moler 1985). Urban and agricultural developmental interests would continue to degrade or eliminate large expanses of suitable habitat throughout the project area under the future without project scenario. Even with continued habitat destruction and alterations, this species will probably persist in most areas if large, unfragmented pieces of suitable habitat persist (Service, 1999a). However, continued habitat fragmentation will result in isolated small groups of indigo snakes that cannot ensure the continuation of viable populations.

C. Non-native flora and fauna

An increase is anticipated in the 2050 future-without project scenario in the spatial coverage of invasive non-native plant species, such as Brazilian pepper and Australian pine due to land disturbance and projected lower water levels. With the lack of monitoring and maintenance, there will also be an increase in other non-native plants including shoebutton ardisia (*Ardisia elliptica*) and old world climbing fern (*Lygodium spp.*). The spread of all these invasive non-native plant species has resulted in the conversion of large acreages with a variety of native vegetative species to less diverse and in some cases mono-specific vegetative cover with reduced value as wildlife habitat (Corn et al. 1999, Brandt and Black 2001). Detrimental effects to wildlife habitat value caused by non-native vegetation invasion were described in detail in a previous section.

Introduction and spread of non-native fish species has increasingly been problematic in the project study area. The causative factors for this non-native fish problem include illegal introductions, unnatural habitat due to construction of canals and impoundments, and the establishment of vectors for travel and refugia (linear canals and deeper water) unlike the natural Everglades environment (Benson et al. 2001). Evaluation of the effects on occurrence and productivity of native fish species is controversial at best, but some studies report that the effect is negative and will be exacerbated in the next 50 years (Turner et al. 1999; Trexler et al. 2000).

VII. DESCRIPTION OF SELECTED PLAN/PROJECT AND OTHER ALTERNATIVES

As noted in Section I.A above, the BBCW Project is being planned in two phases which will require two separate PIRs. The overall plan is being referred to as the "Master Plan" or Alternative O. A description of the full Alternative O is provided below along with descriptions of the other full project alternatives. The description for Alternative O Phase 1, also referred to as the Tentatively Selected Plan, is provided at the end of this section. Only one Phase 1 alternative was developed and evaluated.

A. Environmentally Preferred Plan (Alternative O)

This alternative was derived from components of Alternatives M and Q and is intended to make use of common water management features to attain the objectives of the BBCW Project. Alternative O includes the use of flow-ways, spreader canals, culverts, piping, weirs, canal plugs, secondary canal and mosquito ditch plugs (102 total) and pumps to achieve the overall project goals of restoring and enhancing wetlands and near shore bay habitat by minimizing point source discharges and improving the quantity, quality, timing, and distribution of water to freshwater and tidal wetlands and to the bay. Details of the features and operations of the selected plan can be found in the draft PIR available through Documentum at http://webtop.cerpzone.org. Figure 5 shows the EPP and a summary of project features (*i.e.,* pumps, spreaders, culverts, etc.) appear in Table 7.

For purposes of planning for this project, the term "available water" as used by the PDT in this document is understood to mean "water that would have been otherwise discharged directly to tide through primary coastal structures." This volume of water will be allocated using the associated operating capacity rules assigned by the PDT, and will be discharged to the interior model domain at the PDT designated site, feature, and location. Any excess water beyond the total diversion capacity will be discharged to the bay through the designated coastal structure.

Detailed, specific, and definitive operating rules (open and close triggers, weir elevations, outflow-stage-discharge relationships) for modeling purposes are required for all structures and features to be modeled. Follow-on implementation rules would also be required for the actual field operations to be incorporated in the related operating plan in the PIR. This would be a later requirement to be undertaken by the PDT and staff water managers.

1. Sub-region 1 – Deering Estate C-100A Component

The Deering Estate sub-component includes features to route surface water from the C-100A Canal into a historical slough located on publicly owned lands to restore more natural flows into Biscayne Bay and the near shore environment in this region. This component consists of extending an existing canal from the C-100A spur canal to the topographically lower area of the historic slough. Water flow into the slough will be pumped and then managed passively by a weir within the slough to impound water in strategic locations restoring freshwater wetlands and nursery habitat along the shoreline. This component includes a 100 cubic feet per second (cfs) pumping capacity to move water from the spur canal through a pipe to a short spreader system located on the east side of Old Cutler Road. A 500-ft extension of the spur canal will be constructed across the southern part of the Deering Estate Power's Property, located on the west side of Old Cutler Road, from the end of the existing spur canal to the pump station. The component includes plugging several secondary drainage canals and mosquito ditches and it includes the construction of a 3-acre educational wetland in the design. This component is included in the District's BBCW expedited project.

Detailed operations of this component appear in the draft PIR. Generally, when water is available at the S-123, the first 50-cfs will be allocated to the Deering Estate component, the next

available 50-cfs will be allocated to the next sub-region (northern Cutler Wetlands, described below), the next available 50-cfs will be allocated to the Deering Estate, and the fourth available 50-cfs will be allocated to the northern Cutler Wetlands.

2. Sub-region 2 – Cutler Wetlands C-100 Component

This project feature will restore a more natural flow of freshwater to Biscayne Bay by transporting freshwater through a pumped system of flow-ways and spreader swales to wetlands and remnant creek systems located between the C-100 south of S-123 and the C-1 Canal north of control structure S-21. By restoring overland sheet flow, a more natural flow pattern of freshwater will be conveyed into Biscayne Bay and BNP minimizing point source discharges, improving near shore salinity regimes and estuarine habitat.

This component includes a 100-cfs pump located on the C-100 canal to move water south through a pressure culvert, for transport across private property, to a spreader swale for hydrating the northern Cutler Wetlands. The component also includes two 10-scf pumps located on water detention features associated with the Saga Bay development to move water through pressure culverts to the aforementioned spreader feature. The component also includes plugging secondary canals and mosquito ditches. A flood protection levee is included along a partial length of the spreader feature to protect residential development in the Saga Bay area.

As noted above, when flow is available at S-123, this pump on the C-100 canal will divert water south through a pipe towards the northern Cutler Wetlands up to a maximum rate of 100 cfs. The quantity of water diverted by this pump will be one-half of the available water at the S-123 structure. The spreader feature will then discharge water eastward across the northern Cutler Wetlands. The two 10-cfs pumps will operate continuously from June through January and will be idle February through May. They will pump water from the detention lakes eastward to the spreader canal SC-C1.

3. Sub-region 3 – Cutler Wetlands C-1 Component

This project feature will restore a more natural flow of freshwater to the bay by transporting freshwater through flow-ways and spreader swales to wetlands and remnant creek systems located between the C-1 Canal north of control structure S-21 and the C-100 Canal south of S-123. By restoring creek flow, a more natural flow pattern of freshwater will be conveyed into Biscayne Bay and BNP restoring historical tidal creeks, minimizing point source discharges, improving near shore salinity regimes and estuarine habitat. This component includes the Cutler Flow-way which will be located on the Lennar property located immediately north of the South Dade Wastewater Treatment Plant. In the short-term, the Cutler Flow-way will have up to 50 cfs of
C-1 water diverted into it via the PU-C4 pump station. If and when reuse water becomes available, 50 cfs of this flow will be sent to this flow-way in place of the 50 cfs of stormwater (this diversion will not be done after reused wastewater has become available.)

This component includes a 400-cfs pump capacity to divert water from the C-1 (upstream of the South Dade Landfill) through a lined ditch to the spreader system constructed between C-1 and the Burger King property in the northern Cutler Wetlands. A series of flap-gated culverts allow water to gravity feed from the spreader system eastward into the Cutler Wetlands. The component also includes a flow-way, called the Cutler Flow-way, that is designed to accept and treat 50 cfs of reused wastewater. This water will move eastward through the flow-way and enter the Cutler spreader feature via rise culverts. The bottom of the flow-way is not lined, but the flood protection levees associated with the flow-way are lined to prevent seepage. Until the wastewater reuse project comes online, the flow-way will operate using the first 50-cfs available from the C-1. The component also includes plugging secondary canals and mosquito ditches that disrupt flow in the Cutler Wetlands.

4. Sub-region 4 – L-31E (Goulds Canal south to Florida City Canal)

The L-31E sub-component includes features to re-route existing surface water from the C-102, Military, C-103, and North Canals through a series of pumps and spreaders into the L-31E borrow canal, adjacent freshwater wetlands and ultimately into remnant creek systems east of the L-31E Canal between SW 256th Street and the Florida City Canal. This project feature will restore a more natural flow of water by transporting freshwater through a pump fed culvert system that will restore freshwater wetlands and historical tidal creeks, minimize point source discharges, and improve near shore salinity regimes.

This component includes five pump stations (920 cfs total pumping capacity) to divert water from the C-102 and C-103 canal systems (including North Canal and Florida City Canal). In this sub-region Alternative O uses the L-31E as a spreader feature in places to move the diverted water into the wetlands through a series of flap-gated riser culverts. It also includes several riser culverts and submerged stop-log riser culverts in L-31E to control the flow of water between the major east-west conveyance canals and L-31E. This component also includes a new spreader canal located between Military and Florida City Canal to distribute water into the freshwater wetlands west of L-31E. Water will move from this spreader feature into the wetlands through a series of flap-gated culverts. Material excavated to create the spreader will be deposited along the spreader's western edge to create a flood control levee. Between C-102 and Military Canal, diverted freshwater is assumed to hydrate freshwater wetlands west of L-31E through groundwater seepage. The component also includes plugging secondary canals and mosquito ditches on both sides of L-31E. Details of the operations of the features in this component can be found in the draft PIR 1 (Corps 2008).

An important operational change that will affect this sub-region is the elimination of the drawdown of water for seasonal agriculture during the late wet season and early dry season. Water elevation criteria at the coastal structures in this sub-region will be 2.2 ft year round opening trigger (instead of the current 0.8 ft dry season trigger).

Flows from the C-102, Military, C-103 and North Canals will be diverted into areas west of the L-31E to rehydrate freshwater wetlands. Diversion into wetlands will also improve water quality (nitrate and phosphorus removal) before this water reaches the bay. This diversion will occur in

two ways. The first method will be to pump C-102 water directly into isolated sections of the L-31E borrow canal which will then discharge water east through gated culverts to tidal wetlands and west into adjacent freshwater via groundwater seepage. The second method will be to pump C-103 water (From C-103 and North Canal) directly into a newly constructed spreader canal that lies west of the L-31E levee. Water in this spreader canal will flow into freshwater wetlands which will discharge via groundwater seepage and potentially through overland flow to the L-31E borrow canal. Water will flow from the L-31E borrow canal to the tidal wetlands via a number of flap-gated riser culverts constructed in the L-31E levee. The L-31E culvert risers will be set at an elevation that is somewhat higher than the coastal structure opening stage. In other words, the purpose is to divert "available" S-21 A and S-20F water to L-31E and spreader canals and to directly charge these features for westward and eastward flows to fresh water and coastal wetlands. It is anticipated that storage of peak flows will be accommodated in these freshwater wetlands and that operational refinements after project construction will result in additional environmental benefits. The ability to divert large storm flows through the existing coastal structures will be maintained and protection against saltwater intrusion will be enhanced.

The future location of wastewater reuse application in the Sub-region is not known at this time. Since current Florida regulations require that reuse water be first applied to a polishing wetland prior to discharge into natural wetlands, the PDT has assumed that rather than direct discharge to coastal wetlands, the reuse water will first flow through freshwater wetlands. In this alternative, 150 cfs is sent from the wastewater reuse plant to Sub-region 4. The wastewater reuse treatment plant is assumed to be built adjacent to the existing South Dade Wastewater Treatment Plant. There are no additional features or associated costs for discharging reused wastewater directly into Sub-region 4; costs associated with transferring reused wastewater to the point of application are assumed to be covered by the wastewater reuse project itself rather than the BBCW Project.

5. Sub-region 5 – Model Lands

This component includes features to direct modest flows southward into the Model Lands area. It relies on existing natural and also existing constructed features including remnant sloughs and canals which are fed via small pumps. The premise of the project features in this portion of the study area is that there exists available water in the Florida City Canal such that the pumps can scavenge enough water to result in rehydration of freshwater wetlands. However, based on the expansive and expanding white zone in this area and model output, there is a concern that diverting flows to the south away from Biscayne Bay in this component of Alternative O may result in negative impacts to the nearshore estuarine zone and the desired expanded mesohaline salinity conditions.

This component includes four relatively small pumps (150 cfs total pumping capacity) on the Florida City Canal to divert water southward into the freshwater wetlands and sloughs of the northern Model Lands. One of these pumps (30 cfs capacity) diverts water into Winkeye Slough (also known as Long Slough), located near the western end of Florida City Canal. Another pump (20 cfs capacity) diverts water into a relatively high quality slough near the northwest side of the FPL Turkey Point Power Plant. The third pump (50 cfs capacity) diverts water south from the

Florida City Canal through the borrow ditch associated with Tallahassee Road. The borrow ditch will serve as a conveyance and spreader feature to distribute water into adjacent wetlands through culverts. The fourth pump (50 cfs capacity) diverts water from the Florida City Canal south into the L-31E.

The pumps on the two sloughs are operated using seasonal rules. At Winkeye Slough the pump will continuously discharge 30 cfs into the slough from June through November. From December through March, the pump will continuously discharge 15 cfs into the slough. During April and May, the pump will be idle. For the slough near FPL, the pump will continuously discharge 20 cfs into the slough from June through November. During the entire dry season, December through May, the pump will not be operated in order to minimize the potential for exacerbating salt-water intrusion in this area. Operation of the other two pumps is based on water availability at S-20F (C-103). An operational modification of the project is the raising of the operations stage at S-20 to 3.0 ft (about half a ft increase) to provide additional hydration of the Model Lands and to prevent water that is pumped into the L-31E during large storm events to be discharged directly to the bay via S-20. This operations change should better hydrate wetlands along L-31E in the Model Lands.

B. Other Alternatives

The final array of alternatives consists of four alternative plans, including the no action alternative (*i.e.,* the future without project), Alternative O (the Selected Plan) and variations on the plan (Alternatives M and Q). The alternatives under consideration were developed as a result of the analysis of other alternatives that were screened out due to cost, real estate, or other issues.

1. Alternative 1 - No Action Plan

Alternative 1 is the No Action Plan, which is also the Future Without Project Condition. This alternative was developed from the existing hydrology with modifications for anticipated changes in the watershed due to land use changes, water supply changes, water quality changes, and changes caused by other water resource projects in the watershed.

The following assumptions were made to predict Future Without Project Condition in the BBCW Project:

1. Non-CERP projects are successfully implemented by 2050 (including the implementation of best management practices).

2. No CERP projects would be implemented. Despite some minor improvements in flow conditions, it is anticipated that the ecological problems to Biscayne Bay and adjacent coastal wetlands associated with water management practices would remain unaddressed.

2. Alternative M

This alternative was derived from common components of previous alternatives and is intended to make use of existing water management features to attain the objectives of the BBCW Project. Alternative M2 includes the use of flow-ways, culverts, piping, weirs, plugs, and pumps to achieve the overall project goal and objectives of the project. Aside from the Future Without Project scenario, Alternative M is considered the "minimum" alternative.

In Alternative M, the Deering Estate (Sub-region 1) component is identical to Alternative O. It includes features to route surface water from the C-100 Canal into a historical slough located on publicly owned lands to restore more natural flows into Biscayne Bay and the near shore environment in this region. This component consists of extending an existing canal from the C-100 Canal to the topographically lower area of the historic slough. Water flow into the slough will be pump driven and then managed passively by weirs within the slough to impound water in strategic locations restoring freshwater wetlands and productive nursery habitat along the shoreline.

The Cutler Wetlands C-100 component (Sub-region 2) for Alternative M is designed to restore a more natural flow of freshwater to Biscayne Bay by transporting freshwater through a pumped system of flow-ways and spreader swales to remnant creek systems located between the C-100 south of S-123 and the C-1 Canal north of control structure S-21. The component includes a 20 cfs pump located on C-100 and a pressure culvert to move water from C-100 to the spreader.

The Cutler Wetlands C-1 component (Sub-region 3) is designed to restore a more natural flow of freshwater to the bay by transporting freshwater through a pumped system of flow-ways and spreader swales to remnant creek systems located between the C-1 Canal north of control structure S-21 and the C-100 south of S-123. The alternative includes a 620 cfs pump to move water from C-1 through a 100-acre STA flow-way to a spreader swale that runs from the southern end of the Burger King property to the northern end of L-31E. Flap-gated riser culverts are used to control the movement of water through the spreader. The component also includes a flood protection levee west of the spreader and a plug in SW 87th Avenue. By restoring creek flow, a more natural flow pattern of freshwater will be conveyed into Biscayne Bay and BNP restoring historical tidal creeks, minimizing point source discharges, improving near shore salinity regimes and estuarine habitat.

The L-31E component (Sub-region 4) of Alternative M includes features to re-route existing surface water from the C-102 Canal, Military Canal and C-103 Canal into remnant creek systems east of the L-31 East Canal between SW 256th Street and the Florida City Canal. Primary features in this component include a series of flap-gated riser culverts placed in L-31E between C-1 and Florida City Canal. Flow to the wetlands east of L-31E is gravity fed through the culverts. Although this alternative assumes gravity flow from the L-31E borrow levee will occur, it should be noted that there is some question as to whether the desired diversions from the coastal canals into the wetlands can be achieved without the use of pumps to provide hydraulic head since the lands east of the levee may be at an elevation higher than the normal operating stage of 2.2 ft. This component also includes a 6,000-ft pipe for conveying reused wastewater from the South Dade Waste Water Treatment Plant to the north end of the L-31E borrow canal. Alternative M does not include features in Sub-region 5.

3. Alternative Q

This alternative is intended to minimize infrastructure needed for the redistribution of canal discharges and water volumes associated with anticipated reused wastewater, while maintaining existing levels of flood protection in developed areas. It leaves in place existing infrastructure to the extent possible to reduce construction costs, including L-31E, but allows eastward surface water flow through this levee. Due to land acquisition requirements, it is the second most costly of the alternatives. The alternative is similar to Alternative O with the following major exceptions: (1) Alternative Q includes a much longer spreader system in Sub-regions 4 and 5 that stretches from C-1 south and westward to upper Card Sound Road in the northern Model Lands, (2) Alternative Q includes 3 new water control structures located on C-102, C-103, and North Canal located upstream of the existing coastal structures to divert water from conveyance canals to the spreader system, (3) Alternative Q restores a greater spatial extent of freshwater wetlands to the west of L-31E and in the Model Lands, and (4) Alternative Q has the potential to connect with the C-111 Spreader Canal Project in the Model Lands which would provide flexibility for water transfer between the two projects. Also, due to the relatively greater extent of freshwater wetlands included for restoration, Alternative Q has a greater capability to treat and store diverted water.

Other important differences between Alternatve Q and the other alternatives are described here. The Deering Estate Component (Sub-region 1) is identical to Alternatives M and O and is consistent with the District's BBCW Acceler8 project. In Sub-region 2, the primary differences between this alternative and Alternative O are slight alterations of the spreader alignment and pump sizes on the detention lakes. Alternative Q includes two 5 cfs pumps on these lakes instead of 10 cfs pumps. In Sub-region 3, the primary difference between Alternatives Q and O is that all the available water from C-1 is pumped to the Cutler Wetlands under Alternative O; whereas, under Alternative Q the first 250 cfs of water from the C-1 would be preferentially discharged to the Cutler Flow-way and Cutler Wetlands and all excess water from the C-1 above 250 cfs would be discharged into the northern end of the spreader that serves Sub-region 3 (a maximum of 150 cfs from the 400 cfs pump). The Cutler Wetlands spreader feature and the Sub-region 4 spreader (from C-1 to Military Canal) are lined in Alternative Q. The alternative includes a flood protection levee and a seepage collector ditch on the western side of the spreader canal between Military and Florida City canals. Pump capacity in Sub-region 4 is almost identical for Alternative Q compared to Alternative O; however, individual pump sizes and locations in this sub-region differ substantially between the alternatives. Details on these pump sizes, locations, and operations for Alternative Q can be found in the AFB document (http://webtop.cerpzone.org). Alternative Q includes ten pairs of 36-inch culverts spaced along Card Sound Road to allow flow across this major barrier. No other alternative includes this feature. Also, Alternative Q degrades obsolete roadways in the Model Lands to further remove barriers to flow across the landscape. Reused wastewater is treated similarly in Alternative Q compared to Alternative O. Also, Alternative Q includes plugging secondary east-west canals and north-south mosquito ditches as in Alternative O. Alternative Q has a 50-cfs pump on Winkeye Slough compared to the 20 cfs pump at this location in Alternative O. Other minor differences between Alternative Q and the other alternatives can be found in the AFB document.

Like Alternatives M and O, Alternative Q eliminates the dry season drawdown in its operations. Alternative Q, however, includes increasing stage in the Model Lands by 0.5 ft above existing condition by setting S-20 operating stage at 2.9 ft year round and by placing a structure at the mouth of Card Sound Road borrow canal.

4. Yellow Book Alternative

The Yellow Book alternative is the alternative envisioned during the Restudy (Corps 1999) and during the PMP stage of the planning process. It is the most reaching of all alternatives in terms of the spatial extent of the wetlands that would be restored, and it provided substantial water storage and treatment capabilities. However, due to the large increases in the value of real estate and construction costs, this alternative became impractical and unaffordable.

Important differences between the Yellow Book alternative and the Master Plan (Alternative O) include:

Sub-region 1. Installation of a 50 cfs pump instead of a 100 cfs pump, overland flow of water diverted from the C-100 spur canal across the Powers Property to Old Cutler Road.

Sub-region 2. The spreader swale extends all the way north from C-1 to C-100 A to C-100B generally east of developed lands (*i.e.,* the conveyance pipe just south of C-100 is replaced by the spreader extension). Spreader swale is designed to pass water north to south and evenly distribute water into the coastal wetlands directly east of the swale. A 200-cfs pump is used instead of a 100-cfs pump on C-100 to divert water south into spreader swale. The Lennar Flow-way was 400 ac in size instead of 200 ac. A 200-cfs pump would divert water into the Flow-way, instead of the master plan's 400-cfs pump that diverts water into a conveyance channel that feeds the spreader.

Sub-region 3. A large STA, several thousand ac in size, would be located just east of Homestead Air reserve Base that would receive 200 cfs (via pump) from C-102 and 200 cfs (via pump) from C-103. Seepage collection ditch along the western edge of the STA. This seepage collector canal would require at least two control structures (riser-culverts), one placed at either end of ditch. Military Canal would be backfilled. A plug in the C-1 canal just downstream of the new linking canal between C-1 and L-31E would be installed. This plug should divert low flows (up to 300 cfs) but allow higher flows (over 300 cfs) to continue down the C-1 canal and exit at S-21. A new lined Canal west of the landfill to connect the C-1 canal (at the diversion plug) and this canal would be sized to pass at least 300 cfs.

Sub-region 4. An STA several hundred acres in size would be located on the south side of Homestead Air Reserve Base and C-103 and extend to Florida City Canal. It would receive 200 cfs (via pump) from C-103 and 200 cfs (via pump) from Florida City Canal. The STA would be designed to operate with 1 to 3 ft of water in it. The stage in the STA would be controlled by either broad-crested weirs or riser culverts. Seepage management facilities around the STAs is interpreted to mean seepage collection ditches along the northern and western

margins of the STA to protect adjacent developed areas. Berms will be required along the canals. North Canal would be backfilled from L-31E to Tallahassee Road.

Sub-region 5. The component uses Florida City Canal as a spreader between S.W. 127th Avenue and S.W. 107th Avenue to move water south into the Model Lands. It includes an STA approximately 100 ac in size to receive water from the western end of Florida City Canal via a 50 cfs pump. The water from the STA would be distributed into wetlands via a spreader swale approximately one mile in length located along the southern end of the STA.

C. Alternative O Phase 1; the Tentatively Selected Plan

As noted in the Introduction section above, construction of the BBCW Environmentally Preferred Plan (Alternative O) will be phased over time and the Corps will seek authorization for the project via two PIRs. PIR 1 (or Phase 1) is also the Tentatively Selected Plan and will include components of the BBCW expedited project, and additional management measures and features to address project objectives. Phase 1 will focus on rehydrating saltwater wetlands and restoring desired salinity regimes in the near shore waters of Biscayne Bay. Phase 1 features have limited ability to restore freshwater wetlands in the project area. The following project features are proposed for Phase 1.

1. Sub-region 1 – Deering Estate C-100A Component

The Deering Estate Flow-way is comprised of a 500-ft extension of the C-100A Spur Canal, construction of a 2-ac freshwater wetland on the Power's Addition Parcel, and delivery of freshwater under Old Cutler Road to the Cutler Drain and ultimately to coastal wetlands located on the Deering Estate along Biscayne Bay.

The Spur Canal extension and freshwater wetland will run approximately 500 ft through the Power's Addition Parcel. The pump station required to move the water is also located on the Power's Addition Parcel and has 100 cfs total capacity. The pump will discharge to a surcharge chamber and then to the 60-in diameter discharge pipe running under Old Cutler Road and to the spreader structure found on the east side of Old Cutler Road. No further structures are required downstream of the outlet structure because the Cutler Drain is found immediately east of the roadway.

2. Sub-region 2 – Cutler Wetlands C-100 Component

Phase 1 does not include any features in this component.

3. Sub-region 3 – Cutler Wetlands C-1 Component

The Cutler Wetlands C-1 Flow-way consists of a pump station, a conveyance canal, culverts for roadway and canal crossings, and a spreader canal. Other project features in this area include the plugging of existing mosquito ditches found in the saltwater wetlands east of L-31E Levee and Canal.

The pump station is located on C-1 and will have a 400 cfs total capacity. This water is delivered to a lined conveyance canal that is 6,900 ft in length. The conveyance canal will run under the existing SW 97th Avenue, SW 87th Avenue (L-31E Levee), and across the L-31E Canal via concrete box culverts and deliver water to the spreader canal located in the saltwater wetlands. This spreader canal is divided up into four segments. The first segment runs from the box culverts southward for 2,980 ft. The second segment runs from the box culverts northward for 4,867 ft and the third segment runs from the second segment north eastward for 2,500 ft. The fourth and final segment is a second "tail" to the spreader canal system that continues a little further to the north than segment 3 before it turns eastward and has a length of 2,813 ft. These separate tails are aligned to connect with historic low lying areas that are primary concerns for rehydration.

Approximately 2,500 linear ft existing mosquito ditches will be plugged. The intent is to discourage the channelization of the water delivered to the area by the spreader canals.

4. Sub-region 4 – L-31E (Goulds Canal south to Florida City Canal)

<u>L-31E North Features</u>
The L-31E North area generally is described as the portion of the project between C-1 on the north to Military Canal on the south. These features include structures that will isolate the L-31E Canal from the major discharge canals (C-102 and Military Canal) as well as gated riser culverts (L-31E Culverts) that will deliver water from the L-31E Canal, through the L-31E Levee, and discharge in the saltwater wetlands to the east. In addition, a pump station will be constructed to mimic the intent of the L-31E Culverts by pumping water over the L-31E Levee and deliver water directly to the saltwater wetlands.

Gated Riser Structures with 36-inch culverts will be constructed in L-31E Canal on the south side of C-102, as well as on the north side of Military Canal, to isolate those reaches of L-31E Canal. These structures will allow operating L-31E Canal at a higher water level than currently possible and this will assist the L-31E Culverts in discharging water to the saltwater wetlands to the east. The gated structure on the north side of C-102 will assist the 50 cfs pump station, also at that location, that will move water over the L-31E Levee directly to the saltwater wetlands. The gated structures on the south side of C-102 and the north side of Military Canal will work together to isolate that reach of L-31E Canal. It is in this reach that five separate

L-31E Culverts will be located. Additionally, this reach of L-31E Canal will be fed water from the C-102 by a 100 cfs pump station located just south of C-102 (in the same physical structure as the gated riser culvert).

The L-31E Culverts, situated on the L-31E North levee, consists of the installation of five 36-inch Corrugated Aluminum Alloy Culverts with flap gates with manatee protective barriers at five different locations. The culverts will gravity discharge to the east at the edge of the wetlands. The downstream side of the culverts will be equipped with aluminum flap gates for backflow prevention. The flap gate will inhibit direct saltwater intrusion during periods of high tide when the tailwater elevation could exceed the headwater elevation.

L-31E South Features

The L-31E South area generally is described as the portion of the project between Military Canal on the north to North Canal on the south. These features include structures that will isolate the L-31E Canal from the major discharge canals (Military Canal and C-103) as well as gated riser culverts (L-31E Culverts) that will deliver water from the L-31E Canal, through the L-31E Levee, and discharge in the saltwater wetlands to the east. A pump station will be constructed to supply the isolated reaches of L-31E Canal with water. A freshwater wetland system is included in this region.

Gated Riser Structures with 36-inch culverts will be constructed in L-31E Canal on the south side of Military Canal and the north side of C-103, this will isolate this reach of L-31E Canal. A 40 cfs pump will work in conjunction with the gated structure on the north side of C-103 to provide water for that reach of L-31E Canal. The riser structures on either side of Military Canal will be connected to create an inverted siphon that will allow water to move north or south in the L-31E via gravity while isolating Military Canal.

Five more L-31E Culverts will be constructed in this area, three between Military Canal and C-103, and two between C-103 and North Canal. The design of these culverts will be identical to those described in the L-31E North Features section.

The freshwater wetland system consists of two pump stations, a spreader canal, a small berm, and a seepage collector ditch. The first pump is located on the north western edge of the wetland and delivers 40 cfs from C-103 to the spreader canal. The spreader canal runs from C-103 to the North Canal, approximately 2,619 ft. Once filled, the spreader canal will deliver overland flows eastward to the freshwater wetland. To help alleviate flooding concerns to the west of the spreader canal, a small berm and seepage collector ditch will be constructed immediately to the west of the spreader canal, both the same length as the spreader canal, 2,619 ft. The seepage collector ditch will discharge via gravity to C-103. The second pump for the wetland is located approximately halfway from the first pump to L-31E Canal and will deliver an additional 40 cfs to the wetland. No spreader canal is associated with this pump and instead will deliver directly to a concrete spreader structure.

5. Sub-region 5 – Model Lands

Phase 1 does not include any features in this component.

Please see the main body of the draft PIR for further details on all of the alternatives described above (Corps 2010).

VIII. POTENTIAL BENEFICIAL AND ADVERSE EFFECTS OF THE PROJECT

The primary purpose of the BBCW Project is to restore a more natural hydrology to an area where surface water flow has been channelized. As described above in Section VII, the EPP includes a variety of features and management measures to redistribute water into coastal wetlands, including pumps, spreader canals, culverts, and operational modifications. This section of the report describes the potential beneficial and adverse effects of the project.

A. General Fish and Wildlife Effects and Benefits

1. Wetland Restoration

Completion of the BBCW Project is important to the management and improvement of resource values of the adjacent conservation areas with Federal interest, such as BNP, Crocodile Lake National Wildlife Refuge, and ENP. In addition to contributing to reestablishing an extensive regional landscape for wildlife, the restoration area will conserve infiltration areas to benefit groundwater resources and maintain barriers to salt-water intrusion. Currently the BBCW Project area has a hydrologic influence over western part of BNP. BNP lands and submerged areas along the western side of Biscayne Bay have been impacted by overdrainage and other altered hydrologic effects, and therefore should benefit from hydrologic restoration planned by the BBCW Project. The restored project area would support wide-ranging species such as the endangered wood stork, as well as the American crocodile and species of State-listed wading birds.

The long-term goal of the EPP and the TSP is to return the hydrology of the area downstream of the pumps and spreader canals to a condition more similar to that which existed prior to drainage. The combination of a restored hydrology, a more natural fire regime, and a non-native vegetation control program can be expected to evolve toward reestablishing the pre-drainage character of the BBCW plant communities. This would mean that plant communities that have developed under the existing hydrologic and fire regimes, but were not present prior to drainage, would be replaced during the decades following restoration by communities more similar to those present prior to drainage. In addition, extant plant and animal communities that also existed in the BBCW Project area prior to construction of the canal system, but have become established in new areas as a result of drainage, would likely return to their original distribution.

The presence and health of wildlife populations are a function of the habitats available to support them. Given the dramatic changes in hydrologic and fire regimes in the BBCW Project area over the past sixty years, the current wildlife populations have undoubtedly changed from those present prior to alteration. Implementing the recommended alternative would return the landscape to a more natural hydrology, which has obvious implications for wetland-dependent

wildlife species. Amphibians, otters, wading birds, forage fish and aquatic invertebrates would likely see a resurgence of their populations. All lands within the TSP footprint would be in public ownership and managed as a natural area, thus protecting it from development.

Removal of non-native vegetation and restoring natural vegetation communities in the project area will restore and enhance the area's fish and wildlife resources. Wetland habitat types found in the project area, particularly freshwater graminoid marsh and mangrove wetlands, supply plant biomass to the food web of Biscayne Bay. Both also serve as vital refuge and nursery grounds for a wide variety of freshwater and estuarine fish and invertebrate species, as well as foraging grounds for a variety of wading birds and reptiles, including the federally threatened American crocodile. Freshwater and oligohaline graminoid marshes foster the production of large numbers of mosquito fish, sailfin mollies, and other small fishes that serve as the prey base for many of the region's wading birds and higher trophic level predators. Current water management practices have resulted in altered hydroperiod and water levels in these marshes, which has reduced prey fish production and impacts breeding capabilities of wading birds. Restoring more natural salinities, hydroperiods, and water levels to these marshes, as planned in the BBCW, should serve to increase prey fish production and further enhance these habitats for wading birds and other fish and wildlife resources.

Because of flood control and water supply concerns, it is unrealistic to completely restore the BBCW Project area hydrology to pre-drainage conditions. However, features and management measures proposed in the BBCW Project EPP and TSP should improve the local hydrology, which will enhance wetland and nearshore habitats for fish and wildlife. The re-distribution of freshwater from the major conveyance canals into the adjacent wetlands should help reverse, to some extent, the ecological impacts resulting from man-induced altered hydrology in and near the project area.

2. Estuarine Restoration

Estuarine resources in the project area will be positively affected by the restoration of a more natural freshwater flow regime feeding the nearshore zone. Although estuarine ecosystems are designed to withstand seasonal variation in salinity, the pulsing or inundation by freshwater or, alternately, the elimination of variability because of the reduction of freshwater input are harmful to the health of the system. Reduction of point source discharges at major conveyance canals as a result of implementing the BBCW Project will reduce the unnaturally large fluctuations in salinity near canal mouths, resulting in more stable salinity regimes in these areas, which will improve habitat for fish and invertebrates inhabiting the areas near the canal outlets. Reestablishing freshwater inflow to the bay across a broader front along the shoreline should lower salinities there resulting in more suitable estuarine habitat for pink shrimp, spotted seatrout, red drum, and other fish and invertebrates. Lowering salinity along the shoreline should also result in the expansion of shoal grass and widgeon grass in these areas which increases benthic diversity and is a food source for the West Indian manatee. As noted above, the re-establishment of the salinity regime to realize full restoration of fish and wildlife resources throughout the nearshore zone in the project area will require additional water, particularly during the dry season.

B. Construction-Related Effects

Construction activities proposed under the recommended alternative that may result in the removal of native vegetation, including some ecologically valuable habitat include: the removal or plugging of secondary canals and mosquito ditches; and the construction of canal plugs, spreader canals, pump stations, and earthen berms around private property. The EPP design features will have the following specific effects:

1. Removal of Vegetation and Habitat by Project Features

Removal or destruction of ecologically valuable habitat has been minimized for this project by placement of features on disturbed lands or through areas infested with non-native vegetation wherever practical. All pump stations will be placed on existing levees. Table 6 shows the spatial extent of each habitat type affected by project features. The data for the table was provided by the District who used Service's vegetation map created in 2005 and GIS for the analysis. A total of 97.1 ac of natural habitat is displaced by the TSP features, such as, pumps, conveyance channels, spreaders, and culverts. Habitat types displaced include tropical hardwood hammock, mangrove, non-natives, native forested-shrub wetland, mixed wetland hardwoods, and various mixed classes. Sub-region 3 (Cutler Wetlands C-1 Component) features account for nearly 89 percent (86.4 ac) of the natural areas displaced by all project features. This is mostly due to the Cutler spreader feature, which has the largest footprint in natural areas. However, this feature should provide suitable foraging habitat for wood storks. The conveyance channel in this sub-region also has a large footprint, but it will mostly impact non-native vegetation. Culverts in Sub-region 4 (L-31E) have the smallest footprint (about 0.1 ac per culvert) and will displace mostly mangrove swamp.

At the current stage of the planning process it is unclear how many and which mosquito and agricultural drainage ditches will be filled or plugged to help restore a more natural hydrology in the coastal wetlands. Those that are filled or plugged will alter habitat within the ditches for wading birds, fish, amphibians and aquatic invertebrates. However, the quality of wetlands adjacent to the ditches should improve as a result of ditch filling or plugging. Unfilled, shallow mosquito ditches will tend to fill with sediment naturally over time—on the order of several decades—and the areas should begin to more closely resemble wetlands that had not been disturbed.

2. Fish and Wildlife Disturbance

Construction activities could be a temporary disturbance to wider ranging animals such as wading birds and raptors, and will cause permanent displacement of some fish and wildlife species. Noise, fumes, and human presence associated with mobilization of equipment and construction activities may disturb roosting or foraging wading birds and water birds, as well as breeding birds. These factors could also affect other vertebrates and invertebrates found in the project area. Freshwater fish, reptiles, and invertebrates will likely experience temporary increases in mortality associated with construction access on levee roads and the dredge and fill

activities associated with the project. Conveyance channel, spreader swale, STA, culvert, and pump station construction could eliminate, displace, or impede movement of fish and wildlife residing in adjacent wetland and canal habitats.

The threatened eastern indigo snake could be displaced from some areas, particularly in areas along the canal levees where pump stations and culverts will be constructed. The endangered wood stork may have foraging temporarily disturbed. Construction activities in waters inhabited by the West Indian manatee must follow the standard construction precautions.

3. Existing Contaminants and Disposal/use of Soils

As noted earlier in the document, much of the project area, particularly those areas east of L-31E, has been or is currently used for agriculture. As such, these lands may be contaminated with metals, pesticides, and petroleum products. Excavation, transport, and subsequent usage of these contaminated soils during the construction of spreader swales, conveyance channels, berms, and pump stations could increase exposure of contaminants to, and their biomagnifications in, fish and wildlife. The risk can be minimized by following the standard environmental assessment procedures agreed upon by the Service and the District for identification and remediation of contaminated sites on lands to be purchased and used by the project (Service 2008).

4. Invasive Non-native Vegetation

The construction of spreader swales, conveyance channels, berms, and pump stations creates the potential for introduction and propagation of invasive non-native and nuisance plant species in disturbed areas. Further propagation of these species may result in a disruption of native plant communities and thus a loss of native fish and wildlife habitat.

C. Operational Effects

1. General Effects

Pump stations will be constructed and operated in association with spreader channels and berms. The pump stations will operate to divert water from C-100, C-1, C-102, and C-103 to freshwater and tidal wetlands during much of the year. The operation of high-volume pumps to move water from major conveyance canals to the wetlands represents a potential threat to fish and other aquatic resources. Pumps can cause direct loss of fish, amphibians, invertebrates, and other aquatic life through impingement and entrainment. This project is proposing the installation of seven pump stations that connect to canals and discharge to spreaders systems or directly into wetlands. It is anticipated that an unspecified area of habitat located downstream of the spreader system will be altered to a different habitat type over time. The significance of this impacted area on fish and wildlife, including listed species, is unclear, although it is anticipated to increase habitat value for fish and wildlife.

Changing operations to raise stages in the L-31E throughout the year may promote leakage through the L-31E and thus provide fresh water to the coastal creeks. Viewing the existing canal

as a delivery system to the coastline instead of simply a way of "holding-the-line" against saltwater intrusion and storm surges is an approach endorsed by many BBCW PDT members. The preferred alternative includes culverts in the L-31E levee to preferentially direct waters out of the canal to targeted coastal creeks. The project has also included in its footprint those freshwater wetlands inland of the L-31E levee that would see benefits via improved hydroperiods under this scheme.

2. Water Velocities

Project features will likely result in an increase in flow velocities at spreader and culvert outlets and in existing tidal creeks in the coastal wetlands. This increase in flow velocity may have unintended negative consequences. Increased flows through narrow channels can exacerbate erosion and sedimentation, and cause scouring of plants, fish, and aquatic invertebrates. While the Service generally supports the re-distribution of flow from major conveyance canals to adjacent coastal wetlands to improve hydrology of the wetlands and improve salinity conditions nearshore bay waters, we recommend that the volume of diversion be limited during periods of high runoff from within the basin to ensure that high flow velocities are not causing harm to aquatic life or habitat.

3. Non-native Fish

Water diversion operations can cause the undesirable spread of non-native fish, such as the Asian swamp eel, butterfly peacock, and various cichlid species. However, water is diverted primarily into tidal wetlands where it will mix with brackish water, thereby increasing the salinity of the diverted water. The non-native fishes common to the project area are primarily freshwater species and so will not survive well, if at all, in the tidal wetlands and bay waters. Also, these non-native species require relatively deep water habitat, little of which is found in the coastal wetlands of the project area. Deep fresh water habitat in the project area is generally limited to the existing conveyance canals.

D. Water Quality

Implementation of the restoration plan should improve water quality in the tidal wetlands and nearshore areas by moderating the large salinity fluctuations caused by freshwater point source discharges and distributing these discharges via overland sheetflow and creek flow to the downstream estuary. However, water quality is of concern in the BBCW Project area for other reasons. Perhaps the most important issue is the nitrogen species concentrations in the canal water that will be redistributed into the coastal wetlands. Those canals in the northern part of the project area (C-100 and C-1) have relatively low concentrations of nitrates, 0.09 and 0.11 mg/l average concentrations between 1997 and 2000, respectively, and do not pose a significant risk (Table 2). However, two major canals in the central part of the project area, C-102 and C-103, have relatively high concentrations of nitrates, 4.2 and 2.3 mg/l average concentrations between 1997 and 2000, respectively.

Dedicated water treatment features, such as STAs, were not included in the EPP or the TSP for two primary reasons: (1) costs due to required land acquisition, and (2) costs due to the necessity to line the feature to prevent seepage of water into groundwater. In lieu of dedicated engineered water treatment features, the project will rely on freshwater and tidal wetlands as water treatment wetlands to the extent possible. Wetlands are known to enhance water quality in streams and watersheds by trapping sediments and by accumulating and transforming a variety of nutrients and other chemical substances (Jones 1976; Lowrance et al. 1984; Whigham et al. 1988; Kuenzler 1989; Johnston 1991). Freshwater redirected from canals to the wetlands will also be diluted with rain water before it enters the bay. So, the freshwater entering the bay in the project area should improve over existing conditions.

However, the benefits to water quality by the project noted above may be offset by other factors. Initially, the system may become adversely impacted by increasing nutrient loading to the wetlands. However, in time the system should revert to stable conditions. Possible water quality problems in the wetlands may include: remobilization of trace metals and pesticides adsorbed in sediments, release of total phosphorus and sulfates, and a possible increase of methyl mercury in lower trophic levels. Because canals are effective pathways for invasive non-native flora and fauna, the project may initially increase the abundance of these species in these wetlands. Also, canal water currently enters the bay as strong pulses that jet out into the more central area of the bay and become quickly mixed with bay waters through wind and tidal forces. Canal water that is redirected into the wetlands as a result of the project will enter the bay at lower velocities and will be retained along the coast for longer periods of time. This may expose the nearshore area to lower water quality than currently exists.

E. Summary of Consultation under the Endangered Species Act

In a letter dated January 24, 2005, the Service provided the Corps with a threatened and endangered species list for the BBCW project area (Table 4). Federally listed species of most concern in the project area include the Florida panther, West Indian manatee, American crocodile, wood stork, bald eagle, and eastern indigo snake. Listed plant species of concern included Johnson's seagrass, crenulate lead-plant, endangered deltoid spurge, endangered Small's milkpea, and threatened Garber's spurge. Through coordination with the Corps, this list was subsequently modified to exclude the bald eagle as this species was delisted on July 9, 2007.

The Corps submitted a Biological Assessment (BA) to the Service on October 29, 2008, which provided project effect determinations for all listed species included in the Service's species list. Through subsequent coordination, the Corps determined the project would have "no effect" on the Everglade snail kite, Cape Sable seaside sparrow, roseate tern, and beach jacquemontia. The Corps' BA included "no effect" determinations on critical habitat for the Everglade snail kite and Cape Sable seaside sparrow. The Corps also determined the project "may effect, but is not likely to adversely affect" the West Indian manatee, Florida panther, wood stork, American crocodile, eastern indigo snake, sea turtles, Shaus swallowtail butterfly, crenulated lead plant, Garber's spurge, tiny polygala, Small's milkpea, and deltoid spurge, as well as . The Corps' BA included "may effect, but not likely to adversely affect" determinations on critical habitat for the West Indian manatee and American crocodile. The Service concurred with these determinations in a

letter dated November 18, 2009. Our concurrence was based partly on the stipulation of implementing standard protection measures for the West Indian manatee and eastern indigo snake, and special protection measures for the American crocodile. Also, the Corps agreed in its October 29, 2008, BA to include measures for the wood stork as outlined in the *Habitat Management Guidelines for the Wood Stork in the Southeast Region* (Service 1990)

Implementation of the project should benefit several federally listed species by lowering salinity in the coastal wetlands and nearshore region through increased freshwater flow to these areas. Lowering salinity in the coastal wetlands should increase productivity of preyfish, thus providing an increase in the forage base of wood storks and State-listed wading birds. Lower salinities in the coastal wetlands will also make the habitat more suitable for hatchling and juvenile crocodiles. As noted above, juvenile crocodiles require low salinities for growth and survival due to limited physiological capability to osmoregulate. Changing salinity in the nearshore waters of the project area could affect sea grass thereby affecting herbivores such as the green sea turtle and manatees. However, the sea grass change is most likely to species composition only, and no reduction in seagrass biomass is anticipated to occur. There will likely be some short-term and small scale negative impacts to listed species, such as, disruption of local feeding areas due to project construction activities and elimination of 97 ac of coastal wetland habitat to accommodate project features. However, some project features (e.g., the spreader swales) should provide high quality habitat for federal and state-listed wading birds.

IX. EVALUATION OF THE PROJECT

This section provides results of the Criteria-based Ecological Evaluation Method and it provides insightful regional restoration information from early hydrodynamic modeling results in the project area.

A. Criteria-based Ecologic Evaluation Method

For convenience and accuracy, the CBEEM is handled as an Excel spreadsheet model. As such, there are 14 separate sheets used to make the necessary calculations. Including results from all of the 14 sheets in this report is unnecessary and cumbersome. For simplicity, results are presented in four tables. Table 8 shows the summary of ecological functional indices, total acres, habitat units, and ecological lift for each of the three ecological zones for all project alternatives. Table 8 also shows the total habitat units (the sum of habitat units for the three ecological zones) for each alternative. Tables 9, 10, and 11 provide the raw scores and normalized scores for each performance measure used in the nearshore, saltwater wetland, and freshwater wetland zones, respectively. All other CBEEM input and output data are available in the PIR.

1. Nearshore Zone

Table 8 shows that the habitat quality index for the nearshore zone is greatest for the Alternative O (EPP, index = 0.65) and least for the Alternative M (index = 0.43). The low score for the Yellow Book (YB) alternative (index = 0.48) can be partially explained by the fact that the freshwater diverted from the major conveyance canals in this alternative is distributed to STAs

and freshwater wetlands 2 to 4 miles inland from the Biscayne Bay shoreline. This results in less freshwater (due to evapotranspiration water loss and seepage to groundwater) that is available to the nearshore area to lower and stabilize salinity conditions, which is a primary objective to restore the nearshore zone. Alternatives M and Q have similar index values for this zone (0.45 and 0.44, respectively). The Phase 1 score (0.54) for the nearshore zone is below the Alternative O and Q scores. This is not surprising, given that most of the freshwater diverted from conveyance canals is distributed to the saltwater wetlands within a mile from the Biscayne Bay shoreline in Phase 1. Applying the Alternative O habitat quality index to the 8,585 ac of nearshore habitat yields a total of 5,565 HUs. The Alternative O (the EPP) provides 3,892 HUs of ecological benefit over the Future Without Project condition. The Phase 1 benefit is 2,950 HUs over the Future Without Project, or 76 percent of the full EPP for the nearshore ecological zone.

An examination of how the alternatives performed for each performance measure (PMs 1, 3, 5, and 6; Appendix A) in the nearshore zone (Table 9) shows that Alternatives O and Q diverted the most freshwater volumes from canals (81 and 80 percent target achieved, respectively). However, the spatial extent of nearshore bay bottom meeting the 20 ppt target is greater under Alternative O (33 percent of target) than Alternative Q (21 percent of target) because Alternative O diverts water to wetlands closer to the bay. The further from the bay water is diverted into wetlands, the less water will arrive to the bay due to evapotranspiration and seepage into groundwater. By the same reasoning, Alternative M diverts the least amount of water from canals (39 percent), but it scores the highest in meeting the nearshore salinity target (39 percent) because it diverts water closest to the shoreline. Alternative O Phase 1 diverts a comparatively moderate volume of water (59 percent of the total available) and achieves the second highest score for nearshore salinity performance measure (37 percent of target).

Alternatives O and Q performed virtually the same, and the highest of all alternatives, in removing nutrients from diverted water (80 percent and 79 percent, respectively). Alternative M performs the poorest in removing nutrients (51 percent of target), whereas Alternatives YB and O Phase 1 perform almost identically (67 percent and 66 percent, respectively). Given that Alternative YB includes several thousand acres of STAs, it is unclear why this alternative would perform poorer than Alternative O in removing nutrients from diverted water. Alternative O has no STAs. Similarly, Alternative Q includes a greater extent of freshwater wetlands into which water would be diverted, so it too, should have removed more nutrients than Alternative O. Performance measure scores for Phase 1 are 72, 83, and 110 percent of the full Alternative O scores for water diversion, nutrient removal, and attainment of salinity target in the nearshore zone, respectively.

2. Saltwater Wetlands Zone

Alternative O Phase 1 is the highest performing alternative in the saltwater wetlands zone (Table 8). Applying the habitat quality index value of 0.33 to the 22,550 ac available in this zone yields a total of 7,398 HUs, and a total benefit of 6,396 HUs over the Future Without Project scenario. Alternatives M and O perform only slightly poorer in this zone—providing 97 percent of the Phase 1 benefits) . All of these alternatives divert water from major conveyance canals either

directly into the saltwater wetlands or into freshwater wetlands within a mile of the saltwater wetlands. By comparison, Alternatives Q and YB provide 69 and 50 percent of the ecological benefit provided by Alternative M. Again the primary explanation for this decrease in performance is because Alternatives Q and YB divert water into freshwater wetlands further inland from the saltwater wetlands compared to Alternatives O and M. This results in less freshwater available to restore habitat in the saltwater wetlands due to evapotranspiration and seepage to groundwater. Increasing freshwater flow to the saltwater wetlands is the primary mechanism by which the hydrology, and therefore the ecology, will be restored in this ecological zone.

Table 10 shows the scores for the performance measures applicable to the saltwater wetlands zone (PMs 2 and 3) for each alternative. Alternatives M and Phase 1 divert the most water directly into the saltwater wetlands (49 percent of the target), and Alternative YB diverts the least (22 percent). This seems logical since Alternatives M and Phase 1 divert very little water into freshwater wetlands and Alternative YB diverts water the furthest to the west (*i.e.,* furthest from the saltwater wetlands). Alternatives O and Q divert the third and fourth greatest volume of water into the saltwater wetlands (45 and 32 percent of target, respectively). Alternative O attains the greatest number of tidal wetland acres meeting the salinity criterion (19 percent of the target) with Phase 1 attaining the second greatest number of acres meeting the target (16 percent of the target). Alternative M performs third best for this performance measure, which does not seem logical given that Alternative M diverts the most freshwater water into the saltwater wetlands. Alternatives Q and YB attain the same spatial extent of tidal wetlands meeting the salinity target and perform the worst for this performance measure, which is logical given that these two alternatives divert water into the wetlands one to four miles west of the saltwater wetlands, so less water should be available to meet saltwater wetland salinity targets.

3. Freshwater Wetlands Zone

In the freshwater wetlands zone, Alternative Q provides the most benefit (Table 8) with 5,315 HUs above the Future Without Project scenario. Alternative YB is the second highest scoring alternative for this ecological zone with a benefit of 4,468 HUs. These two alternatives perform better in this zone because they divert more water from major conveyance canals into freshwater wetlands than the other alternatives. By comparison, Alternative O provides 59 percent of the ecological benefit provided by Alternative Q. Alternative M and Phase 1 provide only 3 and 5 percent, respectively, of the ecological benefit provided by Alternative Q.

Performance of alternatives for each performance measure applicable to the freshwater zone (PMs 4 and 7) is shown in Table 11. It should be noted that the values provided for the PM 4 are a bit confusing because they include the Future Without Project acreages in the totals, but these values are eventually subtracted out from the final HU values for this zone. Alternative Q attains the highest score for all performance measures applicable to this ecological zone, followed by Alternative YB. Alternative M and Phase 1 score significantly worse for all performance measures in this ecological zone compared to the other alternatives. When the Future Without Project scenario is subtracted from totals, Alternatives O, Q, and YB attain fairly similar scores for reydrating freshwater wetlands—achieving 56 to 78 percent of the target. By comparison,

Alternative M and Phase 1 perform significantly worse, achieving only 4 percent of the target. Alternative Q removes the largest number of acres of non-native vegetation (6632 ac or 68 percent of the target), whereas, Alternatives YB and O remove 47 and 31 percent of the non-native vegetation target, respectively. Phase 1 and Alternative M score the poorest for this PM—removing only 3 and 2 percent of the non-native vegetation target, respectively. It is not surprising that Phase 1 and Alternative M scored the lowest for this performance measure because most of the non-native vegetation is in the freshwater wetlands and these alternatives only cursorily address those areas.

The Service has concerns that the freshwater index is applied to such a large spatial extent of freshwater wetlands for all alternatives. Specifically, the application of the index to such a large spatial area for Alternative M and Phase 1 could be considered misleading, given that these alternatives address very small freshwater wetland areas. However, the Future Without Project acreages are eventually subtracted out from the totals when HUs are finalized, which offsets the indices being applied to such large areas for Alternatives M and Phase 1. Still, those not familiar with the methodology may find the procedure and numbers in Table 11 confusing and misleading.

4. CBEEM Output for All Zones Combined

Combining HUs from each of the three ecological zones results in Alternative O yielding the greatest number of total HUs (13,177) with an ecological benefit of 12,207 HUs over the Future Without Project scenario (Table 8). Alternative Q provides the next greatest benefit at 12,115 HUs or 99 percent of the Alternative O benefit. Alternative YB provides the third best total of ecological benefits. Alternative M provides only 61 percent of the benefit attained by Alternative Q. Phase 1 provides a total of 9,630 HUs for a benefit of 8,660 HUs over the Future Without Project scenario, or 71 percent of the Alternative O benefits.

The Service is concerned that the ecological benefits for Phase 1 may be inflated compared to the benefits estimated to be provided by other alternatives, particularly given that Phase 1 diverts only about half of the water estimated to be diverted by the full EPP (Alternative O) and provides few benefits to the freshwater wetlands (Phase 1 addresses only $1/17^{th}$ of freshwater wetlands addressed by the EPP). Freshwater diversion from the conveyance canals into the coastal wetlands is the primary driving force behind the benefits calculations, and Phase 1 diverts only 55 percent of the water estimated to be diverted by the EPP. Our concerns is that if Phase 1 is perceived to truly provide 71 percent of the benefits provided by the EPP, then subsequent phases may be considered cost prohibitive for providing the remaining project benefits. Although the Service understands that it is very difficult to accurately quantify benefits for restoration projects, and given what we consider to be a relatively high degree of uncertainty associated with the benefits methodology used for this project, we caution that the benefits calculations should be used only for relative comparisons of alternatives and should not be taken at face value. Alternately, we suggest that one way to alleviate the perceived inflation in Alternative O Phase 1 benefit values is to add weight to the freshwater wetlands component to better differentiate the logical benefit differences between those alternatives that

provide significant benefits to the freshwater wetlands (Alternatives O, Q, and YB) from those that do not (Alternatives M and Phase 1).

5. Cost Effective/Incremental Cost Analysis

To determine which alternative provides the most ecological benefits compared to the estimated cost, the Corps conducted a Cost Effective/Incremental Cost Analysis. This analysis identifies the most cost effective and best buy alternative within each ecological zone. The detailed results of this analysis are provided in the draft PIR. In brief, the results indicate that Alternative O and Phase 1 are both cost effective and best buy plans for all zones combined. These two alternatives are cost effective and best buy plans for the nearshore ecological zone, and both are cost-effective for the freshwater zones. For the salt water wetland zone, Phase 1 is cost effective and a best buy plan, but Alternative O is neither for this zone. None of the other alternatives are cost effective for more than one ecological zone. Alternative Q is the sole cost effective and best buy plan for the freshwater zone, but costs more than the Alternatives O and Phase 1 while providing fewer benefits overall. Alternatives M and YB is not cost effective for any of the ecological zones.

According to the Cost Effective/Incremental Cost Analysis, Phase 1 is the plan that reasonably maximizes the production efficiency for each of the ecological zones in that it contains the lowest average cost per unit of output and is cost effective for all ecological zones. The Service agrees that Phase 1 performs well and provides a relatively large amount of benefits to the nearshore and saltwater wetlands zones compared to the other alternatives. However, Phase 1 provides comparatively few benefits to the freshwater wetlands zone. Alternative O provides a much more comprehensive watershed restoration plan than Phase 1.

6. Other CBEEM Comments

The Service recognizes that the CBEEM has shortcomings as a way to quantify benefits for evaluating and separating project alternatives. For example, the method to quantify the potential number of acres of freshwater wetlands that will be restored focuses mainly on water levels in the wetlands and does not incorporate the hydroperiod target of the original performance measure that was developed for use with the hydrologic model. Another example is the likely inaccuracy of the calculations for the spatial extent of saltwater wetlands meeting the salinity target. It does not seem logical that Alternative O would attain more acres of tidal wetlands meeting the salinity target than Alternatives M or Phase 1, given that Alternatives M and Phase 1 redirects more water from canals into the tidal wetlands than Alternative O. This may be partially explained by the fact that PM 3 is quantified by the TABS-MDS model, which may not function as well in the saltwater wetlands as it does in the bay proper. However, given the inadequacy of appropriate hydrologic models to conduct these evaluations, the Service believes the CBEEM is a reasonable approach to quantify benefits provided by the suite of alternatives developed for the project.

It is important to note that the HUs output by the CBEEM are not equivalent to the number of acres of habitat restored. HU is simply a metric that is used to help differentiate between

alternatives. As noted above it is derived by applying a habitat quality index to the number of acres that potentially could be affected by project alternatives. For the saltwater and freshwater ecological zones, the entire spatial extent of the Model Lands is included. In reality, much of the Model Lands will not be affected by the project due to the lack of available water. Another way to view the restoration benefits of the BBCW Project is to address the number of wetland acres realistically anticipated to be restored or affected by the project. These acreages were estimated for each alternative to help quantify PMs 4 and 7. The spatial scope of the BBCW Project envisioned by the Restudy encompassed approximately 60,000 ac of coastal wetlands (including all of the Model Lands) and approximately 7,000 ac of nearshore bay habitat. The maximum spatial extent of coastal wetlands anticipated to be restored by the EPP and the TSP is approximately 11,000 ac and 4800 ac, respectively. The extent of nearshore bay habitat will also be reduced in the EPP and the TSP due to lack of available water, particularly during the dry season, as noted above. The Service encourages the Corps and District to seek opportunities and creative means to more fully achieve the restoration in the BBCW study area envisioned by the Restudy.

B. TABS-MDS Model Output

This section provides more relevant information from the TABS-MDS preliminary scenario runs conducted in 2003 that highlight the effects of water redistribution, upstream storage, and additional water. The original purpose of these runs was to provide the PDT some general information about the relationships between freshwater inflows to Biscayne Bay and the nearshore salinity regimes in the BBCW Project area. The model simulation period extended from August 1997 to July 1998, with July 1997 being used as a spin-up period (*i.e.,* the model was allowed to run for this month so that hydrodynamics and salinity can circulate long enough to achieve dynamic equilibrium).

A total of ten preliminary scenario runs were conducted. Runs 1 through 9 were designed to determine the impacts on the nearshore salinity regime of making various independent adjustments to the spatial and temporal distribution of freshwater inflow to the bay, as well as adjustments to total volume of inflow to the bay. The 10th run represented an inverse modeling approach. That is, the spatial and temporal distribution of the inflow is regulated to achieve and maintain a target near-shore salinity of 20 ppt. This run was conducted to estimate the total volume and the temporal and spatial distribution of inflow required to maintain the desired salinity regime in the nearshore region of the BBCW Project area. The following describes the various parameter adjustments made for preliminary scenario runs 1 through 9:

Run 1: Existing conditions – the model is fed freshwater flow through existing canals

Run 2: 21 creek run – the model is fed existing water as if diverted from the conveyance canals through 21 tidal creeks

Run 3: 8 creek run – the model is fed existing water as if diverted from the conveyance canals through 8 primary tidal creeks (the same primary creeks described in section IV.B.4 above)

Run 4: Storage plus 21 creeks – canal flows are routed through an imaginary 15,000 ac-ft storage basin, then fed through 21 creeks (details of the regulation can be found in the Memorandum for Record dated December 20, 2003).

Run 5: Storage plus 8 creeks – canal flows are routed through an imaginary 15,000 ac-ft storage basin, then fed through 8 primary creeks (details of the regulation can be found in the Memorandum for Record dated December 20, 2003).

Run 6: Additional water plus 21 creeks – canal flows are routed through 21 creeks plus an additional 120,000 ac-ft of water is available for flow through the creeks. The additional water is used if and when the discharge through creeks falls below a specified minimum threshold with the available canal water. The minimum threshold was obtained from estimates provided by Meeder et al. (2003) of the required volume to maintain the desired near-shore salinity in the project area.

Run 7: Additional water plus 8 creeks – canal flows are routed through 8 creeks plus an additional 120,000 ac-ft of water is available for flow through the creeks. The additional water is used if and when the discharge through creeks falls below a specified minimum threshold with the available canal water. The minimum threshold was obtained from estimates provided by Meeder et al. (2003) of the required volume to maintain the desired near-shore salinity in the project area.

Run 8: Storage plus additional water through 21 creeks – canal flows are routed through a 15,000 ac-ft reservoir, then fed through 21 creeks, and an additional 120,000 ac-ft of water is available when needed (details of the regulation can be found in the Memorandum for Record dated December 20, 2003).

Run 9: Storage plus additional water through 8 creeks – canal flows are routed through a 15,000 ac-ft reservoir, then fed through 8 primary creeks, and an additional 120,000 ac-ft of water is available when needed (details of the regulation can be found in the Memorandum for Record dated December 20, 2003).

For purposes of this report, four primary points will be made based on the results from these runs:

1. Redirecting water from conveyance canals into the creek systems of the coastal wetlands provides a better distribution of freshwater along the coast that results in a more desirable salinity regime. Figure 13 in Appendix B shows the comparison of average nearshore salinity from August 1997 to October 1997 for existing condition (Run 1), distribution of existing flows through 21 creeks (Run 2), and distribution of existing flows through 8 creeks (Run 3). Note that distribution through the creek systems extend relatively low salinity conditions further north along the coast above Black Point, and it moderates low salinity conditions at the mouth of C-103. Also, there appears to be little difference in salinity regimes for distributing water through 21 creeks as opposed to 8 creeks.

2. The availability to store water allows water to be released during the dry season that would otherwise not be available, which allows more favorable salinity regimes in the nearshore areas during that time of year. Figure 15 (first 2 panels) of Appendix B shows a comparison of nearshore salinity when existing water is distributed through 21 creeks (Run 2) versus existing water with 15,000 ac-ft of storage distributed through the creeks (Run 4). Note that with storage the mesohaline zone extends across a broader section of the bay and lower salinity conditions (<8 ppt) are attained along the shoreline between Black Point and Convoy Point. Results also indicate that the modeled storage volume is not sufficient to store the amount of water needed to maintain mesohaline salinity levels throughout the dry months.

3. The availability of additional water to the system provides the most promise in yielding a viable estuarine habitat. Figure 15 (middle panel) shows that when 120,000 ac-ft of additional water is available, a desirable pattern similar to the one established when storage was available, with the exception that mesohaline conditions extend further north along the coast with the additional water scenario, plus oligohaline and lower mesohaline conditions are more apparent at Black Point. Perhaps more importantly, the availability of additional water greatly reduces the time that salinities are above the preferred mesohaline range. Figure 18 of Appendix B shows that when 85,000 ac-ft (middle panel) or 120,000 ac-ft (rightmost panel) of additional water is available and used in the system the maximum continuous time outside the mesohaline ranges between 0 and 20 days, and these conditions extend well offshore under the 120,000 ac-ft of extra water scenario. By comparison, the existing condition run (leftmost panel) shows that the continuous time outside the mesohaline range is greater than 30 days along most of the shoreline. This has substantial ecological consequences to flora and fauna that are dependent on mesohaline conditions. Note that the 10th scenario run (rightmost panel) indicates that approximately 120,000 ac-ft of additional water per year is needed to maintain mesohaline conditions throughout the year.

4. The last major point to be made using the preliminary scenario run data is the effect of coastline geomorphology on the extent of freshwater mixing. In the Scenario 10 run, the modelers divided the coastline into five creek zones, and simulated the total volume of water that would be required to maintain mesohaline salinity conditions in each zone. Some of the creek zones include creeks that empty into well-confined embayments that inhibit circulation and mixing with open bay water (*e.g.*, Zone 3); other zones include creeks that mostly discharge water along a part of the shoreline that that is not protected and is directly influenced by currents in the bay (*e.g.*, Zone 4). Figure 21 in Appendix B shows the average daily volume of freshwater required for each group, given as the total volume required for that group and as the volume required per creek. Results indicate that the volume of water required for each group is inversely proportional to the degree of physical confinement (*i.e.*, whether or not a creek empties into an embayment) at each group location. For example, the volume of water required for Zone 3, which includes only one creek that discharges into a well-confined embayment, is only about 13 ac-ft per day. Whereas, the volume of water required for Zone 4, which discharges to a region of shoreline directly influenced by current in the bay, is about 545 ac-ft per day. Given the unavailability of water to restore the entire BBCW Project study area, this finding underlines the importance of focusing the available

water into areas that require the least volume of water to achieve restoration. The primary creek systems noted in Section IV.B above discharge into relatively confined areas of the shoreline.

X. RECOMMENDATIONS/CONSERVATION MEASURES

Objectives identified by the Service in providing recommendations on this project are to protect and conserve fish and wildlife resources in the project area, while assuring that maximum ecological benefits are delivered to the BBCW Project area consistent with the basic project purpose. This includes developing recommendations to make this project more environmentally compatible and to further conserve and enhance the diversity and abundance of fish and wildlife resources in the study area. Some of the recommendations provided below are consistent with, and still relevant to, those provided by the Service in the FWCA Report that appeared as part of the Restudy (Service 1999b).

A. Water Availability, Storage, and Preferential Use

1. The storage of wet season flows to provide needed water during the dry season is one of the most critical ecological needs of the project area. Presently there are no natural or engineered storage features to meet this need in the BBCW EPP or the TSP. The Service recommends that every effort be made to identify and include adequate storage to meet dry season water needs in Phase 2 of the project. To that end, the elimination of the dry season drawdown would greatly benefit the project area by providing much needed fresh water storage. The elimination of the drawdown would provide other significant benefits, such as reducing saltwater intrusion, as noted in Section IV.B.5 above. The Service commends the District for initiating a study to reexamine the usefulness and practicality of this current water management practice, and we encourage the District to expedite this study to the extent possible.

2. Because Phase 1 does not address the critical water storage needs and has limited benefit to freshwater wetlands in the project area, the Service recommends planning and implementing Phase 2 as soon as possible. Planning for Phase 2 should allow reformulation beyond the EPP as necessary to include storage features and extensive freshwater wetland restoration.

3. The Service recommends that the Corps continue to seek sources for additional freshwater for the BBCW Project to restore more natural flows to Biscayne Bay. Section IV.B.2 above describes the well-documented need for this water, particularly during the dry season.

4. The BBCW study team has developed water reservations as stipulated in Section 601(h)(4)(A)(iii) of the WRDA of 2000. The Service believes that all of the existing water currently flowing to Biscayne Bay is required to protect the natural system. However, depending on the year, the volume of water that will be reserved for the project through the WRDA 2000 assurances process ranges from only about 48 percent to 88 percent of the water available (*i.e.*, water entering Biscayne Bay through the major conveyance canals in

the project area) to the project area. The Service believes that the remaining water available to this system must be protected by the State of Florida from consumptive use.

5. Given the lack of water necessary to obtain full restoration of the entire project area and the lack of storage features in the selected plan, the Service recommends that the water available for the project be preferentially used to ensure full restoration of the eight primary historic creek systems in the project as described in Section IV.B.3 above. Most of these creek systems empty into geomorphically protected areas along the western shoreline (*i.e.,* coves and embayments), so freshwater entering the bay in these areas will have a longer residence time, thus restoring the desired mesohaline salinity regime conducive to healthy estuarine flora and fauna.

B. Operations

1. Pump operating criteria as defined in the Draft Project Operating Manual in the PIR should be carefully evaluated as the project is implemented to ensure the desired quantity, timing and distribution of freshwater to the coastal wetlands and nearshore region is attained.

2. The Service recommends evaluating and implementing changes in water control operations to improve hydrologic conditions in the coastal wetlands as soon as practicable, including the incremental elimination of the dry season drawdown in the C-102 and C-103 basins and the increase in the S-20 opening trigger by 0.5 ft during the dry season.

3. As other features of the CERP are designed and operated (Lake Belt, L-31N Seepage, and C-111 Spreader Canal), water management protocols for the BBCW Project components need to be reconsidered in the context of the modified C&SF project. This may include provisions for a future increase in water availability, storage capacity and treatment, and modification of operations for elements of the selected plan to benefit Biscayne Bay and its coastal wetlands that are consistent with the BBCW goals and objectives.

4. The Service recommends that the Corps evaluate the impingement and entrainment of fishes and other aquatic organisms at all project inflow pumps as a pilot project to estimate the significance of cumulative impacts on native fishes, and recreational and commercial fisheries, for all the pumps in the BBCW selected plan. The pilot project should evaluate intake designs, screens, and pump type (*e.g.,* screw-type pumps should injure or kill fewer fish than impellor-type pumps). Furthermore, the Service recommends that any new pumps that are installed prior to the end of the pilot project have the capability to be retrofitted with devices (such as screens) that will reduce or eliminate impingement and entrainment of fish and other aquatic life.

C. Protection and Recovery Measures for Listed Species

1. Standard construction precautions will be implemented for the eastern indigo snake and West Indian manatee during the construction phase for all components of the project to reduce the likelihood of adverse effects on those federally listed species.

2. Because of the possibility of American crocodiles nesting or being present in the project area, and because vehicular traffic will temporarily increase during project construction, which may affect crocodiles if they are present, special protection measures for crocodiles are included as permit conditions for the project. These measures include pre-construction crocodile and crocodile nest surveys. If crocodiles or crocodile nests are detected in any survey, a protection plan will be developed in coordination with the Service and implemented prior to the initiation of construction.

3. Most of the proposed construction sites are presently on private or public properties for which we have limited information regarding the presence of federally listed species. Therefore, as those sites are acquired (or easements are negotiated), the Corps should ensure that more detailed surveys are conducted by a qualified biologist approved by the Service and the FWC to determine the presence of listed species. If listed species are found, the Corps and Service will determine if re-initiation of consultation in accordance with section 7 of the Endangered Species Act is necessary.

4. The Service has concerns about the potential for the exposure of federally listed species, as well as other fish and wildlife, to contaminants when former agricultural lands are flooded. If the ecological risks from contaminants to listed species becomes evident, the Corps and Service will determine if re-initiation of informal, or initiation of formal, consultation in accordance with section 7 of the Endangered Species Act is necessary.

5. Any new canals that are constructed as part of this project that are hydraulically connected to Biscayne Bay (or any other water bodies inhabited by, or capable of being inhabited by, manatees) must have barriers to prohibit manatee movement into newly constructed canal reaches from the bay (or other relevant water bodies inhabited by manatees). This includes the new spreader canals proposed for this project. Such barriers will ensure that BBCW Project facilities will pose no additional threat of structure-caused mortality or injury, entrapment in culverts or canals, or any other form of take, as defined in the Endangered Species Act. Manatee barriers should be provided for all new pump stations, culverts, and other structures as appropriate.

6. The Corps will notify the Service's South Florida Ecological Services Office no later than one month prior to start of the construction phase for any of the components so that we may, if necessary, ensure that precautions are in place, and if necessary, monitor effects of construction activities on threatened and endangered species.

7. Should blasting be necessary, the Corps must follow the Service's "Guidelines for the Protection of Marine Animals During the Use of Explosives In the Waters of the State of Florida" and monitor local wildlife activity during this action. Care should be taken to avoid unnecessary disturbance of roosting, foraging, or wading birds or other local wildlife such as perching birds, raptors, waterfowl, mammals, reptiles, amphibians, and fish that utilize associated habitats. A qualified fish and wildlife biologist, approved by the Service and the

FWC, should be present throughout blasting activities to monitor fish and wildlife response and offer advice to construction personnel.

8. The Service recommends adding wildlife corridors beneath or through roadways, particularly Card Sound Road, to reduce crocodile mortality caused by motorized vehicles. Mortality from automobiles account for a large number of crocodile deaths in south Florida, and it is particularly a problem along Card Sound Road, which is in the project area. The Service recognizes that this recommendation falls outside the spatial scope for the Tentatively Selected Plan, but these corridors should be given a high priority for Phase 2 of the BBCW Project.

9. For additional species listed as threatened, endangered, or of special concern by the State of Florida, the Corps should consult with the FWC regarding those species' habitat needs and additional recommendations to conserve those species.

D. Monitoring and Adaptive Management

1. Given the lack of reliable modeling and the high level of uncertainty of the effects from implementing the EPP, the implementation of sound monitoring and adaptive management plans are critical to project success. The Service recommends close adherence to the water quality and ecological monitoring plans established for the BBCW Project, including the ecological monitoring specified in the RECOVER Monitoring and Assessment Plan and the project-level monitoring plans appearing in the PIR. This monitoring should be periodically evaluated for relevance and usefulness. Also, the Service recommends that the adaptive management plan developed for the project be implemented to maximize the restoration success of the project and to provide information for the planning and construction of Phase 2 of the project. This adaptive management plan should also be periodically reviewed and revised as appropriate. This process should facilitate the restoration and enhancement of the BBCW Project's wetland and estuarine habitats.

2. Similarly, monitoring data obtained through the District's Everglades Expedited Restoration Program component of the BBCW Project, which includes the Deering Estate Flow-way, the Cutler Flow-way, and the L-31E Culverts components should be evaluated closely for restoration effectiveness and for effects on fish and wildlife. This information should be used to help guide the design of the Phase 1 and Phase 2 BBCW Project components.

E. Control of Non-native Vegetation

1. As noted in Section IV.B.12.a above, the removal and control of invasive non-native plant species is important to the success of this project. The Service recommends that sufficient project assets be provided for the initial physical or chemical removal of non-native vegetation. Changes in hydrology resulting from the project should contribute substantially to the control of non-native vegetation, but initial removal of mature stands will be required. Removal and control of invasive non-native vegetation also influences the survival and well-being of the listed plant species in the project area.

2. The Service recommends that an invasive non-native species management plan be implemented as part of the Tentatively Selected Plan. This management plan should have four components: (1) construction practices that reduce the spread of the non-native plants; (2) initial aggressive treatment and management of substrates that are bared by restoration activities; (3) monitoring of non-native vegetation, and (4) extensive site management activities by the land manager, including controlled burns. Without such a plan, invasive non-native vegetation would re-infest the project area, particularly the construction areas.

F. Migratory Birds

As noted in section IV.B.6 above, the Lennar Wetland Mitigation site is a high-quality stopover and feeding area for migrating shorebirds. The Service recommends maintaining this site as high quality habitat for these birds. Generally, this will entail ensuring that the site does not become overgrown with vegetation. These shorebirds require shallow water mudflat habitat (including exposed surfaces) for foraging. Perhaps just as importantly, water depths should not exceed 0.5 ft in most of this wetland parcel so shorebirds can forage effectively. Also, the BBCW Project must be careful not to pump water onto this site at inappropriate times of the year (*e.g.,* August through October). The BBCW PDT should examine the project area for other sites suitable for preserving or restoring for migratory shorebirds, and manage those sites for migratory shorebirds. For example, the shorebird foraging site described above could be expanded by adding the 42-ac parcel adjacent to and south of the mitigation site. This parcel would have to be cleared of the non-native vegetation that currently infests the site, and it would have to be graded to an elevation equal to the existing mitigation site to the north.

G. Wastewater Reuse

1. The Service recommends that planning for Phase 2 of the BBCW Project should include sufficient flexibility to take advantage of all treated wastewater made available by the south Miami-Dade Wastewater Reuse Project, under the contingency that the treated water is deemed suitable for rehydrating coastal wetlands.

2. If treated wastewater from the south Miami-Dade Wastewater Reuse Project is made available to CERP, the BBCW water quality monitoring plan should be revised to ensure that the wastewater effluent meets all applicable water quality standards. The revised monitoring plan should utilize the latest science related to EPOCs. Project managers should adopt a similar sampling protocol to that being developed for the Biscayne Bay Coastal Wetlands Rehydration Pilot Project for water quality sampling for EPOCs. Additionally, the monitoring plan should be used to determine if any agrochemicals are being mobilized from the soils into the surface water.

H. Contaminants

1. As noted above, Phase 1 and Phase 2 ESAs have revealed significant contamination of soils on some of the properties in the project area that have been purchased and assessed by the

District. In some cases, the contamination detected is at a level that is toxic to fish and wildlife. The Service's Environmental Contaminants staff has reviewed the assessment reports, and based on the potential risk indicated by limited soil sampling and food chain modeling, the Service has made specific recommendations in letters to the District. These letters and their recommendations have been summarized in Section II.B above.

2. Either the District or the Corps should continue to coordinate sampling plans, specifications, and techniques with the Contaminants Section of the South Florida Ecological Services Office prior to future Phase I and Phase II ESA sampling. This recommendation refers to any construction activity related, but not limited to, new canals, pump installation, other excavation, and natural storage and water quality treatment areas.

3. We recommend the use of SQAGs during the ESA for contaminants in order to facilitate the evaluation of environmental risk that will accompany any land acquisition for this project. If a Phase 2 analysis indicates the presence of contaminants at levels toxic to fish and wildlife, remediation to environmentally acceptable levels based on ecological risk to receptor organisms may be required.

I. Additional Recommendations

1. The Service views the project flexibility for plugging or filling of major east-west drainage ditches as one of the most important management measures that is planned for implementation as part of the BBCW Project. These ditches accelerate the drainage of these coastal wetlands, contributing to the unnatural and harmful dry conditions during the dry season. Decompartmentalization of the BBCW Project area, specifically the removal of mosquito and drainage ditches, has been recommended by various study reports as the first step in facilitating the management, restoration, and hydrologic re-connection of the wetlands in this part of the Biscayne Bay watershed (Ruiz et al. 2002; Ross et al. 2003; Meeder and Harlem 2004; Ruiz and Ross 2004). The Service recommends ensuring that resources are available for implementing this management measure as part of Phase 1, as needed.

2. The Service recommends that restoration efforts include fire as a means of maintaining and stimulating the expansion of the graminoid communities desired in the coastal wetlands of the project area, particularly in certain areas of the project as defined by Ruiz and Ross (2004). This may require periodic controlled burns as necessary to manage the system. The Service recognizes the delicate nature of using this management measure, particularly given the project's close proximity to urban areas, but it will likely be necessary to control the woody vegetation in these wetlands to ensure successful restoration.

3. As the project proceeds through the PIR phase, some lands that were previously anticipated to be available for project components, may prove to be unavailable. The substitution of other areas, not previously evaluated for fish and wildlife habitat, would require further coordination with the Service to determine potential losses to ecologically valuable upland and wetland habitat.

4. If land leases expire or change the performance of the plan, the Corps should evaluate the effect this will have on predictions about the future with project conditions.

J. Coordination with Other Programs

The Service encourages actions that promote basin-wide changes in both urban and agricultural land use practices in order to meet the water quality goals of the project. The efforts of various Federal, State, County, and local interagency groups should be recognized as a tool to assist in successfully achieving the objectives of the BBCW Project. We recommend that the Corps and District continue coordination with the following efforts.

1. Other Federal restoration plans and programs (*e.g.,* the Service's Multi-Species Recovery Plan, the Service's Coastal program, the U.S. Department of Agriculture's Wetland Reserve Program) or State land acquisition programs (*e.g.,* Program for Conservation and Recreation Land Acquisition, Save Our Rivers) can provide guidance or funding for the restoration aspects of this project.

2. The Biscayne Bay Regional Restoration Coordination Team, established by the Working Group of the South Florida Ecosystem Restoration Task Force, has an action plan for the restoration and conservation of Biscayne Bay. The team is comprised of members from local, State, and Federal agencies as well as nongovernmental organizations and individuals. The action plan includes detailed steps that address all facets for restoring or enhancing the bay and surrounding watershed ecosystems, including water quality, water management, fisheries resources, fish and wildlife habitat, and imperiled species.

K. Relevant Recommendations Appearing in Restudy FWCA Report

Many of the recommendations provided in the Restudy Draft and Final FWCA Reports for Everglades restoration, in general, and for Biscayne Bay and the BBCW Project, in particular, remain applicable today. General recommendations in the Restudy Draft FWCA Report regarding water supply, land acquisition and non-native plant and animal control are still relevant for the BBCW Project. Other specific recommendations made in the Restudy Draft FWCA Report that remain particularly relevant include:

1. *"The Comprehensive Plan is intended to provide surface water flows sufficient to meet restoration targets for BNP and Biscayne Bay. In the meantime, surface water flows should meet or exceed the 1995 Base condition, and there should be neither any annual or seasonal net loss in the total volume nor any reduction in the spatial and temporal distribution of combined surface and groundwater flows."*

2. *"Every effort should be made to find sources, storage, and means of distribution of water to Biscayne Bay that (a) require minimal water treatment to reach ambient water quality in southern Biscayne Bay, (b) are likely to receive adequate funding, (c) have the greatest probability of success, (d) can achieve current and future restoration targets, and (e) for*

which the long-term environmental and economic consequences can be reasonably predicted (e.g., use reuse water as a last resort)."

3. *"Although the D13R4 scenario presents many challenges with respect to water quality, the Department recommends that sufficient water treatment capacity be built into the plan to handle the increased water volumes needed to achieve the hydrologic characteristics as were observed in Biscayne Bay and ENP under D13R4. Additionally, more thorough monitoring of a variety of pollutants will be required in the basins from which this water will be derived. These data will provide better estimates of the sizes of storage areas needed for initial treatment. Selection of appropriate technology for supplemental treatment (in addition to the STAs) must consider the potential ecological effects of all pollutants, not just phosphorus."*

XI. SUMMARY OF POSITION

The Service recognizes the considerable effort that has gone into developing this project and selecting an alternative, and we support the EPP and the TSP for the BBCW Project. The TSP, as described, should provide meaningful hydrologic and ecologic improvements to the nearshore waters of southwestern Biscayne Bay and the adjacent coastal wetlands. Maintenance of a proper salinity regime and reductions in harmful point source discharges should promote the growth and spatial increases of oysters, as well as increase the species diversity and abundance of estuarine fish and invertebrates that are part of oyster communities and healthy seagrass beds. The improved salinity and flow regimes should also increase the spatial extent of species-diverse seagrass beds, restore more natural wetland vegetation communities, and improve the overall health of the project area.

At the landscape level, completion of the BBCW Project is important to the management and improvement of resource values of the adjacent conservation areas with Federal interest, such as Biscayne National Park (BNP), Crocodile Lake National Wildlife Refuge, and Everglades National Park. In addition to contributing to reestablishing an extensive regional landscape for wildlife, the restoration area will conserve infiltration areas to benefit groundwater resources and maintain barriers to salt-water intrusion. Currently the BBCW Project area has a hydrologic influence over western part of BNP. BNP lands and submerged areas along the western side of Biscayne Bay have been impacted by overdrainage and other altered hydrologic effects, and therefore should benefit from hydrologic restoration planned by the BBCW Project. All lands within the TSP footprint would be in public ownership and managed as a natural area, thus protecting them from development.

Recovery of federally threatened and endangered species would be fostered by improved habitat conditions in the project area. Federally listed species in the project area include, but are not limited to, the Florida panther, West Indian manatee, American crocodile, wood stork, sea turtles, and eastern indigo snake. The Service and Corps have completed informal consultation under the Endangered Species Act for this project, as detailed in Section VIII-B-1 above. Implementation of the project should benefit several federally listed species by improving salinity regimes, and thus habitat conditions, in the coastal wetlands and nearshore region through increased freshwater flow to these areas. Lowering salinity in the coastal wetlands

should increase productivity of preyfish, thus providing an increase in the forage base of wood storks and State-listed wading birds. Lower salinities in the coastal wetlands should also make the habitat more suitable for hatchling and juvenile crocodiles. However, there will likely be some short-term and small-scale negative impacts to listed species, such as, disruption of local feeding areas due to project construction activities and elimination of approximately 97 ac of coastal wetland habitat to accommodate project features.

However, the Service has concerns about the benefits that will be provided by the EPP and TSP, given the reduced scope of the project as envisioned in the Restudy. We are concerned that the project has been divided into two phases due mainly to funding limitations and concerns about flood impacts, and we are concerned that Phase 2 may not be implemented due to various reasons, such as land availability and Federal and State budget uncertainties. We recommend that Phase 2 be planned and implemented as soon as possible.

The Service is also concerned about the lack of available freshwater for the project to fully restore the coastal wetlands and nearshore areas of western Biscayne Bay, particularly during the dry season. The need to increase freshwater flows to improve ecological conditions in Biscayne Bay has been well documented and the freshwater volumes required to fully restore appropriate salinity conditions in the nearshore region of western Biscayne Bay and adjacent wetlands have been made. However, the source and process for alleviating this freshwater deficit has not been identified. Closely related to this issue, the Service is concerned about the volume of water reserved for the project under the WRDA 2000 water assurances process. The Service believes that all of the existing water currently flowing to Biscayne Bay is required to protect the natural system and must be protected by the State of Florida from consumptive use. As noted above, even the water currently flowing to Biscayne Bay is not enough to restore desired target ecological hydrologic conditions.

The Service is also concerned about the lack of freshwater storage capability in the project. The disruption of dry season flows to the coastal areas has perhaps been the anthropogenic modification of greatest impact to the project area, and has underlined the need for storage of wet season flows for use in the dry season for the natural environment. The BBCW Project Delivery Team attempted to address this problem in some project alternatives. However, alternatives with storage features were eventually screened out as too expensive for CERP. The elimination of the dry season drawdown would have helped alleviate the dry season freshwater deficit and this operational change was included in virtually all project alternatives. The District determined that the elimination of the drawdown would adversely affect agricultural interests in the project area due to flooding and removed the operational change from the EPP and the TSP. The Service is concerned that this useful and cost effective operational change was eliminated from the TSP, which significantly reduces the ecological benefits of the envisioned project. However, the District recognizes the potential ecological benefits to coastal wetlands and prevention of saltwater intrusion by the elimination of the seasonal drawdown and initiated a study in 2009 to review the need for the drawdown and the impacts to the system caused by the drawdown. The Service commends the District for this action and we encourage the District to expedite this evaluation. The Service also recommends that freshwater storage features and additional

freshwater flows be reconsidered for Phase 2 of the project, which may require some reformulation of the EPP.

The spatial scope of the BBCW Project envisioned by the Restudy encompassed approximately 60,000 ac of coastal wetlands and approximately 7,000 ac of nearshore bay habitat. The spatial extent of coastal wetlands anticipated to be restored by the EPP and the TSP is approximately 11,000 ac and 4800 ac, respectively. The extent of nearshore bay habitat will also be reduced in the EPP and the TSP due to lack of available water, particularly during the dry season, as noted above. Even though the project has diminished significantly in spatial scale from what was originally envisioned, the Service still supports the project as an important first step in restoring the nearshore waters of southwestern Biscayne Bay and the adjacent coastal wetlands. However, the Service encourages the Corps and District to seek opportunities and creative means to more fully achieve the restoration in the BBCW study area envisioned by the Restudy during Phase 2 of the BBCW Project.

Much of the land parcels needed for Phase 1 of the project have been purchased or were already in public ownership. However, much of the land required for the full EPP has yet to be acquired. In both cases, the Service is concerned about contaminated soils in these areas because most of these lands are, or were at sometime in the last half century, in active agricultural production. Contaminants of concern include OC, organophosphates, and carbamates pesticides for insect control, as well as a variety of herbicides and fungicides. Environmental assessments have been conducted on most properties acquired by the District in the BBCW Project area and some have revealed significant contamination of soils. In some cases, the contamination detected is at a level that is toxic to fish and wildlife. The Service's Environmental Contaminants staff will continue to review the assessment reports, and based on the potential risk indicated by limited soil sampling and food chain modeling, the Service will make specific recommendations to the District. Other Service concerns noted above include: (1) the use of treated wastewater as an additional freshwater source, (2) water quality, (3) migratory birds, (4) invasive species control, and (5) integrating the BBCW Project with other CERP efforts.

Given the lack of reliable modeling and the high level of uncertainty of the effects from implementing the Tentatively Selected Plan, the implementation of sound monitoring and adaptive management plans are critical to project success. The Service recommends close adherence to the water quality and ecological monitoring plans developed for the BBCW Project, including the ecological monitoring specified in the RECOVER Monitoring and Assessment Plan and the project-level monitoring plans appearing in the PIR. Also, the Service recommends that the adaptive management plan developed for the project be implemented to maximize the restoration success of the project and to provide information for the planning and construction of Phase 2 of the project. This process should facilitate the restoration and enhancement of the BBCW Project's wetland and estuarine habitats.

The recommendations made by the Service on this project are intended to make this project more environmentally compatible and to further enhance the diversity and abundance of fish and wildlife resources in the project area, while assuring that maximum ecological benefits are delivered to Biscayne Bay and adjacent coastal wetlands consistent with the basic project

purpose. In addition to the recommendations made above, the Service also developed recommendations regarding: (1) the preferential use of available freshwater, (2) project and system water management operations, (3) threatened and endangered species, (4) contaminants, (5) wastewater reuse, (6) non-native vegetation removal and control, (7) impingement and entrainment of fish and aquatic organisms by pumps, (8) fire management, (9) migratory birds, (10) backfilling drainage and mosquito ditches, and (11) coordination with other programs. Potential adverse impacts to fish and wildlife resources should be minimized by incorporating these recommendations.

The Service reiterates that we support the BBCW Project TSP as a first step in restoring the nearshore waters of southwestern Biscayne Bay and the adjacent tidal wetlands. Even though the spatial extent of wetland restoration envisioned by the Restudy will not be realized by the TSP, the redistribution of freshwater from harmful point source discharges to a more natural flow across the tidal wetlands to nearshore bay waters should improve ecological conditions in the project area. The Service appreciates the cooperation of the Biscayne Bay Coastal Wetlands Project Delivery Team in responding to our concerns and recommendations throughout the planning process. We remain committed to assist in addressing our remaining recommendations to further enhance fish and wildlife resources as detailed project plans are reviewed and the project is constructed, and we look forward in providing assistance to planning and implementing Phase 2 of the BBCW Project.

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Table 1. Nutrient loading into the three primary sections of Biscayne Bay through conveyance canals. The BBCW Project area is located in south Biscayne Bay. DIN equals dissolved inorganic nitrogen.

1994-2002 Average Canal Load (Tons per year)				
	Nitrate	Ammonia	DIN	Total Phosphorus
North Bay	235	312	547	19
Central Bay	39	28	67	3
South Bay	1021	52	1073	5
TOTAL	1295	392	1687	27

Table 2. Summary of South Miami-Dade canal water quality at selected DERM sampling locations upstream of salinity control structures (1997-2000 data).

Water Quality Parameter	**Cutler Drain CD02**	**Black Creek (C-1) BL02**	**Goulds Canal GL02**	**Military Canal MI02**	**Mowry Canal (C-103) MW04**	**Princeton Canal (C-102) PR03**
FIELD PARAMETERS						
pH	7.6	7.9	7.5	7.6	7.4	7.3
TSS	4			4	4	4
TDS	306				463	390
Turbidity	0.5	1.5	3.6	0.8	0.7	0.6
D.O.	6.3	4.8	3	5.6	5.9	5.6
NUTRIENTS						
Ammonia Nitrogen	0.01	0.18	3	0.035	0.01	0.02
Total Phosphorus	0.004	0.011	0.016	0.009	0.004	0.003
Ortho Phosphorus	0.005		0.005	0.005	0.003	0.004
Nitrate + Nitrite	0.09	0.11	0.1	0.44	2.3	4.2
TKN	0.3			0.2	0.2	0.2
METALS						
Copper, dissolved	2			2	2	2
Zinc	3			5.2	3	3
BIOLOGICALS						
Total Coliform	50	105	205	40	90	285
Fecal Coliform	10	20	68	10	10	20

Table 3. Acres, number of polygons, mean polygon size, and percent of total acres for each of 28 vegetation/land use categories used to describe the BBCW Project area north of SW 360th Street.

Vegetation Class		Acres	Number of Polygons	Mean Polygon Size (acres)	Percent of Total Acres
1.	Coastal band mangrove	2737.0	82	33.4	15.3
2.	Dwarf dense mangrove	1257.5	115	10.9	7.0
3.	Dwarf sparse mangrove	336.2	53	6.3	1.8
4.	Salt marsh	118.5	24	4.9	0.7
5.	White mangrove and/or buttonwood	507.2	30	16.9	2.8
6.	Native forested-shrub wetland	196.4	66	3.0	1.1
7.	Brazilian pepper	467.7	31	15.1	2.6
8.	Australian pine	158.9	28	5.7	0.9
9.	Other exotics	105.6	19	5.6	0.6
10.	Sawgrass	1470.6	114	12.9	8.2
11.	Cattail	363.3	109	3.3	2.0
12.	Pine rockland	87.4	3	29.1	0.5
13.	Tropical hardwood hammock	184.0	5	36.8	1.0
14.	Filled-developed-disturbed	4250.7	63	67.5	23.8
15.	Open water	574.2	60	9.6	3.2
2/4.	Dwarf dense mangrove / salt marsh	33.2	4	8.3	0.2
2/10.	Dwarf dense mangrove / sawgrass	126.6	11	11.5	0.7
3/4.	Dwarf sparse mangrove / salt marsh	23.9	6	4.0	0.1
3/10.	Dwarf sparse mangrove / sawgrass	99.0	18	5.5	0.6
5/7.	White mangrove / Brazilian pepper	128.7	5	25.7	0.7
6/7.	Native F-S wetland / Brazilian pepper	1901.3	33	57.6	10.6
6/8.	Native F-S wetland / Australian pine	1314.9	59	22.3	7.3
6/9.	Native F-S wetland / other exotics	528.1	28	18.9	3.0
6/10.	Native F-S wetland / sawgrass	152.6	17	9.0	0.9
6/11.	Native F-S wetland / cattail	104.8	7	15.0	0.6
7/8.	Brazilian pepper / Australian pine	49.7	6	8.3	0.3
8/10.	Australian pine / sawgrass	521.8	32	16.3	2.9
10/11.	Sawgrass / cattail	71.7	21	3.4	0.4

Table 4. Federally and state listed Threatened (T) or Endangered (E) species or Species of Special Concern (SSC) that exist or potentially exist in the BBCW Project area. Species with designated critical habitat (CH) near the project area is also shown.

Common Name	Scientific Name	Federal Status	State Status
MAMMALS			
Florida mastiff bat	*Eumops glaucinus floridanus*		E
Everglades mink	*Mustela vison evergladensis*		T
Florida panther	*Puma concolor coryi*	E	E
West Indian manatee	*Trichechus manatus*	E (CH)	E
BIRDS			
Roseate spoonbill	*Ajaia ajaja*		SSC
Cape Sable Seaside Sparrow	*Ammodramus maritimus mirabilis*	E (CH)	E
Limpkin	*Aramus guarauna*		SSC
Piping plover	*Charadrius melodus*	T (CH)	T
White-crowned pigeon	*Columba leucocephala*		T
Little blue heron	*Egretta caerulea*		SSC
Reddish egret	*Egretta rufescens*		SSC
Snowy egret	*Egretta thula*		SSC
Tricolored heron	*Egretta tricolor*		SSC
White ibis	*Eudocimus albus*		SSC
Arctic peregrine falcon	*Falco peregrinus tundrius*		E
Wood stork	*Mycteria americana*	E	E
Brown pelican	*Pelecanus occidentalis*		SSC
Everglade snail kite	*Rostrhamus sociablis plumbeus*	E (CH)	E
Black skimmer	*Rynchops niger*		SSC
Least tern	*Sterna antillarum*		T
Roseate tern	*Sterna dougallii dougallii*	T	T
REPTILES			
American alligator	*Alligator mississippiensis*		SSC
Loggerhead sea turtle	*Caretta caretta*	T	T
Green sea turtle	*Chelonia mydas*	E	E
American crocodile	*Crocodylus acutus*	T (CH)	E
Leatherback sea turtle	*Dermochelys coriacea*	E	E
Eastern indigo snake	*Drymarchon corais couperi*	T	T
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E
Gopher tortoise	*Gopherus polyphemus*		SSC
Kemp's Ridley sea turtle	*Lepidochelys kempii*	E	E
Rim rock crown snake	*Tantilla oolitica*		T
FISHES			

Mangrove rivulus	*Rivulus marmoratus*		SSC
INVERTEBRATES			
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	E	E
Florida tree snail	*Liguus fasciatus*		SSC
PLANTS			
Tiny polygala	*Polygala smallii*	E	
Crenulate lead plant	*Amorpha crenulata*	E	
Deltoid spurge	*Chamaesyce deltoidea* spp. *deltoidea*	E	
Small's milkpea	*Galactia smallii*	E	
Garber's spurge	*Chamaesyce garberi*	T	
Beach jacquemontia	*Jacquemontia reclinata*	E	

Table 5. Reused wastewater quality targets.

Parameter	Reuse	Wetlands Application	Class III / OFW
TSS, mg/ L	5(1)	5	3.5
$CBOD_5$, mg/ L	20(2)	5	NA
Total Nitrogen, mg/l as N	NA	3	0.27
Total Phosphorous, mg/L as P	NA	1	0.005
Fecal Coliform, # / 100ml	<1.0	<1.0	<1.0
Total Ammonia- N, mg/L			0.02 –0.05 mg/L(depends on method of collection and analysis)
Nitrite/Nitrate-N, mg/L			0.01 mg/L
TKN, mg/L			0.22 mg/L
Ortho-P (mg/L)			0.002 mg/L
Dissolved Oxygen range (mg/L)			5.0-7.3
Turbidity, NTU			0.5 NTU
Salinity			Shall not change salinity in test site by more than 5 ppt
pH range			6.5-7.5 (*)
Heavy Metals			
Emerging Pollutant of Concerns (EPOC)			Lowest possible levels(**)
Cryptosporidium and Giardia			Lowest possible levels(**)

(1) Single sample maximum

(2) Annual average

(*) Appropriate limits for pH in the estuarine zone will require further evaluation.

(**) Even though, currently there are no established numerical criteria or antidegradation targets for these parameters, available information shall be gathered on removal efficiency of various treatment technologies and detectable levels after advanced treatment for these parameters for comparative assessment. In practical terms, the objective would be to identify the technology that reduces such contaminants to the lowest level.

(a) Task 5 – Final Report South Dade Advanced Wastewater Treatment Alternatives, (USCOE, 2004)

Table 6. Spatial extent of natural habitat types (in acres) removed or displaced by project features, including pump stations, conveyance canals, spreader swales, culverts, and berms. The data does not include the spatial extent of non-natural areas (e.g., roads and highways) or Brazilian pepper displaced by project features. Data from the District's 2004 GIS land use-land cover database.

Project Component	Land Use or Vegetation Type Impacted	Number of Acres Impacted
Deering Flow-way	Filled/Develop/Disturbed	6.10
	Tropical hardwood hammock	0.02
Cutler Flow-way	Brazilian pepper	48.19
	White mangrove/Buttonwood	23.51
	White mangrove/Brazilian pepper	12.00
	Filled / Developed/Disturbed	11.54
	Coastal Band Mangrove	2.25
	Native forested-shrub wetland /Australian pine	0.41
L-31E Culverts	Native forested-shrub wetland/Brazilian pepper	4.11
	Filled/Developed/Disturbed	4.58
	Cattail	0.10
	Open water	1.82
	Brazilian pepper	4.07
	Australian pine	0.73
	Coastal band mangrove	0.92
	Dwarf dense mangrove	0.09
	White mangrove/buttonwood	0.05
	Native forested-shrub wetland	0.10
	Native forested-shrub wetland/Australian pine	0.17
	Dwarf dense mangrove	0.11
	Dwarf dense mangrove/sawgrass	0.02
	Mixed wetland hardwoods	0.25
Totals	**Native vegetation communities**	**27.32**
	Non-native vegetation	**53.09**
	Native/non-native mixed communities	**16.69**
	Filled/Develop/Disturbed	**22.22**

Table 7. Summary of features in Alternative O.

Deering Estate Flow-way	Pump (PU-D1) – Upgrade from 20 to 100 cfs – Cutler Rd, new canal
Deering Estate Flow-way	Improve Powers Property ditch(CC-D1) – 5'D, 8'BW, 600' L, 1400 cy
Deering Estate Flow-way	Spreader along east right of way of Old Cutler Road (consistent with BODR recommended design)
Deering Estate Flow-way	Culverts under Old Cutler Rd (CC-D2) – 42" RCP 70' L
Deering Estate Flow-way	Weir on Cutler Drain (S-D1) – sheetpile – 40 ft
Deering Estate Flow-way	Plug Secondary Canals and Mosquito Ditches
Deering Estate Flow-way	Grade part of Powers property
Deering Estate Flow-way	Enhance C-100 A to pass 100 cfs rather than 20 cfs
Cutler Wetlands	Spreader Canal (SC-C1) – 3' D, 75'BW, 19700'L, extends south
Cutler Wetlands	Levee (L-C1) west of Spreader Canal – 3' H, 6000 ft
Cutler Wetlands	Pump (PU-C1) - 100 cfs
Cutler Wetlands	Culvert (CC-C1) – 60 " RCP 4700' L, 100 cfs from PU-C1 to Cutler spreader north
Cutler Wetlands	Pump PU-C2 – Saga Bay North – 10 cfs
Cutler Wetlands	Pump PU-C3- Saga Bay South – 10 cfs
Cutler Wetlands	CC-C2 – Pipe for PU-C2 to Spreader Canal (SC-C1) – 10 cfs – 24", 1000'L
Cutler Wetlands	CC-C3 – Pipe for PU-C3 to Spreader Canal (SC-C1) – 10 cfs – 24", 1000'L
Cutler Wetlands	STA C-1 Pump (PU-C4) - 400 cfs
Cutler Wetlands	Lined Canal CC-C4 to connect PU-C4 to spreader SC-C1 – 7500'L- 400 cfs capacity , 6'D, 20'BW, include diverting 50 cfs Culter Flow-way
Cutler Wetlands	Lennar Flow-way (STA C1) – 100 acres – no cost
Cutler Wetlands	Lennar Floway Berms (L-C2) - 4 H, 1.89 mi, 66700 cy
Cutler Wetlands	CC-C5 – culverts from Lennar thru L31E -6 – 48"
Cutler Wetlands	CC-C6 L31E (87th Ave) Borrow Canal Gated Culvert (operable plug)
Cutler Wetlands	Plug mosquito ditches
L-31E Wetlands	Plugs in ditches east of L31E
L-31E Wetlands	Add Pump-(PU-H1) – 50 cfs
L-31E Wetlands	Culvert (CC-H1) for PU-H1 – 50 cfs
L-31E Wetlands	Insert 6 flapgated culverts (CC-H2) in L31E levee north of C102 - 48" thru L-31E
L-31E Wetlands	Gated Culvert (CC-H3) on L31E Canal – blocks flow from C-102
L-31E Wetlands	Insert 8 flapgated culverts (CC-H4) in L31E levee between Military Canal and C102 - 48" thru L-31E

Table 7. Continued.

L-31E Wetlands	Gated Culvert in Goulds Canal (CC-H5) (operable plug)
L-31E Wetlands	Add 500 cfs pump (PU-H2) in SE corner of intersection of C-102 and L-31E borrow canal.
L-31E Wetlands	CC-H6 between Military Canal and C-103 - 5 flapgated culverts in L31E levee - 48"
L-31E Wetlands	Pump (PU-H3) - 300 cfs from C-103 to Spreader Canal (SC-M1) – 2 – 150 cfs pumps
L-31E Wetlands	Spreader Canal (SC-H1) from C-103 to Military Canal – 300 cfs
L-31E Wetlands	Pump (PU-H4) - 20 cfs from C-103 to Spreader Canal (SC-H2)
L-31E Wetlands	Spreader Canal (SC-H2) from C-103 to North Canal - 20 cfs
L-31E Wetlands	Pump (PU-H5) - 50 cfs from North Canal to Spreader Canal (SC-H3)
L-31E Wetlands	Spreader Canal (SC-H3) from Florida City Canal to North Canal, 50 cfs
L-31E Wetlands	CC-H8 between C-103 and north canal - 1 flapgated culvert in L31E levee-48"
L-31E Wetlands	CC-H7 – submerged stoplog riser culverts in L31E Canal at intersection with Military Canal to allow north to south flow - (6) 48"
L-31E Wetlands	CC-H9 between North Canal and Florida City Canal - (2) flap-gated culvert in L31E levee- (2) 48"
L-31E Wetlands	CC-H10 – submerged stoplog riser culverts in L31E Canal that allow north to south flow in L-31E under C-103 canal – (3) 48"
Barnes Sound Wetlands	Pump (PU-M2) Add 50 cfs Pump on Tallahassee Rd Canal (137th ave) -on Western Side of the Racetrack
Barnes Sound Wetlands	Gated Culvert (CC-M2) on Tallahassee Rd. Canal (137th)(operable plug)
Barnes Sound Wetlands	Two culverts (CC-M1) on Tallahassee Rd. Canal (137th) – 12" to 24"
Barnes Sound Wetlands	Pump (PU-M1) - 30 cfs from Fl City Canal
Barnes Sound Wetlands	Levee L-M1 located west of Wink Eye Slough
Barnes Sound Wetlands	Pump (PU-M4) - 50 cfs from Florida City Canal - send south in existing L31E Canal
Barnes Sound Wetlands Barnes Sound Wetlands	Pump (PU-M3) - 20 cfs from Florida City Canal southeast to hydrate historic slough Plug mosquito ditches

Table 8. Summary of CBEEM output, including total acres, habitat units, ecological benefit (in habitat units) in each of the three ecological zones for all project alternatives.

TOTAL HABITAT UNIT SUMMARY (NET FWO CONDITION)							
	Existing Condition	**Future Without**	**Alternative O**	**Alternative M**	**Alternative Q**	**Alternative YB**	**Alternative O, P1**
NEARSHORE HABITAT LIFT *							
Nearshore Indices	0.09	0.19	0.65	0.43	0.60	0.48	0.54
Nearshore Acres	8,585	8,585	8,585	8,585	8,585	8,585	8,585
Habitat Units (acre-lift)	**732**	**1,673**	**5,565**	**3,696**	**5,154**	**4,147**	**4,624**
2050 HU Lift		**941**	**3,892**	**2,023**	**3,481**	**2,474**	**2,950**
SALTWATER WETLAND HABITAT LIFT **							
Saltwater Indices	0.04	0.04	0.32	0.32	0.23	0.18	0.33
Saltwater Acres	22,550	22,550	22,550	22,550	22,550	22,550	22,550
Habitat Units (acre-lift)	**973**	**1,002**	**7,176**	**7,236**	**5,292**	**4,136**	**7,398**
2050 HU Lift		**29**	**6,174**	**6,234**	**4,290**	**3,134**	**6,396**
FRESHWATER WETLAND HABITAT LIFT ***							
Freshwater indices	0.41	0.41	0.74	0.43	0.97	0.88	0.44
Freshwater Acres	9,638	9,638	9,638	9,638	9,638	9,638	9,638
Habitat Units (acre-lift)	3,997	**3,997**	**7,108**	**4,181**	**9,311**	**8,465**	**4,280**
2050 HU Lift		**-**	**3,111**	**185**	**5,315**	**4,468**	**283**
TOTAL HABITAT LIFT							
Total Habitat Units (acre-lift)		**970**	**13,177**	**8,441**	**13,085**	**10,077**	**9,630**

Key: FWO future without
HU habitat unit

* Nearshore Habitat Lift is computed by averaging the three sub-indices and multiplying this result by the total available nearshore acreage. The three sub-indices are: 1) Percent of available water diverted from coastal structure, 2) The average of the percent nitrogen and phosphorus load targets achieved, 3) Percent of nearshore acres within 500 meters of the shoreline meeting the target salinity conditions. This habitat lift is measured in units of "acres of lift".

** Saltwater Wetland Habitat Lift is computed by averaging the two sub-indices and multiplying this result by the total saltwater wetland acreage. The two sub-metrics are 1) Percent of available water diverted directly to saltwater wetlands, and 2) Percent of saltwater wetland acreage meeting the target salinity condition. This habitat lifts is measured in units of "acres of lift".

*** Freshwater Wetland Habitat Lift is computed by averaging two sub-indices and multiplying this result by the total freshwater wetland acreage. The two sub-indices are 1) Acres of freshwater wetland with sufficient water, and 2) the acreage of freshwater wetland free of invasives and exotics. This habitat lift is measured in units of "acres of lift".

Table 9. CBEEM output for the nearshore ecological zone. Performance measures applicable to this zone include PMs 1, 3, 5, and 6. See Appendix A for complete documentation of how the performance measures are evaluated.

NEARSHORE ECOLOGICAL ZONE										
Objectives and Criteria	**Units**	**Method**	**Target**	**Existing Condition**	**Future Without Project**	**Alt O**	**Alt M**	**Alt Q**	**Alt YB**	**Alt O, Part I**
A. Reduced canal discharge										
1. Potential % of surface water diverted from canal (PM 3)	ac-ft/yr	Flow quantity diverted from canals (DBHYDRO)	368,934	-	-	300,496	144,549	294,952	223,557	216,943
				0%	0%	81%	39%	80%	61%	59%
B. Reduced contaminant concentrations and loads										
1. Nitrate Load Reduction (PM 5)	Mtons/yr	GIS Land use / Nitrate Removal	23	847	305	49	232	54	104	143
				0%	66%	97%	75%	96%	90%	85%
2. Phosphorus Peak Load Reduction (PM 6)	Mtons/yr	USGS Flow / Conc Eqn.	0	33	33	21	9	20	14	15
				0%	0%	62%	27%	61%	44%	47%
Average % Target Achieved				0%	33%	80%	51%	79%	67%	66%
C. Salinity performance										
1. Acres of Bay bottom meeting 20 psu criterion (within 500 M of shore) (PM 1)	Acres	TABS-MDS / PSR Run Analysis with Flow Diversion Calcs	3462	886	886	1157	1348	744	605	1268
				25.6%	25.6%	33%	39%	21%	17%	37%
Nearshore Mean Criteria Result				0.085	0.195	0.648	0.430	0.600	0.483	0.539
Total Available Nearshore Acres				8,585	8,585	8,585	8,585	8,585	8,585	8,585
Total Nearshore Habitat Units (acre-lift)				732	1,673	5,565	3,696	5,154	4,147	4,624
Nearshore Habitat Units (Net from Future Without) (acre-lift)				-941	0	3,892	2,023	3,481	2,474	2,950

Key: Alt Alternative; GIS Geographical Information System; PM performance measure; PSR preliminary scenario runs; M meter; USGS US Geological Survey

Table 10. CBEEM output for the saltwater wetlands ecological zone. Performance measures applicable to this zone include PMs 2 and 3. See Appendix A for complete documentation of how the performance measures are evaluated.

SALTWATER WETLAND ECOLOGICAL ZONE										
Objectives and Criteria	**Units**	**Method**	**Target**	**Existing Condition**	**Future Without Project**	**Alt O**	**Alt M**	**Alt Q**	**Alt YB**	**Alt O, Part I**
A. Reduced canal discharge										
1. Potential percent of surface water diverted to SW Wetlands (PM 4)	ac-ft/yr	Flow diversion using DBHydro Database	368,934	-	-	166,118	180,322	117,431	79,620	181,623
				0%	0%	45%	49%	32%	22%	49%
B. Salinity performance										
1. Acres of tidal wetlands meeting 0-20 psu criterion (PM 2)	Acres	Average Daily SW Wetland Acres Meeting Criteria (TABS-MDS-MDS model output)	21,035	1,815	1,869	3,916	3,219	3,177	3,177	3,446
				8.63 %	8.88%	18.62 %	15.30%	15.10%	15.10%	16.38%
Saltwater Wetlands Mean Criteria Result				0.043	0.044	0.318	0.321	0.235	0.183	0.328
Total SW Wetland Acres Available				22,550	22,550	22,550	22,550	22,550	22,550	22,550
Total SW Wetland Habitat Units (acre-lift)				973	1,002	7,176	7,236	5,292	4,136	7,398
Net SW Wetlands Habitat Units (Net from Future Without Condition) (acre-lift)				-29	0	6,174	6,234	4,290	3,134	6,396

Key: ac-ft/yr: acre-feet per year, Alt: Alternative, PM: performance measure, ppt: parts per thousand

Table 11. CBEEM output for the freshwater wetlands ecological zone. Performance measures applicable to this zone include PMs 4, and 7. See Appendix A for complete documentation of how the performance measures are evaluated.

FRESHWATER WETLAND ECOLOGICAL ZONE										
Objectives and Criteria	**Units**	**Method**	**Target**	**Existing Condition**	**Future Without Project**	**Alt O**	**Alt M**	**Alt Q**	**Alt YB**	**Alt O, Part I**
A. Rehydrated wetland lift										
1. Wetlands with sufficient water (PM 4)	Acre-lift	GIS Mapping /Seepage Analysis	9638	3997	3,997	7,168	4,205	7.994	8,378	4,229
B. Reduced invasive non-native plants *										
1. Acres of Invasive/Exotics Removed (PM 7)	Acre-lift	GIS Mapping Analysis	9763	0	0	3051	160.5	6632	4555	334
Net FW Wetland Habitat Units (Net from Future Without Condition) (acre-lift)				**0**	**0**	**3,111**	**185**	**5,315**	**4,468**	**283**

Key:

Alt	Alternative
FWO	Future Without
GIS	Geographical Information System
PM	Performance Measure

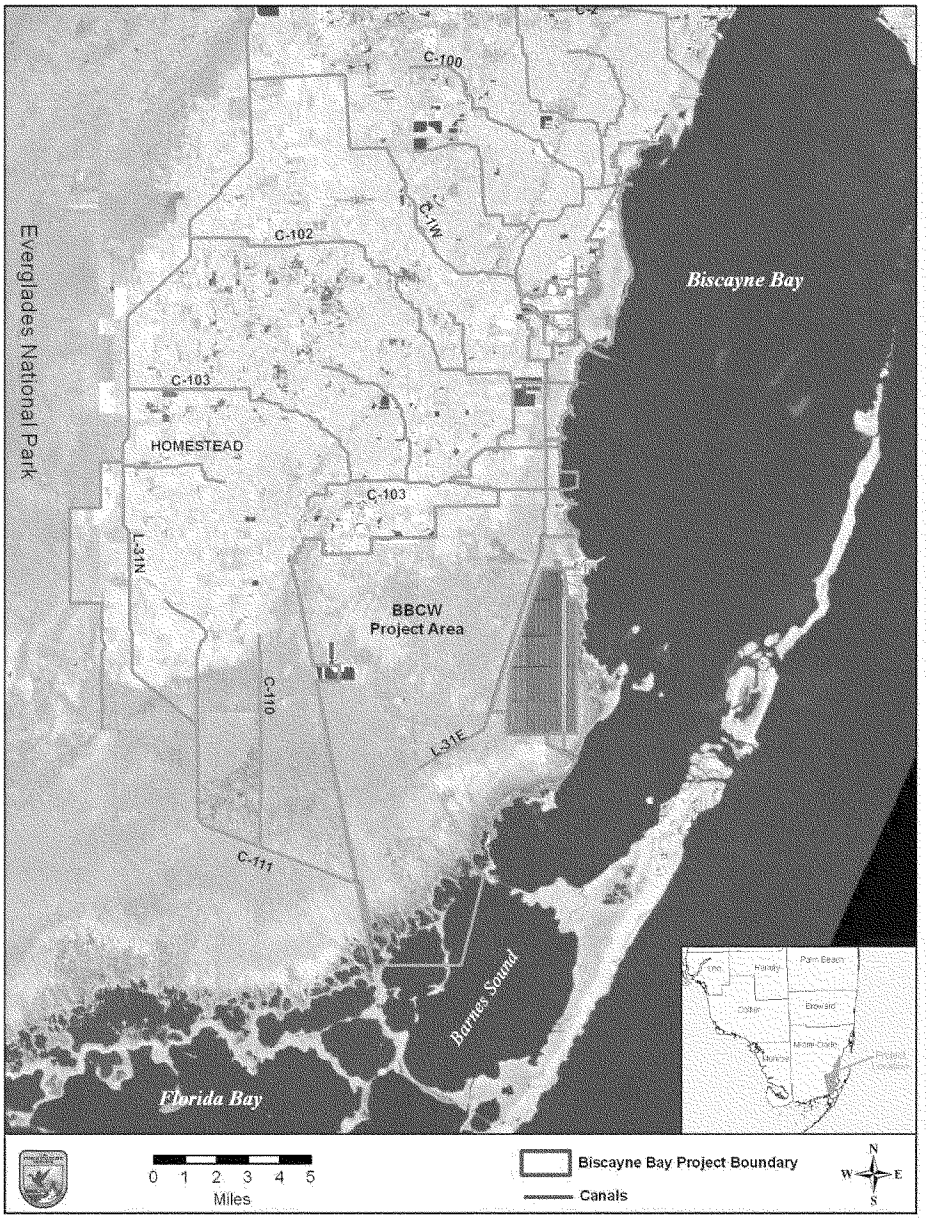

Figure 1. Map of the BBCW Project study area.

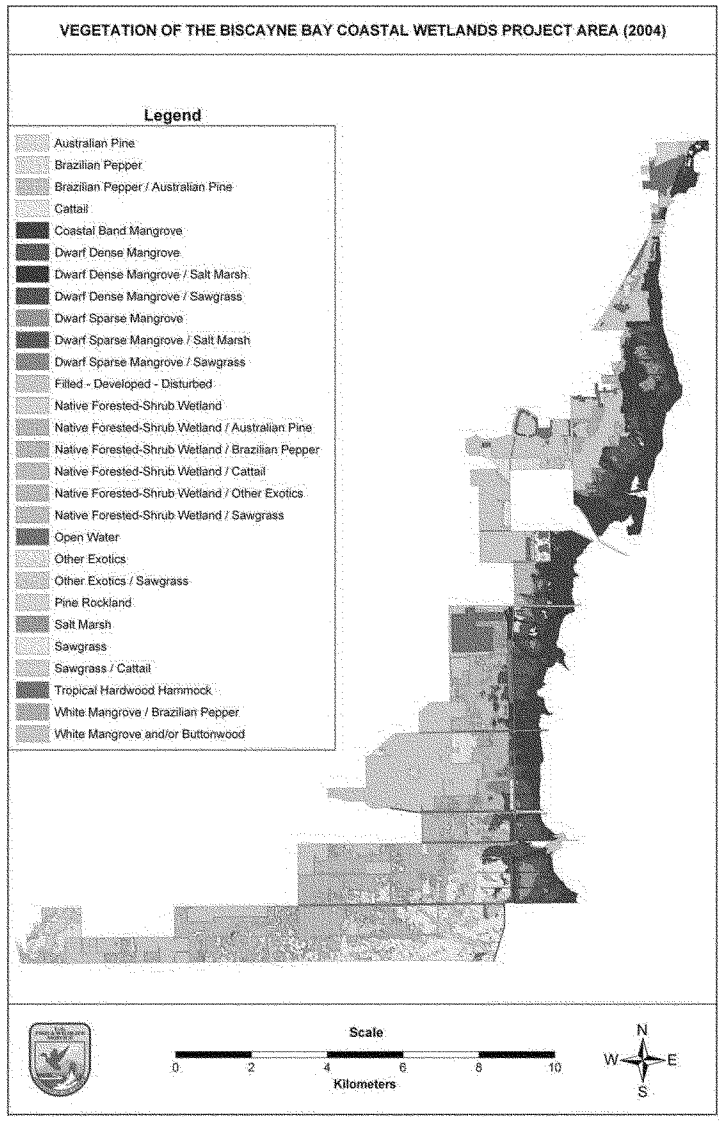

Figure 2. Vegetation map of the BBCW Project area between Shoal Point (Deering Estate) and Turkey Point (northern Model Lands).

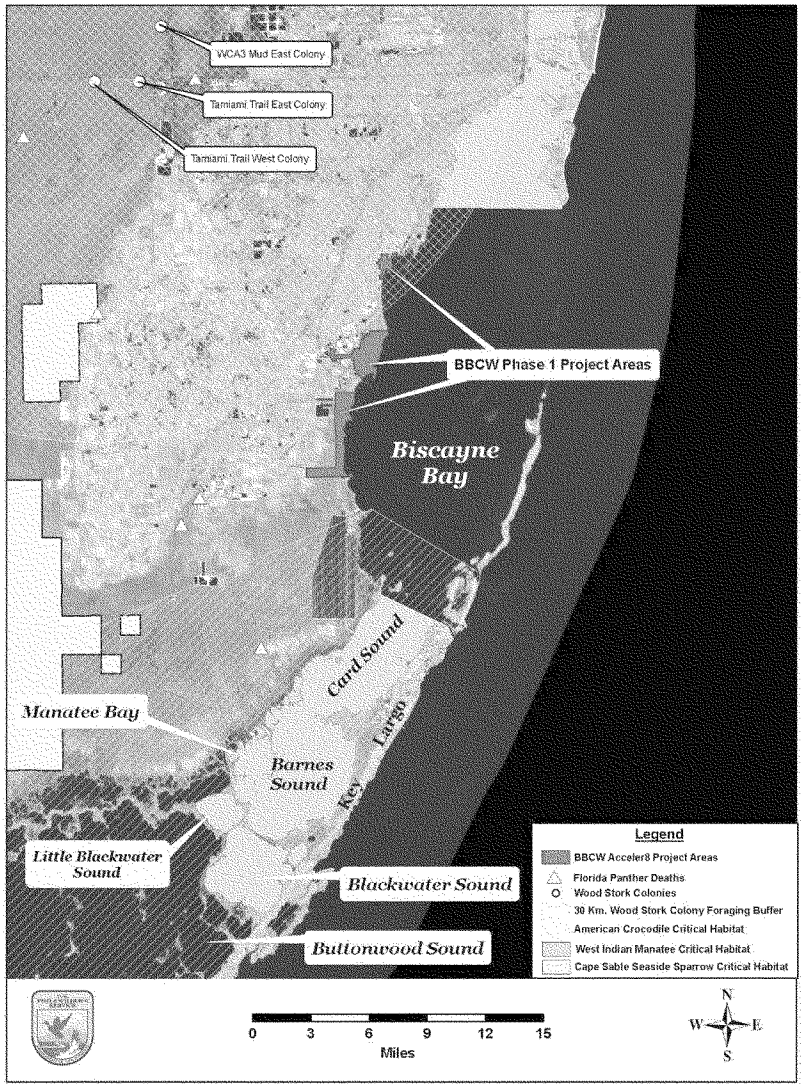

Figure 3. Map showing the location of designated critical habitat for the American crocodile, West Indian manatee, and Cape Sable seaside sparrow; nearest Florida panther deaths; and the nearest wood stork colonies, including the colony foraging buffer, relative to the BBCW Phase 1 Project.

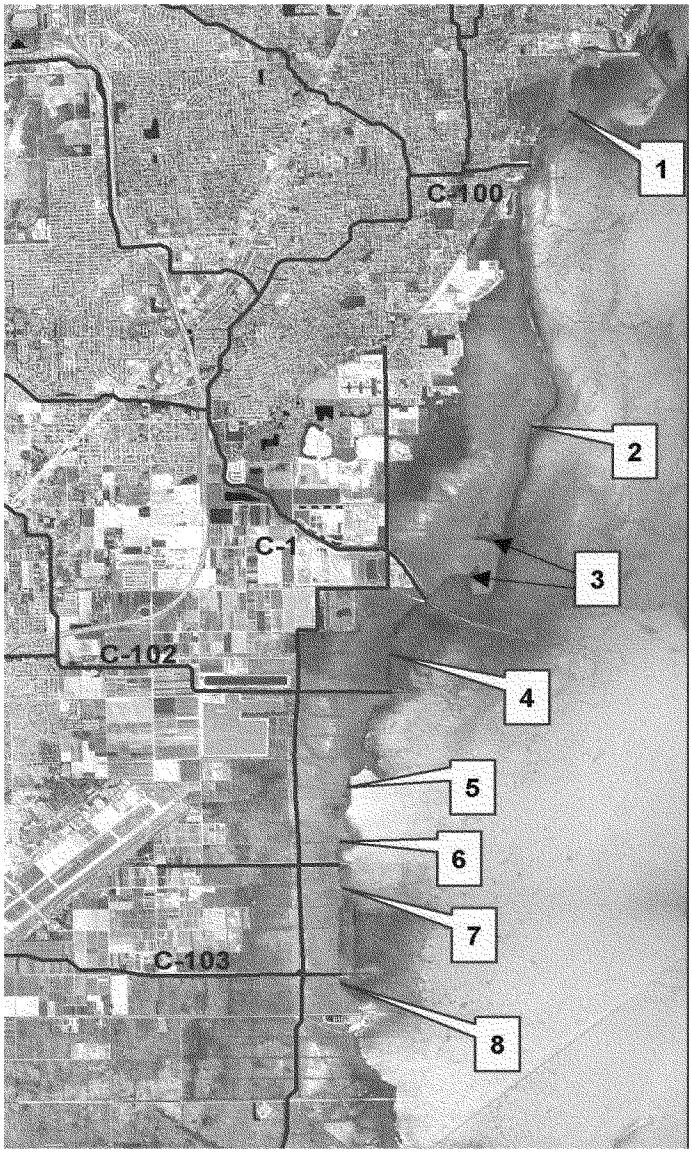

Figure 4. Map of BBCW Project area showing eight primary creek systems.

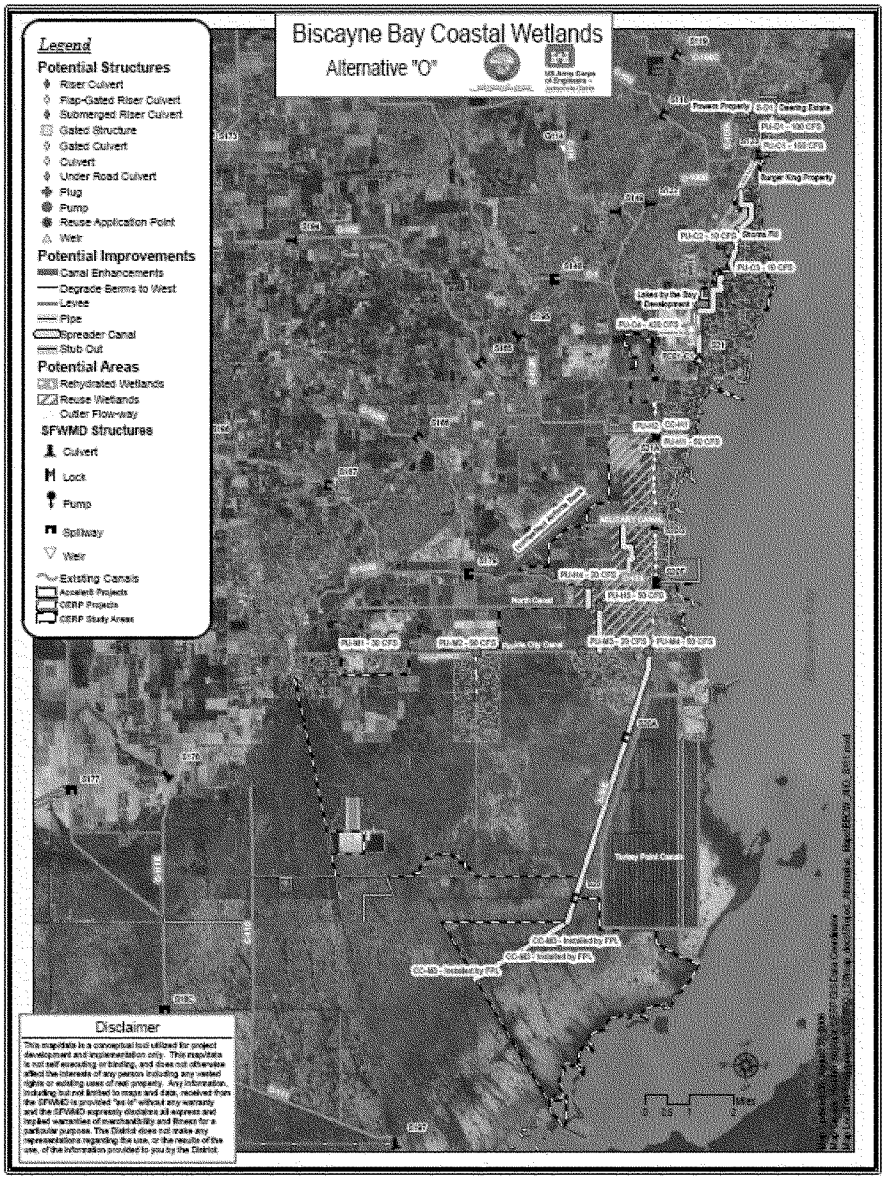

Figure 5. Map of the BBCW National Restoration Plan (Alternative O).

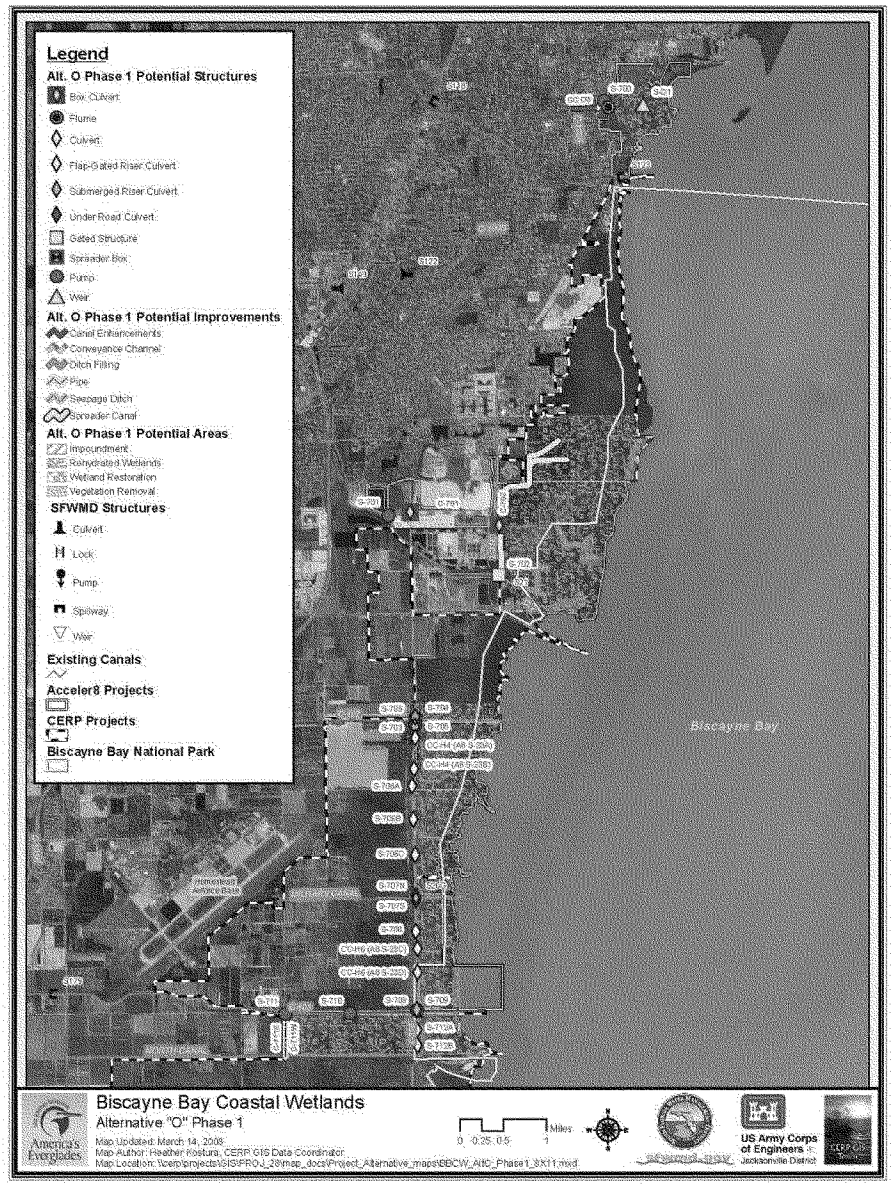

Figure 6. Map of the BBCW Tentatively Selected Plan (Alternative O Phase 1).

APPENDIX A

Documentation for the Eight Performance Measures Used in CBEEM

Evaluation Criterion Number and Name
Performance Measure 1. Restore nearshore salinity regime.
Criterion Target and Description
The nearshore salinity target is equal to or less than 20 ppt. The nearshore area is defined as the area between the shoreline out to 500m during the low flow season and 1000m during the high flow season.. This performance measure evaluates the restoration of nearshore habitat as a function of salinity and the average daily volume of water diverted from canals. It directly addresses Project Object 1 (Restore nearshore and tidal wetland salinity regimes to reestablish productive nursery habitat along the shoreline) by quantifying the spatial extent of nearshore restoration using salinity as a surrogate. The performance measure is also tied closely to the Biscayne Bay conceptual ecological model by addressing a key driver (water management) and primary stressors (operation of structures and altered freshwater flow) that influence salinity patterns in the bay, thus impacting various ecological attributes such as estuarine fish and invertebrates, benthic communities, etc. (Browder et al. 2005.)
Justification and Current Condition
The salinity regime of the nearshore areas of southwestern Biscayne Bay has been modified significantly due to manmade changes in local hydrology. Today, higher salinities along the shoreline, especially during the dry season, have led to the decline in oyster reefs that once thrived at creek mouths, have reduced the suitability of the area for American crocodiles (*Crocodylus acutus*), and have resulted in a shift of fish and macro invertebrate fauna to that more characteristic of marine conditions than estuarine conditions. Restoring the salinity in the nearshore habitat to mesohaline conditions (5 to 20 ppt) throughout the year would provide the optimal salinity regime for the flora and fauna that historically inhabited this area, such as widgeon grass (*Ruppia maritima*), shoal grass (*Halodule wrightii*), eastern oysters (*Crassostrea virginica*), American crocodiles, red drum (*Sciaenops ocellatus*), and other fish and invertabrates. For example, in Florida, oyster spat have an optimal salinity range of 20-23 ppt, whereas juveniles prefer salinities between 10-20 ppt and adults have an optimum range of 10-20 ppt (Woodward-Clyde 1998). Target salinity for estuarine fishes is 5-15 ppt from June through October, with higher salinities during the remainder of the year. Ideal salinity for juvenile crocodiles is 0-20 ppt in the mangrove wetlands and coastal creeks during the wet season and several months into the dry season (approximately June through January; Mazzotti and Cherkiss. 2003). The salinity target for this performance measure is set at 20 ppt, which is at the mid to upper end of the preferred range for most of the above species. Without freshwater discharges the salinity would exceed the 20 ppt target. Alternatives that provide the most uniform freshwater discharge in terms of timing and spatial extent are scored the highest for this performance measure.

Reestablishing mesohaline salinities (20 ppt) along the shoreline should help restore a broader, more stable zone in shallow waters further offshore (500 to 1000 m) that will provide more suitable nursery habitat for pink shrimp (*Farfantepenaeus duorarum*; Browder et al. 2002, Diaz 2001). Shrimp densities in the northern part of the restoration area (between Shoal Point and Black Point) appear robust (Diaz, pers. Comm. 2001.). However, shrimp densities in the southern area (between Black Point and Convoy Point) are very low (Diaz, pers. Comm. 2001.), possibly because of the widely fluctuating salinities that now prevail in the southern area.

Lowering salinities in the nearshore areas will also serve to reduce or eliminate periods of high salinity (greater than 35 ppt) concentration in parts of Biscayne Bay (the area between the shoreline out to 500m offshore) within the project area. These hypersaline conditions inhibit estuarine productivity by contributing to salinity variability and slowing the growth rates of target species (Browder et al. 2005). Areas of hypersalinity have occurred nearshore in Biscayne National Park during the dry season, and throughout the year within Manatee Bay and the Florida Keys National Marine Sanctuary (Card Sound and Barnes Sound).

Evaluation Method/Approach

CBEEM Performance Metric(s):

Nearshore, C.1. Acres of Bay Bottom Meeting Salinity Criteria (<=20 ppt)

This metric is evaluated using Scenario 10 of the TABS-MDS-MDS Preliminary Scenario Runs (PSR) as the baseline to determine what percentage of the available nearshore acreage meets the target salinity range. The Scenario 10 PSR runs were set up to determine the spatial and temporal distribution of freshwater inflow necessary to continuously meet the target nearshore zone salinity of <= 20 ppt. The period of simulation for the TABS-MDS PSR runs was August 1, 1997 to July 31, 1998 which represents fairly average bay salinity conditions. The nearshore zone is defined for the dry season (Dec through May) as the area between the shoreline out to 500 meters. For the wet season (June through November) it is defined as the area between the shoreline out to 1000 meters.

The delineation of the four geographic used in this metric is as follows: (1) Deering Estate to C-100, (2) C-100 to C-1, (3) C-1 to Military Canal, and (4) Military Canal to Florida City Canal. Barnes Sound and Manatee Bay were not included in this analysis because the PSR run did not include this area and furthermore very little of the project water is diverted south of Florida City Canal. The daily flow required to meet the salinity target in each of four nearshore zones is shown in the **Table 1-1**. Note that the Cutler basin receives diverted water from three sources. The ability of each alternative to meet the target salinity is evaluated by comparing the volume of diverted water and the Scenario 10 flows required to meet the salinity.

The volume of daily flows diverted into the saltwater (tidal) wetlands for each of the four zones is calculated based on water available at the coastal water control structures of the major conveyance canals in the project area (S123, S21, S21A, and S20F), and pump sizes and operations defined by each alternative. The results from the saltwater wetland diversion calculations are used here. Water

diverted to the saltwater wetlands was used in this metric since the water diverted to the freshwater wetlands is done west of the L-31W borrow canal for the most part. To calculate the percentage of the nearshore acres meeting the salinity target, the percent of the target flow delivered for each sub-basin is calculated on a daily basis. The percent flow target achieved is limited to 100% for those days where the diverted flow volume exceeds the daily target volume from the PSR run. The average seasonal percent flow target for each basin is then calculated and multiplied by the seasonal total acreage available to compute the average seasonal acreage meeting the salinity target. The overall average target is computed by averaging the wet season and dry season results.

Table 1-1
Required Flow to Meet Nearshore Salinity Target (< 20ppt)
from Scenario 10 of TABS-MDS PSR Runs

Nearshore Zone:	Source of Diverted Water	Average Daily Flow to Meet Salinity Target (ac-ft/day)	Dry Season Target Acreage (Shoreline to 500 m) (acres)	Dry Season Target Acreage to (Shoreline to 1000 m) (acres)
Deering Estates	½ C-100	340	364	728
North Cutler	½ C-100 + C-1 + Tidal Wetlands Reuse	540	1326	2652
C-1 to Military Canal (includes South Cutler)	C-102	315	827	1654
Military Canal to Fl City Canal	C-103	210	945	1890
TOTAL		**1405**	**3462**	**6924**

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Comments/Notes

Literature Cited:

Browder, J.A., Z. Zein-Eldin, M.M. Criales, M.B. Robblee, S. Wong, T.L. Jackson, and D. Johnson. 2002. Dynamics of pink shrimp (*Farfantepenaeus duorarum*) recruitment potential in relation to salinity and temperature in Florida Bay. Estuaries.
Browder, J.A., R. Alleman, S. Markley, P. Ortner, and P.A. Pitts. 2005. Biscayne Bay Conceptual

Ecological Model. Prepared for the Comprehensive Everglades Restoration Plan. WETLANDS, Vol. 25, No. 4, December 2005, pp. 854-869.
Diaz, G. 2001. Population dynamics and assessment of pink shrimp (*Farfantepenaeus duorarum*) in subtropical nursery grounds. Ph.D. Dissertation. University of Miami, Coral Gables, FL.
Mazzotti, F.J. and M.S. Cherkiss. 2003. Status and conservation of the American crocodile in Florida: Recovering an endangered species while restoring an endangered ecosystem. University of Florida, Ft. Lauderdale Research and Education Center. Technical Report 2003, 41 p.
Shafer, M. 2008. Description of CBEEM Performance Measure Calculations. Prepared for United States Army Corps of Engineers.
Woodward-Clyde International-Americas. 1998. Final Report. St. Lucie Estuary historical SAV and American oyster literature review. Prepared for the South Florida Water Management District; West Palm Beach, Florida.

Evaluation Criterion Number and Name (PM)
Performance Measure 2. Restore tidal wetland salinity regime.
Criterion Target and Description
This performance measure uses the latest TABS-MDS runs to determine the number of acres of tidal wetlands that are maintained at a salinity of 20 ppt or less (the optimal salinity for restoration in this wetland type). The performance measure directly addresses Project Objective 1 (Restore nearshore and tidal wetland salinity regimes to reestablish productive nursery habitat along the shoreline) by quantifying the spatial extent of tidal wetland restoration using salinity as a surrogate. It also addresses Objective 3 (Restore and improve quantity, quality, timing, and distribution of freshwater to the bay, including Biscayne National Park) by improving the quantity, quality, timing, distribution of freshwater to the bay. It also is directly tied to the Everglades Mangrove Estuaries CEM by addressing one of the two primary drivers (water management) and one of the three primary stressors (freshwater flow volume, duration, and distribution) that determine coastal salinity gradients. These salinity gradients, in turn, affect numerous ecological attributes in the coastal wetlands, including crocodiles, mangrove fish communities, and wading birds (Davis et al. 2005). This performance measure is applied only to the saltwater wetlands zone.
Justification and Current Condition
Key ecological indicators for healthy tidal wetlands include eastern oysters, American crocodiles, and estuarine fish. Optimal salinities for these species are generally 0-20 ppt. Maintaining salinities between 0-20 ppt will also provide optimal conditions for restoring the complex network of creek systems that historically characterized the tidal wetlands in the project area (Meeder et al. 1999, 2000, 2001). These creeks provide unique and important habitat for various flora and fauna, including deep water refugia and low salinities required by the American crocodile. Salinity regimes near the mouths of creeks apparently provided the only suitable living conditions for the eastern oyster (*Crassostrea virginica*) in Biscayne Bay, as evidenced by relic oyster reefs found near the mouths of historic creeks by Meeder et al. (1999). These oyster reefs, in turn, provided habitat for a variety of estuarine organisms. Alternatives that score best with this performance measure will theoretically restore the most saltwater wetland habitat in the project area. Alteration of freshwater flow patterns and volumes have reduced the occurrence of mesohaline, oligohaline, freshwater marshes, and sloughs, and have allowed the landward expansion of saltwater and mangrove wetlands, including low-productivity, sparsely vegetated dwarf mangroves communities typical of the hypersaline or white zone (Egler 1952; Tabb et al., 1967; Meeder et al., 1996; Ross et al., 1996, 2000, 2002). Historically, graminoids such as sawgrass (*Cladium jamaicense*) and spike rush (*Eleocharis cellulose*) occurred almost to the western shore of the bay. Reestablishing an oligohaline-to-mesohaline salinity gradient across the tidal wetlands, as evaluated by this performance measure, should serve, over time, to increase the density and spatial coverage of desirable graminoids in this ecological zone.

Also, reestablishing appropriate salinities in the tidal wetlands (*i.e.*, attaining the salinity target for this performance measures) should increase the production of preyfish in this habitat type. There is evidence that decreased freshwater flows to marshes and estuaries have decreased the productivity of these areas for fish populations, probably as a result of increasing the salinity in these wetlands (Pool et al., 1975; Schomer and Drew, 1982; Loftus and Eklund, 1995). These studies also suggest that the process is reversible in that persistent freshwater conditions result in higher prey fish biomass than either brackish or marine conditions. Re-hydration of the coastal wetlands should decrease the salinity in the wetlands and, thus, increase the productivity of prey fish resulting in an increase in the numbers of foraging and nesting wading birds (Browder et al. 2005).

Evaluation Method/Approach

CBEEM Performance Metric(s):

Saltwater Wetlands, B.1. Acres of Tidal Wetlands Meeting 0-20 ppt Criteria

The acres of tidal wetlands with salinity below 20 ppt will be estimated using output from the BBCW TABS-MDS MDS model developed specifically for this project. The available acres of tidal wetlands for five different areas will be estimated using GIS coverage as well as the TABS-MDS model mesh. The regions are Shoal Point (Deering), Cutler North, Cutler South, Homestead North, Homestead South, and Card Point. The available tidal acreage for each of these zones is shown below:

Available Tidal Wetlands	
Shoal Point	**151**
Cutler North	**842**
Cutler South	**1,599**
Homestead North	**1,462**
Homestead South	**1,000**
Card Point	**15,981**
Total Acres	**21,036**

The estimated tidal wetland salinity benefit will be calculated by determining the average daily Area (acres) where salinity was less than 20 ppt during the critical June through January. Keeping salinities below 20 ppt during this time period is important for hatchling and juvenile crocodiles, but it is also important to keep salinities near 20 ppt during the dry season for oysters, crocs, and other critters. . The salinity output from the TABS-MDS model runs will be post-processed by identifying the model elements where the average daily salinity is less than < = 20 ppt, adding the area of those model elements to compute the daily acreage of tidal wetlands with salinity meeting the criteria. The average daily acreage of tidal wetlands meeting the criteria is calculated based on the daily results. The percent of target achieved is then calculated by dividing the average daily acreage by the total available acreage. The original modeling and evaluation plan was to have TABS-MDS results available for three versions of each alternative (average, wet, and dry conditions) and then take an average of these results. However, given time constraints it will not be possible to run several of the alternatives using

TABS-MDS under average and dry conditions. With this constraint, the "average" tidal wetland benefits for Alt M, and ALT Q are estimated based upon the results of the wet conditions model runs or in the case of YB based upon the most similar alternative (Alt Q). Though this method of estimation is not as desirable as having modeling results, it presents little risk of skewing the overall evaluation of the alternatives since the metric is less than 15% of the overall score and the difference between alternatives is not great.

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Evaluation Criterion Number and Name (PM)
Performance Measure 3. Reduce direct canal discharge.
Criterion Target and Description
This performance measure evaluates the project's ability to reduce point source discharges from major conveyance canals that dissect the project area. The target is to completely eliminate flow through the coastal structures (S123, S21, S21A, and S20F) by diverting all available water into the coastal wetlands. It directly addresses Project Object 2: Redistribute freshwater flow to minimize point source discharges to improve freshwater and estuarine habitat. It also addresses Project Objectives 1 (Restore nearshore and tidal wetland salinity regimes to reestablish productive nursery habitat along the shoreline), 3 (Restore and improve quantity, quality, timing, and distribution of freshwater to the bay, including Biscayne National Park), and 4 (Preserve and restore spatial extent of natural coastal glades habitat) by increasing the quantity, and improving the distribution, of freshwater to restore nearshore, tidal wetland, and coastal glades habitats. The performance measure addresses a key driver (water management) and important stressors (structure operations and freshwater flow volume, duration, and distribution) in both the Biscayne Bay and Everglades Mangrove Estuaries CEMs (Browder et al. 2005, Davis et al. 2005). These drivers and stressors affect coastal salinity gradients and hydroperiods, as well as, physical impacts (structure operation and depth alteration) that influence the many ecological attributes of these systems (fish, birds, macro invertebrates, benthic communities, etc.). Variations of this performance measure is applied to the spatial extent of all three ecological zones (nearshore, saltwater wetlands, and freshwater wetlands) since the ability to divert water is a key element of the BBCW Project restoration efforts.
Justification and Current Condition
Channelized flow of freshwater across the watershed and point source discharges at canal mouths has been responsible for a variety of negative ecological impacts to the coastal wetlands and nearshore areas of western Biscayne Bay. These impacts are significant in the Biscayne Bay Coastal Wetlands project area as 4 major conveyance canals (C-100, C-1, C-102, and C-103) discharge runoff to the bay there. Point source discharges are especially damaging because they result in large and highly ephemeral fluctuations in salinity. In southern Biscayne Bay, the salinity of marine waters (30-35 ppt) downstream of coastal canal structures frequently drops 20 ppt within 60 minutes and returns almost as rapidly (Wang et al. 1988). As currently operated, these dramatic salinity fluctuations can occur several times per day during the wet season (May – October). These extreme and rapid shifts in salinity create an extremely unstable estuarine environment that greatly inhibits productivity. The unnatural salinity fluctuation can severely impact or kill attached or rooted plants (such as seagrasses) and animals (such as sponges and corals), as well as more mobile organisms like finfishes (Montague and Ley, 1993; Irlandi et al., 1997; Serafy et al., 1997). Thorhaug et al. (1976) observed that species diversity and numbers of fish, mollusks, crustaceans, and algae decreased in the vicinity of a canal in Biscayne Bay. The problem can be alleviated by shifting canal discharge to a more widespread overland flow which results in more gradual salinity fluctuations that are more conducive to a biologically healthy bay ecosystem (Alleman et al. 1995). This performance measure evaluates the capability of each project alternative to reduce point source canal discharges.

Degradation of estuarine conditions has also resulted from severely reduced overland flow due to channelization. Once healthy oyster bars that existed in and off the mouths of historic creeks (Meeder et al. 2001) and populations of other important estuarine species that were once abundant in the area, such as American crocodiles, red drum, and spotted sea trout have been reduced (Kushlan and Mazzotti, 1989; Serafy et al., 1996). Redirecting water from conveyance canals across broad expanses of tidal wetlands to nearshore areas will help reverse these effects through reestablishment of appropriate salinity regimes.

Redirecting water from conveyance canals into freshwater wetlands should also improve hydropatterns (hydroperiods and water levels) in freshwater wetlands in the project area (Browder et al. 2005). Channelized flow has severely reduced sheetflow, lowered water levels and reduced hydroperiods across these wetlands resulting in displacement of gramninoid marshes by shrubby/forested wetlands. Modified hydropatterns have also allowed infestation by invasive non-native vegetation. Of particular concern is the establishment of Brazilian pepper (*Schinus terebinthifolius*) and Australian pine (*Casuarina* spp.) in the wetlands. Redirecting the canal flows into these marshes should improve hydropatterns and help restore the appropriate marsh vegetation. This performance measure evaluates each project alternative's capability to redirect canal flow into the adjacent wetlands.

Evaluation Method/Approach

CBEEM Performance Metrics:

Nearshore, A.1. Potential Percent of Surface Water Diverted from Canal
Saltwater Wetland, A.1. Potential Percent of Surface Water Diverted to Saltwater Wetlands
Freshwater Wetland, A.1. Potential Percent of Surface Water Diverted to Freshwater Wetlands

The reduced canal discharge metric for the nearshore ecological zone is calculated as a percent of the available water that is diverted by project features into freshwater or saltwater wetland areas. The logic of this performance measure is that harmful salinity swings at the mouths of the canals will be moderated by the diversion of canal discharge into both freshwater and saltwater wetland areas. It is calculated using the total capacity of pumps in each basin that divert water from the canals and the time series of daily coastal structure discharges provided either by the historic measurement record (DBHDRO database) or by simulation results from the South Florida Water Management Model 2x2 (SFWMM). The four coastal structures of interest are: S-123 on the C-100 canal, S-21 on the C-1 canal, S-21A on the C-102 canal, and S-20F on the C-103 canal. The freshwater and saltwater wetland and total diversion pump capacities for each of the alternative are shown in **Table 3-1**. To calculate the volume of water that could be diverted from the canal on a given day, the following logic statement was used in the calculation spreadsheet:

If the Daily Structure flow (Q) is less than or equal to total pump capacity (P_{TPC}), then the diversion quantity is equal to Q. If Q is greater than P_{TPC}, then a volume equal to P_{TPC} is diverted and the remainder is released to tide. Where P_{TPC} is the total pump capacity for the basin. As an Excel function this equation is written as:

=if(Q<=Tot_Pump_Cap, Q, Tot_Pump_Cap).

The reduced canal discharge metric as applied to the freshwater wetlands is calculated as a percent of the total water available that is diverted by project features into freshwater wetland areas. It is calculated using the capacity of pumps that divert water into freshwater wetland areas and the time series of daily coastal structure discharges either historic flows or simulated flows. The four coastal structures of interest are: S-123 on the C-100 canal, S-21 on the C-1 canal, S-21A on the C-102 canal, and S-20F on the C-103 canal. The pump capacities in this table are assigned to receiving wetlands, either saltwater or freshwater. For these benefit estimates, water is proportionately divided between the freshwater and saltwater wetlands based upon the relative size of the pumps dedicated to each habitat type. To calculate the volume of water that could be diverted from the canal into freshwater wetlands on a given day, the following logic statement is used in the calculation spreadsheet:

If the Daily Structure flow (Q) is less than or equal to freshwater pump size (P_{FW}), then freshwater diversion quantity is equal to $Q * P_{FW} / P_{TPC}$; If Q is greater than P_{TPC}, then a volume equal to P_{FW} is diverted and the remainder is released to tide or pumped by the P_{SW}: Where P_{FW} is pump capacity for freshwater wetlands, P_{SW} is the pump capacity for saltwater wetlands and P_{TPC} is the total diversion pump capacity for the basin. As an Excel function this equation is written as:

*=if(Q<=Tot_Pump_Cap, Q*FW_Pump_Cap/Tot_Pump_Cap, FW_Pump_Cap).*

The percent of canal discharge diverted to saltwater wetlands is also calculated using the capacity of pumps that divert water into saltwater wetland areas and the daily time series of coastal structure discharges. The same calculation logic is used for the saltwater wetland benefits associated with canal diversion.

For all three of the canal flow diversion performance metrics, the reported value is the percent of available flow that is diverted to either the saltwater and freshwater wetland ecozones or in the case of the nearshore ecozone, the total percent of all diverted flow.

Table 3-1.
Diversion Pump Capacities for Freshwater and Saltwater Wetland Rehydration.

TOTAL PUMP CAPACITY (cfs)					
Alternative	**C-100**	**C-1**	**C-102**	**C-103**	**REUSE**
ALT O	**200**	**400**	**550**	**520**	**200**
ALT Q	**170**	**400**	**400**	**500**	**200**
ALT M	**20**	**620**	**0**	**50**	**200**
ALT YB	**50**	**200**	**200**	**250**	**200**
ALT O, PHASE 1	**100**	**400**	**150**	**120**	**0**
FRESHWATER WETLAND DIVERSION PUMP CAPACITY (cfs)					
ALT O	**50**	**50**	**250**	**470**	**150**
ALT Q	**85**	**50**	**400**	**500**	**150**
ALT M	**10**	**50**	**0**	**0**	**150**
ALT YB	**50**	**50**	**200**	**250**	**150**
ALT O, PHASE 1	**50**	**0**	**50**	**100**	**0**

SALTWATER WETLAND DIVERSION PUMP CAPACITY (cfs)					
ALT O	150	350	300	50	50
ALT Q	85	350	0	0	50
ALT M	10	570	0	50	50
ALT YB	0	150	0	0	50
ALT O, PHASE 1	50	400	100	20	0

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Evaluation Criterion Number and Name (PM)
Performance Measure 4. Potential freshwater wetland rehydration.
Criterion Target and Description
This performance measure quantifies the spatial extent of freshwater wetlands that can potentially be rehydrated by each alternative. The target is to fully restore the freshwater wetlands within the freshwater wetland ecological zone of the project area that generally includes the area west of L-31E between C-102 and Florida City Canal, and it includes roughly the northern third of the Model Lands east of Card Sound Road. The specific area for which the analysis was performed is defined by the freshwater wetland area anticipated to be affected by Alternative Q, including the Lennar Flow-way (~9600 acres). It is directly tied to Project Objective 4: Preserve and restore spatial extent of natural coastal glades habitat. It also addresses Project Objective 3 by improving timing and distribution of freshwater flow to the bay. The metric is applied only to the freshwater wetland zone.
Justification and Current Condition
This performance measure assumes that the greater the potential to hydrate freshwater wetlands the greater the potential for achieving the following ecological benefits: (1) increased spatial restoration of coastal glades and freshwater marsh habitat, (2) increased spatial restoration of sheetflow from freshwater habitats to the bay, (3) improved timing and distribution of freshwater flow to the bay. This performance measure is only applied to the spatial area of the freshwater wetlands. Historically, most of the area east of the coastal ridge within the project area was freshwater marl prairie with some deeper hydroperiod habitat downstream of the transverse glades (Davis, 1943). Historic reports for the area (Egler, 1952) indicate that the vegetation was dominated by a broad band of freshwater graminoid marsh that graded landward into pinelands and seaward into brackish graminoid marsh and mangrove swamps. The freshwater marsh was dominated by sawgrass but mixed with a variety of other graminoids at higher elevations (shorter hydroperiods) and with spike rush at lower elevations (longer hydroperiods). Current vegetation patterns include replacement of extensive pinelands and the shortest hydroperiod wetlands with urban and agricultural development, encroachment of woody species into higher elevation (shorter hydroperiod) wetlands, landward encroachment of brackish-tolerant species such as buttonwood (*Conocarpus erectus*) and red mangrove (*Rhizophora mangle*), and landward expansion of the white zone (Ross et al., 1996, Meeder et al., 1996). The importance of freshwater wetlands in the coastal regions of Southern Florida has been documented. Freshwater wetlands are linked to: 1) increased wildlife diversity and abundance; 2) improved water quality; 3) increased storage capacity; 4) groundwater and aquifer recharge; 5) enhanced downstream functions of the natural environment; and 6) improved human interests. Thus, reversing the historic trend of freshwater wetland losses and achieving additional gains would be a significant achievement. This performance measure evaluates the potential freshwater wetland spatial area that can be restored if sufficient water is available to achieve required hydropatterns.

Freshwater rehydration will result in additional benefits associated with the attenuation of high flows that result in negative impacts to the nearshore environment. Also freshwater rehydration will provide the saltwater wetlands a more reliable supply of water through diverting surface water flows into the groundwater system. These benefits are accounted for separately in nearshore and saltwater performance measures.

Evaluation Method/Approach

CBEEM Performance Metric:

Freshwater, B.1. Wetlands With Sufficient Water

There are several methods of estimating the ecological benefits of wetland rehydration. In other South Florida restoration projects, wetland rehydration benefits are typically estimated using hydrologic models that predict the change in the number of days in which a given area has a groundwater stage within a range suitable for wetland species. This method was used in the original CERP Restudy modeling done with the SFWMM2x2. However given the extremely high transmissivity of the surficial Bicayne Bay Aquifer in the study area, it is not a trivial undertaking to create a sub-regional groundwater model that is capable of accurately reflecting project related hydroperiod changes. In this part of Florida, groundwater simulation model results show that applied water disappears quickly into the groundwater flow system without changing the groundwater stage histogram significantly. With these modeling obstacles in mind, the team developed the simplified method for estimating wetland benefits.

The simplified method used to account for wetland benefits associated with wet but not saturated soils relies upon the assumption that an acre of land is sufficiently hydrated to support wetland vegetation if the quantity of surface water applied on a given day at least equals the expected seepage losses to the groundwater system. In other words, wetland lift is proportional to the volume of water applied and inversely proportional to the rate of groundwater seepage. This method does not consider groundwater stage to determine whether wetland acreage is inundated; however, it is reasonable to apply in this case since excessive groundwater seepage rates in southern Miami-Dade County limit the duration in which water ponds in wetland restoration projects. The equation used here to estimate wetland lift is:

$L = Q / (S*CF)$

Where:

L = Wetland lift (acres of lift)
Q = Flow diverted into wetland (cfs)
S = Seepage rate (ft/hr)
CF = Conversion factor (86400 sec/day/43560 ft^2/acre)

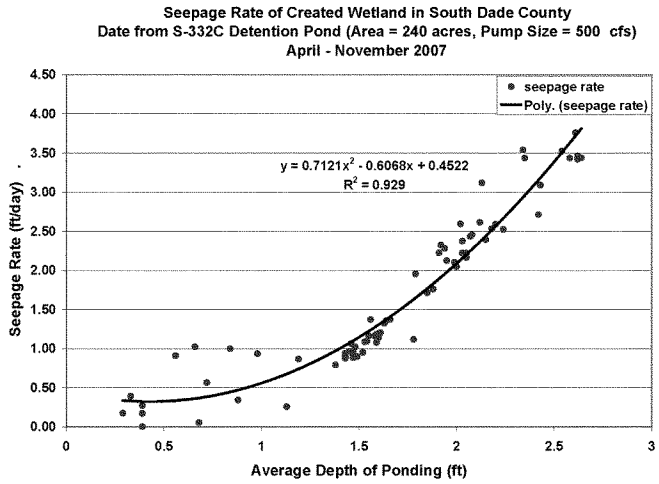
For example, a volume of water equal to 100 cfs diverted into a wetland where seepage losses are equal to 0.5 ft per hour, will generate net wetland lift of 165 acres ((100 ft^3/sec)/(0.5 ft/hr*24 hours/day*86400 seconds/day/43560 ft^2/acre) = 165 acres).

The most relevant source of data for the seepage rate of southern Miami-Dade County constructed wetlands comes from the S-332B, S-332C, and S-332D detention areas constructed along L-31N and

L-31W canal/levees in western Dade County. The soils and hydrogeologic properties of the soils at these constructed wetlands are very similar to those in the BBCW Project area. **Figure 4-1** shows seepage as a function of depth of inundation at S-322C pond. Since the BBCW constructed wetlands will be primarily built to enhance wetland function and not as flood detention areas such as at S-332C, the range of inundation should be approximately 0.5 to 1.5 ft above land surface. At these depths of inundation, the estimated seepage rate is between 0.3 to 1.2 feet per day. The seepage rates used for the wetland lift calculations for the BBCW Project are 0.6 ft/day for the wet season and 1.2 ft/day for the dry season. These seepage rates were selected based on the desire to maintain the depth of inundation between 1.0 and 1.5 ft. The dry season seepage rate is conservatively set to twice the wet season rate because it is likely that the groundwater stage will be lower in the dry season and thus seepage losses would be higher.

To calculate the daily number of freshwater wetland functional lift acres, the quantity of water diverted within each basin for each alternative is computed using the pump diversion capacity. The daily diverted volume is multiplied by the seasonal seepage constant (acres/cfs) which is calculated based on reasonable seepage rates from the S-332C pond. The average freshwater wetland functional lift is calculated by taking an average of the daily functional lift over the period of record. The total for each alternative is computed by adding together the lift from each basin. The estimated lift from reuse water for each alternative is calculated by assuming a constant daily volume of water applied to the freshwater wetlands and multiplying it by the seasonal seepage constant to calculated rehydrated acreage.

Figure 4-1



In the C-1 and C-100 basins, the freshwater diversion pump capacity for all of the alternatives exceeds the available freshwater wetland acres when the seepage rate is estimated to be 0.6 ft/day. For the C-102 and C-103 basins, the available wetland acreage is not all rehydrated even at peak diversion rates for any of the alternatives. To ensure that the acreage estimates for each basin cannot exceed the available acreage regardless of the seepage rate assumed, all of the wetland rehydration acreage equations are set up to check to see if the available acreage is exceeded. The available freshwater acreages are specified by alternative and basin on input page of the spreadsheet.

To compute the percentage of lift achieved, the average freshwater wetland rehydrated acreagefor each alternative is divided by the available lift which is computed as the total number of acres available times one minus the existing wetland function (Available FW Lift = Total FW Acres * (1 – Functional Value). Estimates of the existing wetland function within the study area are shown in Table 4-1. (Pitts, 2008).

It is important to note that this simple method of estimating wetland lift provides a means of discriminating between alternatives using relative comparisons. It is not meant as a method of computing absolute wetland lift as this would require a broader investigation of site conditions as well as final design conditions.

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Evaluation Criterion Number and Name (PM)
Performance Measure 5. Reduce nitrogen concentrations.
Criterion Target and Description
Water quality (in terms of nitrogen reduction) is evaluated based on the spatial extent of stormwater treatment areas (STAs) and wetlands, and on the volume of water diverted into those features by each alternative. This performance measure addresses Project Objective 3 by quantifying the improvement to the quality of water (in terms of nitrogen removal) entering Biscayne Bay and Biscayne National Park. It also addresses a key driver (water management) and important stressors (freshwater flow and altered nutrient inputs) in the Biscayne Bay and Everglades Mangrove Estuaries CEMs (Browder et al. 2005, Davis et al. 2005). These, in turn, influence coastal nutrient dynamics and water quality that affect numerous ecological attributes in these systems, including estuarine fish, wading birds, benthic flora and fauna, etc. It is applied only to the nearshore zone.
Justification and Current Condition
Open waters of south Biscayne Bay are highly oligotrophic (*i.e.*, the water has very low concentrations of dissolved organic and inorganic nutrients, including nitrogen species). Flora and fauna characteristic of the bay rely on the oligotrophic conditions for their health and well-being. Corals, which are found scattered across the hardbottom habitat of central Biscayne Bay, are particularly sensitive to nutrient concentrations, having evolved in nutrient-poor conditions. Seagrasses common in the nearshore zone of the project area also respond to changes in nutrient concentrations. Excess nutrients in this system can stimulate the growth of phytoplankton and epiphyte populations that can prevent sufficient light penetration through the water column to sustain benthic communities, such as seagrass, corals, and sponges. Dissolved nitrogen concentrations (particularly nitrates) are much higher in canal waters than the receiving waters of Biscayne Bay. This performance measure quantifies the reduction in nitrates in water entering the bay as a result of passing across wetlands prior to their entry to the bay. Wetlands are known to reduce nitrogen inflow concentrations. However, the reduction capacity is dependent on several factors, including ratio of organic to inorganic nitrogen, dissolved oxygen levels, alkalinity, availability of carbon, wetland pH, hydraulic residence times, and total nitrogen load. Kadlec and Knight (1996) list first-order, area-based rate constants for nitrogen removal for several wetlands. The values range from a low of 0.56 meters/year (m/yr) to 66.36 m/yr, with a mean of 15.4 m/yr, and are considered to be temperature dependent. Presently, untreated water enters the bay from conveyance canals. Alleman et al. (1995) noted that increases in nutrient concentrations in Biscayne Bay account for most of the negative water quality trends in the bay. Management measures that remove nutrients from the water prior to its entry to the bay can reverse these trends. All project alternatives include measures to reroute nutrient laden canal water through STAs and wetlands, which should reduce concentrations or nutrient loads reaching the

bay. The primary difference in the alternatives is the volume of water that will be rerouted and the spatial extent of wetlands onto which the water will be diverted. This performance measure evaluates the extent to which each alternative can remove nitrogen from water redirected into STAs and coastal wetlands, prior to its entry to the bay.

Evaluation Method/Approach

CBEEM Performance Metric:

Nearshore, B.1. Nitrate Load Reduction

The BBCW Project will reduce nitrate loading to the bay as a result of the diversion of surface water into freshwater and saltwater wetlands. This performance measure compares the ability of a project to achieve the desired nitrate load target. The existing nitrate load is estimated using the most recent average nitrate concentrations measured in the four canals and the total flow that passes through the coastal structures. The target nitrate load for the four coastal structures (S-123, S-21, S-21A, and S-20F) is estimated using a target nitrate concentration and multiplying this by the average annual flow available at the four structures. The estimated amount of nitrate removed by the project alternatives is based upon the amount of water diverted to the wetlands, the effective treatment area of the wetlands, and the concentration of nitrate once the water has passed through the wetland. Present and future nitrate concentrations in the four canals were taken from a paper by Graves and Pitts (2004). The future nitrate concentrations for the canals are estimated by Graves and Pitts using projections of the change in land use over the next 45 years. The target load condition is estimated using the existing flow conditions and the target nitrate concentration of 0.05 mg/L as determined by Graves and Pitts for the Biscayne Bay Coastal Wetland Project.

The reduction in nitrate load to the bay was estimated using the first-order area-based "K-C*" model developed by Kadlec and Knight (1996). This equation is:

$$C_o = C^* + (C_i - C^*)\exp(-kA/Q),$$

Where:

C_o is the concentration of nitrate in the wetland effluent (mg/L)
C^* is the lowest achievable nitrate concentration in a wetland (mg/L)
C_i is the inflow concentration of nitrate for flow entering the wetland (mg/L)
K is the rate constant (M/yr)
A is the area of the wetland (M^2)
Q is the volume of water applied (M^3/yr)

For this study, C* was assumed to be 0.0075 mg/L and K was assumed to be 50 M/yr. This equation was used to estimate the future wetland effluent concentration for each basin based upon the amount of diverted flow and the maximum upper size of the wetland area. The K-C* model provides the long-term average effluent concentration for treatment wetlands. Though the K-C* equation may not be the best design equation for sizing southern Miami-Dade County wetlands where seepage is large relative to inflow, it can be used here since as a comparative tool with limited risk of type 1 or type 2 error.

The amount of water diverted by each alternative was estimated using the total available pump capacity regardless of whether the water was diverted into freshwater or saltwater wetlands. The wetland acreage available in each basin was estimated based upon the design STA size. Where no defined STA size is specified, the treatment acreage was estimated based on pump size, feature location, and site conditions. Since each alternative diverted a different quantity of water into the wetlands, and the alternatives incorporated different sizes for the target wetlands, the effluent concentrations estimated for each basin are unique to a given alternative. The future land use and nitrate concentrations for each basin are shown in **Table 5-1**. The treatment acreage estimated for each alternative is shown in **Table 5-2**. The effectiveness of each alternative in reducing nitrate discharges to the bay iss calculated as a percent of the target nitrate load reduction achieved. The existing condition nitrate load is used as the baseline.

Table 1
Existing and Future Land Use and Resulting Average Nitrate Concentrations

	C-100		C-1		c-102		C-103	
	Present	**Future**	**Present**	**Future**	**Present**	**Future**	**Present**	**Future**
Basin Land Use								
Ag	2%	2%	36%	7%	62%	25%	51%	20%
Urban	96%	96%	51%	80%	31%	68%	41%	72%
Other	3%	3%	13%	13%	7%	7%	8%	8%
Nitrate Concentration (mg/L)	**0.12**	**0.12**	**1.5**	**0.33**	**2.59**	**1.06**	**2.13**	**0.88**

Table 2
Wetland Treatment Acres and Estimated Effluent Nitrate Concentrations

for D13R and DBHYDRO Flow Records

Wetland Acreage Estimates for Nitrate Reduction					
Freshwater Wetland Application Area (acres)					
ALTERNATIVE	**C-100**	**C-1**	**C-102**	**C-103**	**Total**
Alt O	142	207	1000	3000	4349
Alt Q	142	207	1000	3000	4349
Alt M	142	207	0	0	349
Alt YB	142	277	2250	2000	4669
Alt O, Phase I	142	207	500	480	1329
Saltwater Wetland Application Area (acres)					
ALTERNATIVE	**C-100**	**C-1**	**C-102**	**C-103**	**Total**
Alt O	150	500	500	500	1650
Alt Q	150	500	0	0	650
Alt M	150	500	0	0	650
Alt YB	150	500	0	0	650
Alt O, Phase I	150	500	500	500	1650
Total Wetland Application Area (acres)					
ALTERNATIVE	**C-100**	**C-1**	**C-102**	**C-103**	**Total**
Alt O	292	707	1500	3500	5999
Alt Q	292	707	1000	3000	4999
Alt M	292	707	0	0	999
Alt YB	292	777	2250	2000	5319
Alt O, Phase I	292	707	1000	980	2979

Source/Contact Information

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Comments/Notes

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Evaluation Criterion Number and Name (PM)
Performance Measure 6: Reduce total phosphorous loading to Biscayne Bay.
Criterion Target and Description
Not to exceed monthly average of 5μg/L in open waters and with an average flow-weighted mean inflow concentration of about 6 ppb for Southern Glades, Model Lands, and Coastal Basins.
Justification and Current Condition
Open waters of south Biscayne Bay are oligotrophic, as are other natural systems of south Florida. Past studies have documented that phosphate is generally the limiting nutrient in Biscayne Bay. However, some canals water that currently discharges into south Biscayne Bay and groundwater have higher concentrations of nutrients. Alterations in quality and quantity of water released into Biscayne Bay, Florida Bay, Barnes Sound, and Manatee as a result of the modifications contemplated in the C-111 North Spreader and Biscayne Bay Coastal Wetlands projects could affect the concentration or loads of phosphate reaching Biscayne Bay surface waters in a beneficial or adverse fashion. Rerouting of nutrient laden canal water through wetlands or treatment and detention areas could reduce concentrations or nutrient loads reaching Biscayne Bay. Increased phosphate, or phosphate together with nitrogen inputs, may result in undesirable algal blooms in the water column or as epiphytes on submerged vegetation, and consequently affect seagrass distribution or productivity. Long-term Phosphorus concentration limits established by the Everglades Forever Act represent the concentration levels delivered during the OFW baseline period of March 1, 1978 too March 1, 1979, adjusted for observed variations The long-term concentration limit for Taylor Slough (S-332 and S-175) and the Coastal basin (S-18C) is 11 ppb. Compliance with these concentration limits is expected to provide a long-term average flow- weighted mean inflow concentration of approximately 6 ppb for the Taylor Slough and Coastal Basins. These limits are targets set to prevent an imbalance of Everglades flora and fauna.
Evaluation Method/Approach
<u>CBEEM Performance Metric:</u> B.1. Peak Phosphorus Load Reduction The average phosphorus concentrations in the four canals within the study are near 6 ppb. Given such low average concentrations, it is not reasonable to expect that water diverted into and discharged from rehydrated wetlands would be at a lower concentration. However, the discharge of peak phosphorus concentrations would be attenuated by diverting flow into wetlands. This performance metric incorporates flow based concentration estimation equations developed by the USGS (Lietz, 1996) and the pump size to estimate the fraction of peak concentration load that is diverted from the canals. The following equations were taken from Lietz: S-20F: $P = 5.08X10^{-4} + 2.43X10^{-5} X Q$, R-Squared = 0.99 S-21: $P = -7.38X10^{-4} + 4.27X10^{-8} X Q^2$, R-Squared = 0.88 S-21A: $Ln(P) = 4.72 + 1.71X Ln(Q)$, R-Squared = 0.23 S-123: $P = 6.7X10^{-4} + 5.34X10^{-5} X Q$, R-Squared = 0.99

Using the daily flow record, the daily load and average phosphorus concentration will be calculated for each canal. The daily excess phosphorus concentration will be estimated by subtracting 6 ppb from the daily average phosphorus concentration. The excess phosphorus concentration is set to zero for those periods when the average discharge phosphorus concentration is calculated to be less than 6 ppb. The overall peak phosphorus load reduction is then estimated as the percentage of excess phosphorus load diverted relative to the total excess phosphorus load.
Source/Contact Information
Susan Markley Miami-Dade DERM Susan Teel, teel.susan@epa.gov Biscayne Bay Conceptual Model Chapter 62-602 F.A.C. Chapter 24 of the Code of Miami-Dade County 1991 Settlement Agreement United States v. SFWMD, et al., Fla. Stat. § 373.4592 (1994) Everglades improvement and management Lietz, Arthur C., 1996, Methodology for the determination of nutrient loads to East Coast canals: St. Petersburg, FL, U.S. Geological Survey, Factsheet FS-129-96, *Available online at* http://sofia.usgs.gov/publications/fs/129-96/
Comments

Annex A1-188

Evaluation Criterion Number and Name
Performance measure 7. Reduce non-native vegetation.
Criterion Target and Description
This performance measures evaluates the extent to which each project alternative can eliminate non-native vegetation from the project area. The metric addresses Project Objective 4 (Preserve and restore spatial extent of natural coastal glades habitat) by removing non-native vegetation from the coastal glades. It is applied to the freshwater wetlands zone only. The target is the total number of acres of non-native vegetation within the preliminary BBCW Project boundary, which was determined to be at 9763 acres. None of the alternatives are anticipated to affect lands outside the preliminary project boundary. Acres of non-native vegetation anticipated to be removed by each alternative were normalized against the target. Note that any vegetation class that included non-natives as part of the mix (*e.g.*, white mangrove/Brazilian pepper mix) was included as non-native vegetation coverage.
Justification and Current Condition
The Florida Exotic Pest Plant Council lists 62 species as invading and disturbing the native plant communities in the State, and an additional 57 species as showing a potential to do the same (Florida Exotic Pest Plant Council 1997). Non-indigenous plants can disrupt native biotic communities in several ways, including: 1) changes in community structure and composition, 2) alteration of ecological processes, and 3) hybridization between exotic species and their related native ones, resulting in potentially new pests (Austin 1978, Schmitz et al. 1997, Simberloff 1997). In addition, exotics can affect the quality of human life in the State by impacting water quality and use, diminishing property values, colonizing agricultural lands, increasing fire risk, and producing less aesthetically-pleasing views (Schmitz et al. 1997). In southern Florida, altered hydrology from drainage and disturbance from development have increased opportunities for non-native plants to become established and thrive (McPherson and Halley 1996). Modification of the State's waterways for flood control, water supplies, irrigation, and recreation has further facilitated the spread of some of these species. Non-native vegetation affects both wetland and upland habitats in South Florida. Schmitz et al. 1997 estimate that nearly 2.5 million acres of habitat in southern Florida are covered by the five most widespread non-native species, including in order of significance, Brazilian pepper (*Schinus terebinthifolius*), paperbark tea tree (*Melaleuca quinquenervia*), Australian pine (*Casuarina* spp.), hydrilla (*Hydrilla verticillata*), and water hyacinth (*Eichhornia crassipes*). Presently, significant portions of the BBCW Project area are covered with pure or mixed stands of invasive, non-native vegetation (EPA 1994, M.Ross personal communication). The two non-native species most problematic in the project area are Brazilian pepper and Australian pine. These species typically colonize areas that have been disturbed, usually through direct removal of native vegetation and soil disturbance, or through some form of hydrologic change that is typically anthropogenic in origin. Brazilian pepper is the most common non-indigenous plant in the project area, with an abundance of mature stands occurring almost exclusively in freshwater habitats. These stands often consist almost entirely of Brazilian pepper, with a scattering of willows and an occasional strangler fig or other hammock tree species (EPA 1994). Many stands have an understory consisting primarily of leather fern (*Acrostichum danaeifolium*). Australian pine is the next most common non-native species. It occurs

most commonly along road banks, levees, and berms associated with mosquito ditching, and forms patches or rows that are interspersed with the native dominated community. It may or may not have an understory consisting of white mangrove (*Laguncularia racemosa*), gulf cordgrass (*Spartina spartinae*), or a mixed mangrove community. Other non-native species of note in the project area include the paperbark tea tree, shoebutton Ardisia (*Ardisia elliptica*), and more recently the Old World climbing fern (*Lygodium microphyllum*).

Initial manual eradication of existing non-native vegetation will likely be required to obtain the desired reduction in non-native coverage. Reduction in areal extent of artificial topographic highs, such as canal levees and drainage ditch berms, should help alleviate recolonization of non-natives. Application of additional land management techniques, such as prescribed burns, will likely be required to prevent recolonization and spread of non-natives.

Evaluation Method/Approach

The metric also assumes that all non-native vegetation within the footprint of a given alternative will be controlled or eliminated by changes in hydrology resulting from the project and other means, if necessary (*e.g.*, mechanical and/or chemical removal). Using the vegetation map created by the U.S. Fish and Wildlife Service in 2005 (USFWS 2005) and the 1999 Florida Land Use, Cover and Forms Classification System (FDOT 1999) map, the total area of non-native vegetation lying within the projected footprint of each alternative was determined. Both maps were required because the USFWS map (the most accurate and current) did not cover all of the project area. The FLUCCS map was used in the region that the USFWS map did not cover, which was most of the Model Lands area.

For Alternatives M and O, it was assumed that increased hydration would occur in the wetlands to the west of L-31E from operational changes that would raise groundwater in L-31E, so those wetlands were included in the calculations. For Alternatives O and Q, it was assumed that increased hydration would occur in the wetlands to the west of the spreader canal in the Homestead wetlands (between C-1 and Florida City Canal) operational changes that would raise groundwater in the freshwater wetlands west of L-31E, so those wetlands west of the spreaders were included in the calculations. No exotics removal was credited to the Future Without (FWO) project condition because urban development that would remove exotics would also remove wetlands. It was assumed that all freshwater wetlands west of L-31E were developed in the FWO condition. Exotics removed by the 200-acre Lennar STA/Flow-way were credited to Alternatives M, O, and Q.

Wetland vegetation monitoring via aerial photo-interpretation will be able to determine the extent to which non-native vegetation has been eliminated by comparing future aerial photos with existing vegetation maps of the project area.

Source/Contact Information

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Comments/Notes

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Simberloff, D. 1997. The biology of invasions. Pages 3-17 in Simberloff, D., D.C. Schmitz, and T.C. Brown (Eds.), Strangers in paradise: Impacts and management of nonindigenous species in Florida. Island Press, Washington, D.C.
U.S. Environmental Protection Agency (EPA). 1994. Technical Summary Document for the Advanced Identification of Possible Future Disposal Sites and Areas Generally Unsuitable for Disposal of Dredged or Fill Material in Wetlands Adjacent to Southwest Biscayne Bay, Dade County, Florida. EPA Report No. EPA 904/R-94/007.

APPENDIX B

CEERD-HC-ES 20 Dec 2003

MEMORANDUM FOR Commander, U. S. Army Engineer District, Jacksonville,
ATTN: CESAJ-EN-HI (Mr. Mitch Granat), (Prudential Building)
701 San Marco Blvd., Jacksonville, FL 32207

SUBJECT: Report on the results of preliminary scenario runs for the Biscayne Bay Coastal Wetlands project. These runs are intended to yield rough estimates of the relationship between freshwater discharge distribution and volume, and the near-shore salinity regime of Biscayne Bay in the Coastal Wetlands study area.

1. Enclosed please find the Memorandum for Record that consists of a report detailing the findings of the preliminary scenario runs for the Biscayne Bay Coastal Wetlands project.

2. If you have questions concerning the information provided, please contact Mr. Gary Brown at 601-634-4417.

Encl

THOMAS RICHARDSON
Director
Coastal and Hydraulics Laboratory

Background

1. The purpose of the preliminary scenario runs is to ascertain some general information about the relationships between freshwater inflows to Biscayne Bay, and the near-shore salinity regime in the Biscayne Bay Coastal Wetlands project area (see Figure 1). These preliminary scenario runs were done using an existing hydrodynamic/salinity model and model mesh that had been developed for a previous study of the entire Bay (see Brown, et. al. 2003). Although this existing mesh is not appropriate for use in the final scenario analyses for the Biscayne Bay Coastal Wetlands project, it can be used to ascertain some general information about the system, which in turn could be used as guidance for selecting final design alternatives to be simulated in the final scenario runs. These final scenario runs will be run with a modified model and model mesh that are appropriate for use in this study.

2. The computer code used in this study is the TABS-MDS-MDS finite element numerical model. It is an ERDC modified version of the RMA10 numerical model (King, 1988). It has been used extensively in previous studies of multiple estuaries.

Preliminary Scenario Runs Boundary Conditions and Specifications

A. Simulation period

3. The model simulation period extends from August, 1997- July, 1998. July, 1997 is used as spin-up, i.e. the model is allowed to run for this month so that the hydrodynamics and salinity can circulate long enough for the system to achieve dynamic equilibrium.

B. Boundary Conditions

4. The model boundary conditions and the sources of the boundary condition data are given as follows:

- Flows at 16 coastal structures: taken from the South Florida Water Management District (SFWMD) DBHYDRO database, recently updated by Dr. Mahatel Ansar to account for the influence of the tide on the discharge equations at the structures.
- Tide: taken from Coastal and Hydraulics Laboratory (CHL)/Biscayne National Park (BNP) data gathered at CTD 9 (located in the Safety Valve). The data was missing for Jul 98, so data taken from the NOAA gage at Virginia Key was used to replace this missing data.
- Ocean Salinity: taken from measured monthly averaged ocean salinity at Alina's Reef.
- Wind: Taken from CHL/BNP data gathered at Convoy Point. This was then corrected for wind gage elevation and for shoreline effects on the wind.
- Rainfall: taken from CHL/BNP data gathered at Convoy Point. The data was missing for July 98, so data taken by the SFWMD at S-21 was used to replace this missing data.
- Evaporation: taken from SFWMD data collected at Hialeah, Florida.
- Groundwater Inflow: estimated values supplied by Dr. Chris Langevin at USGS (Langevin, 2000).

C. Preliminary Scenario Run Configurations

5. There are a total of 10 preliminary scenario runs that were conducted. Preliminary scenario runs 1- 9 were designed to determine the impacts on the near-shore salinity regime of making various independent adjustments to the spatial and temporal distribution of fresh water inflow to the Bay, as well as adjustments to the total volume of inflow to the Bay. The 10th preliminary scenario run represents an inverse modeling approach. That is, the spatial and temporal distribution of the inflow is regulated such that the target near-shore salinity is always achieved. This approach is designed to estimate the both the total volume and the temporal and spatial distribution of inflow required to maintain the desired salinity regime in the near-shore.

Table 1 shows a matrix of the various adjustment parameters investigated in preliminary scenario runs 1-9. The following discussion gives definitions and descriptions of these parameters.

Table 1: Preliminary Scenario Run Matrix

Scenario	Flow in existing canals	Flow in 21 tidal creeks	Flow in 8 primary tidal creeks	15K Ac-ft of additional storage	120K Ac-ft of available water	15K Ac-ft of additional storage and 120K ac-ft of available water
Ps1	X					
Ps2		X				
Ps3			X			
Ps4		X		X		
Ps5			X	X		
Ps6		X			X	
Ps7			X		X	
Ps8		X				X
Ps9			X			X

Figures 2 – 6 depict the existing coastal canals, the 21 tidal creeks, and the 8 primary tidal creeks discussed below.

Flow in Existing Canals: the inflows are directed to the Bay via the existing coastal canals. These canals are C-100, C-1, C-102, Military Canal, and C-103. The corresponding discharge control structures at each of these canals are: S-123, S-21, S-21A, S20G, S20F.

Flow in 21 Tidal Creeks: the inflows in the canals in the study area are directed to the Bay via 21 historic tidal creeks. The inflows are distributed as follows: The flow from C-102, Military Canal, and C-103 is combined and distributed evenly among 15 creeks located between Convoy Point (just south of C-103) and Black Point (located at the C-1 outfall) (see Figures 2-4). The flow from the C-1 canal is distributed evenly among 4 creeks located just north of the C-1 Canal (see Figures 4 and 5). The flow from C-100 is distributed evenly between 2 creeks located to the north of C-100 (see Figure 6).

Flow in 8 Primary Tidal Creeks: the inflows in the canals in the study area are directed to the Bay via 8 historic tidal creeks. These creeks were selected from among a set of creeks identified by Dr. Jack Meeder of the Southeastern Environmental Research Center as creeks that show evidence of relatively high historical discharges. The inflows are distributed as follows: The flow from C-102, Military Canal, and C-103 is combined and distributed evenly among the 5 primary creeks located between Convoy Point (just south of C-103) and Black Point (located at the C-1 outfall) (see Figures 2-4). The flow from the C-1 canal is distributed evenly between 2 primary creeks located just north of the C-1 Canal (see Figures 4 and 5). The flow from C-100 is routed to 1 primary creek located to the north of C-100 (see Figure 6).

15K Ac-Ft of Additional Storage: the inflows in the canals in the study area are routed through a storage basin with 15K Acre-feet of capacity. The storage basin is regulated as follows:

If the storage basin is less than half full, the total discharge from the storage basin to the Bay is set at 420 ac-ft/day. This figure is based on estimates given by Dr. Jack Meeder of the required volume of water to maintain the desired near-shore habitat in the study area (Meeder, et. al. 2003). This total volume corresponds to 20 ac-ft/day/creek for the 21 creek simulations, and 52.5 ac-ft/day/creek for the 8 creek simulations.

If the storage basin is more than half full, the discharge increases linearly from 420 ac-ft/day at half the basin capacity, to 1260 ac-ft/day at full basin capacity. If the basin exceeds capacity, then the water is routed directly into the coastal creeks without any attenuation in the storage basin.

Note that all of the water at the 5 coastal structures is routed through the basin, and the outflow from the basin to the Bay is distributed evenly among all of the coastal creeks (i.e. 21 tidal creeks, or 8 primary tidal creeks, depending on the scenario).

120K Ac-Ft of Available Water: the inflows in the canals in the study area are routed through the coastal creeks. The flows are routed according to the rules established for each set of creeks (see Flow in 21 Tidal Creeks and Flow in 8 Primary Tidal Creeks above). If the discharge to the Bay is high, then the inflow hydrograph is unaltered: the flow is merely redistributed to the Bay according to the groupings described above. However, if the discharge falls below a specified minimum threshold, then water is taken from the available 120K ac-ft of storage and is used to maintain the discharge at the specified minimum threshold until the incoming discharge increases above the threshold again.

This specified minimum threshold is the same as the minimum flow established above for the 15K ac-ft of additional storage, i.e. 20 ac-ft/day/creek for the 21 creek simulations, and 52.5 ac-ft/day/creek for the 8 creek simulations.

15K Ac-Ft of Additional Storage and 120K Ac-Ft of Available Water: this configuration functions very much like the 15K ac-ft of additional storage configuration. The difference is that the supplemental water is used to maintain the minimum discharge threshold if the water in the storage basin is completely exhausted. Hence, the outflow is never allowed to drop below the specified minimum threshold value.

Since the storage basin stores the water from all 5 coastal canals, the outflow from the basin to the Bay is distributed evenly among all of the coastal creeks (i.e. 21 tidal creeks, or 8 primary tidal creeks, depending on the scenario).

Figure 7 shows the cumulative inflow hydrographs that result from each of these configurations. Note that the 120K Ac-Ft of available water actually adds to the total volume of inflow, whereas

the 15K Ac-Ft of storage merely redistributes the timing of the inflow, storing water during the wet season and releasing it during the dry.

7. The 10th preliminary scenario run is designed to force the model to supply whatever amount of freshwater is needed to maintain a stable mesohaline environment in the Coastal Wetlands study area. The following describes how this was implemented in the model.

Based on conservation of mass principles, an equation has been developed that can be used to prescribe the inflow to Biscayne Bay. The equation is as follows:

$$q_{IN} = \frac{q_{BAY}}{C_{TARGET}}\left(C - C_{TARGET}\right) \qquad (1)$$

Where:

q_{IN}	=	The freshwater inflow, per unit shoreline length (ft2/sec)
q_{BAY}	=	The net contribution of water from the Bay, per unit shoreline length (ft2/sec)
C_{TARGET}	=	The target salinity concentration at a selected near-shore location (ppt)
C	=	The salinity concentration measured in the model at the selected near-shore location (ppt)

This equation is used to prescribe the inflows to the Bay. The C values are measured values at a distance of 100 to 200m from the shoreline. The shoreline is broken into segments that correspond to natural groupings of the coastal creeks. For this scenario, the 21 tidal creek configuration is used. The creeks are divided into 5 separate groups. Each group is assigned a unique location in the near-shore where the salinity is measured. The total inflow for that group is then adjusted to drive the measured salinity towards the target salinity (using Equation 1). The inflow is evenly divided among the all the creeks associated with that group. Figures 8-12 show the groupings and the corresponding near-shore salinity measurement locations.

In order to solve Equation 1, an estimate of the average flux of water from the Bay to the near-shore is required. The following approximate values were obtained by examining model results and field data from the Biscayne Bay Phase 1 study:

Average net velocity towards the near-shore (v)= 0.2 ft/sec

Average depth (d)= 3 ft

$q_{BAY} = vd = 0.6\ ft^2/sec$

Note that this is merely a gross approximation of this flux. It is not necessary to know the exact value of this flux, because the model will be continuously adjusting the inflows to drive the measured salinity toward the target salinity value.

Results

8. Figure 13 is useful for showing the effect of distributing the fresh water inflow amongst 21 tidal creeks and 8 primary tidal creeks. The figure depicts the average Bay salinity from August 97 – October 97 for flow distributed via 3 different mechanisms: the existing canals, the 21 creek configuration, and the 8 creek configuration. Note that distributing the flow to the creeks does indeed tend to spread the fresh water longitudinally along the shoreline. Specifically, the high flow observed in the existing configuration at C-103 is effectively distributed along the shoreline. This results in a more efficient use of the available fresh water, with respect to nearshore habitat restoration goals.

9. The 21 creek configuration is somewhat more efficient at distributing the flow along the shoreline. In most locations the difference is negligible; diffusion in the Bay tends to obscure the difference in salinity impacts at a given location between 1 large creek and several closely spaced smaller creeks. However, there are some locations, such as at the C-103 canal and in the embayment just north of the C-1 canal, where there is no creek in the 8 creek configuration discharging to the Bay. In these locations, the differences between the 2 distribution configurations are the most pronounced.

10. Figures 14-19 are given in order to determine the impacts of the various preliminary scenario inflow configurations on the salinity of the Bay. Figures 14-16 show average salinity plots over 3 separate time intervals: August 97 – October 97, November 97 – May 98, and June 98 – July 98. The analysis was divided up this way because the 97 –98 flow year was atypical with respect to seasonal rainfall and runoff. Specifically, the dry season months (November 97 – May 98) were actually relatively wet, and the later wet season months (June 98 – July 98) were exceptionally dry.

11. Figure 17 shows the percent of time (over the course of 1 year) that the model salinity falls outside of the mesohaline range (here defined as 5 – 20 ppt). Figure 18 shows the maximum continuous time that the salinity is outside of the mesohaline range. The contour interval is from 0 to 28 days, (28 days is an estimate given by Greg Graves, Florida Department of Environmental Protection, of the maximum continuous time that the salinity can be outside of the mesohaline range in a viable estuarine habitat).

12. In Figures 14-18 there are 5 images. They represent values computed for each of 5 preliminary scenario configurations. In each of these figures, the 21 creek configuration simulations have been chosen for demonstration purposes; however, the 8 creek configuration simulations show the same trends as do the 21 creek configuration simulations, and could have been used instead. (see, for example, Figure 19, which shows the similarity of the impacts observed in the 8 creek and 21 creek scenarios for a given fresh water discharge configuration)

13. The 5 preliminary scenario configuration simulations shown in Figures 14 –18 are as follows:

- Existing flows [Ps2]
- 15K ac-ft of additional storage [Ps4]
- 120K ac-ft of available water (85 K is actually utilized) [Ps6]
- 15 ac-ft of additional storage and 120K ac-ft of available water (7K is actually utilized) [Ps8]
- Target nearshore environment [Ps10]

14. For each of these configurations, the preliminary scenario number that corresponds to the run shown is given in brackets. Also, note that, although 120K Ac-Ft of water is available for use in scenarios Ps6 and Ps8, the total volume is not used in the either simulation, due to the rules of operation that govern the simulations. The actual amount utilized in each simulation is given in parenthesis.

15. By examining these images, it can be seen that the scenarios where additional water is supplied to the Bay show the most promise in yielding a viable estuarine habitat. This tendency can be most readily observed in Figure 18. The reason for this is that the additional water is supplied during the dry season, when it is needed most. If this water is not available, the salinity quickly exceeds the mesohaline limit of 20 ppt.

16. The scenarios with 15K ac-ft of available storage do permit some fresh water to be stored during the wet season and released during the dry. However, the storage volume alone is not sufficient to store the amount of water needed to maintain mesohaline salinity levels throughout the dry months. At least some supplemental water is necessary to maintain these levels.

17. Figure 20 is identical to Figure 7, except that the cumulative inflow hydrograph resulting from preliminary scenario 10 has been added to the plot. This plot represents an estimate of the minimum volume of fresh water inflow required to maintain mesohaline conditions in the coastal wetlands study area for 1 year. There are several things to note about this plot. First, note that the total volume of water required (517 K ac-ft) exceeds the volume of water available from the original inflow hydrograph (400 K ac-ft) by about 120 K ac-ft. Hence, this additional volume of water is required to maintain mesohaline conditions throughout the study area. Also note that the rate of release that is required is relatively constant. This is due partly to the fact that the Bay tends to buffer the variability of the inflow, and hence the rate at which water is required to maintain the desired conditions is mostly a function of such slowly varying trends as seasonally averaged ocean salinity concentrations and seasonally averaged wind speed and direction.

18. Figure 21 is useful for investigating the variability of the fresh water requirements for each of the 5 natural groupings of creeks that are investigated in preliminary scenario 10. The figure shows the average daily volume of fresh water required for each group, given as the total volume required for that group and as the volume required per creek. The most significant trend observed in this figure is that the volume of water required for each group is inversely proportional to the degree of physical confinement at each group location, as dictated by the shoreline morphology. So, for example, the volume of water required for group 3, which is 1

creek discharging into a well-confined embayment, is only about 13 ac-ft/day. However, the volume of water required for group 4, which discharges to a region of the shoreline directly influenced by currents in the Bay, is about 545 ac-ft/day.

19. Another way to state this phenomenon is that the volume of fresh water required for a given location is inversely proportional to the residence time for that location. Hence, if the required volume of water needed for restoration of the entire coastal wetlands study area is unavailable, a targeted restoration effort could be designed to focus on regions that require the least volume of water to achieve restoration. Alternatively, the nearshore residence time of the more exposed regions of the study area could be increased by the construction of groins and other structures.

Conclusions

20. The following general conclusions can be stated for this study. Note again that these runs are intended to be preliminary, and hence the exact quantities required to achieve the desired goals for the Biscayne Bay Coastal Wetlands project should not be taken from this report. Rather, these runs are intended for use as guidance for the selection of the final alternatives to be examined in future final scenario runs.

- The 21 creek configuration is slightly more efficient at distributing the flow along the shoreline than is the 8 creek configuration, but the observed salinity trends are the same for both configurations. The most pronounced differences are observed in confined locations where the 21 creek configuration has a discharge location and the 8 creek configuration does not.

- Scenarios where additional water is supplied to the Bay show the most promise in yielding a viable estuarine habitat.

- The scenarios with 15K ac-ft of available storage do permit some fresh water to be stored during the wet season and released during the dry. However, the storage volume alone is not sufficient to store the amount of water needed to maintain mesohaline salinity levels throughout the dry months. At least some supplemental water is necessary to maintain these levels.

- Approximately 120K ac-ft/yr of additional fresh water is required to maintain mesohaline conditions throughout the study area.

- The required rate of fresh water release is relatively constant. This is due partly to the fact that the Bay tends to buffer the variability of the inflow, and hence the rate at which water is required to maintain the desired conditions is mostly a function of such slowly varying trends as seasonally averaged ocean salinity concentrations and seasonally averaged wind speed and direction.

- The volume of fresh water required for a given location is inversely proportional to the residence time for that location.

- If the required volume of water needed for restoration of the entire coastal wetlands study area is unavailable, a targeted restoration effort could be designed to focus on regions that require the least volume of water to achieve restoration. Alternatively, the nearshore residence time of the more exposed regions of the study area could be modified by the construction of groins and other structures.

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Florida International University, Miami, FL

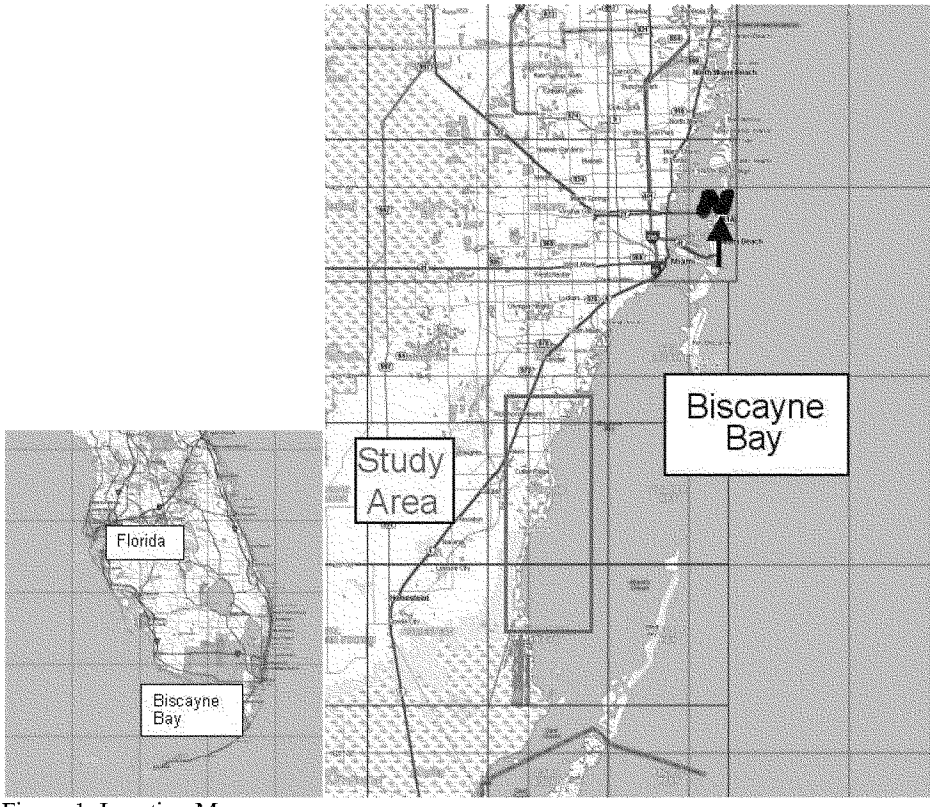


Figure 1: Location Maps

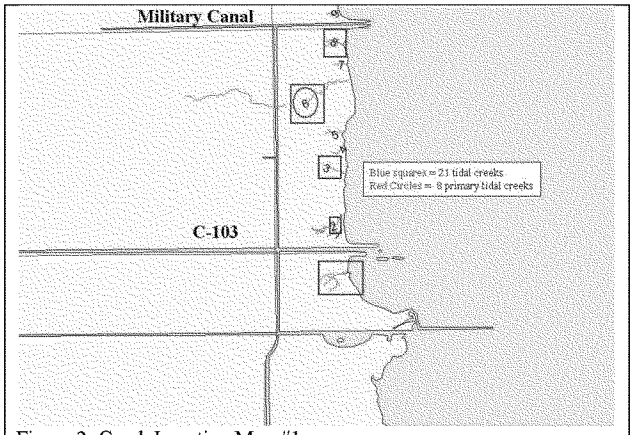


Figure 2: Creek Location Map #1

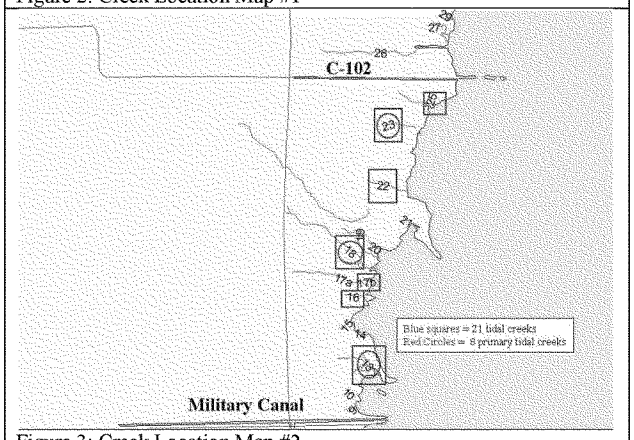


Figure 3: Creek Location Map #2

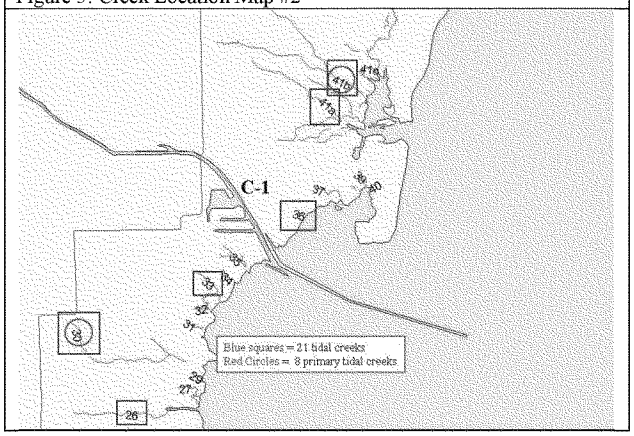


Figure 4: Creek Location Map #3

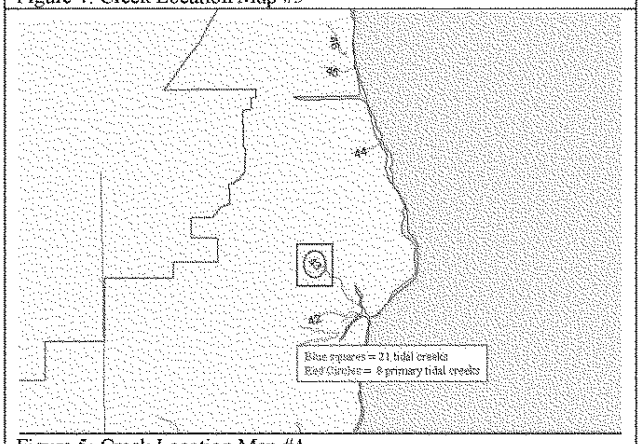


Figure 5: Creek Location Map #4

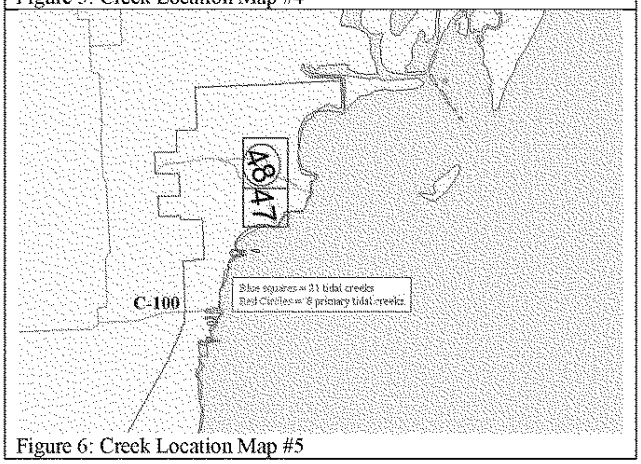


Figure 6: Creek Location Map #5

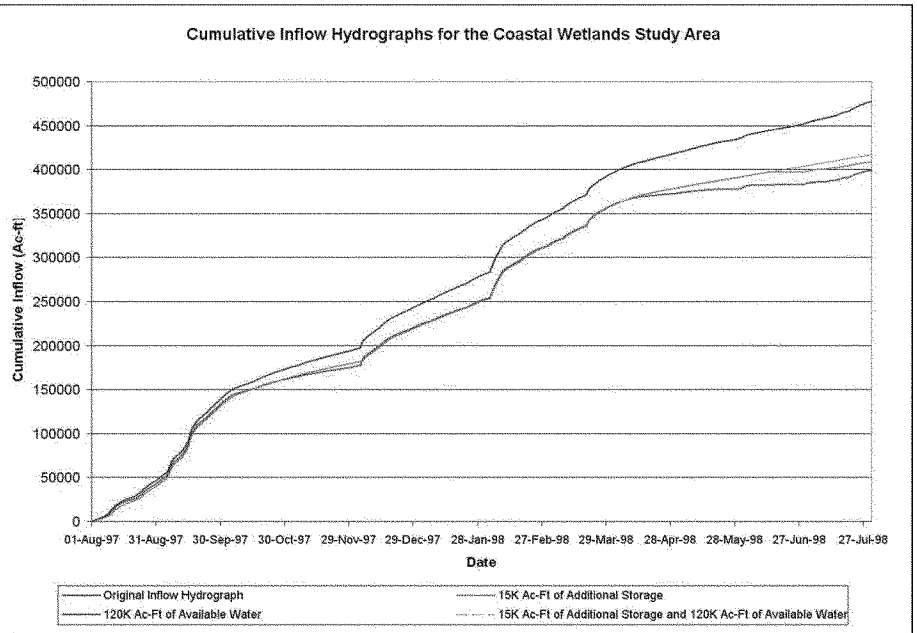


Figure 7: Cumulative Inflow Hydrographs for the Coastal Wetlands Study Area

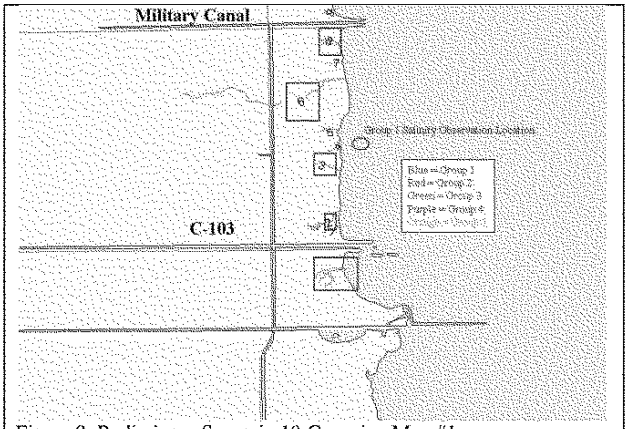


Figure 8: Preliminary Scenario 10 Grouping Map #1

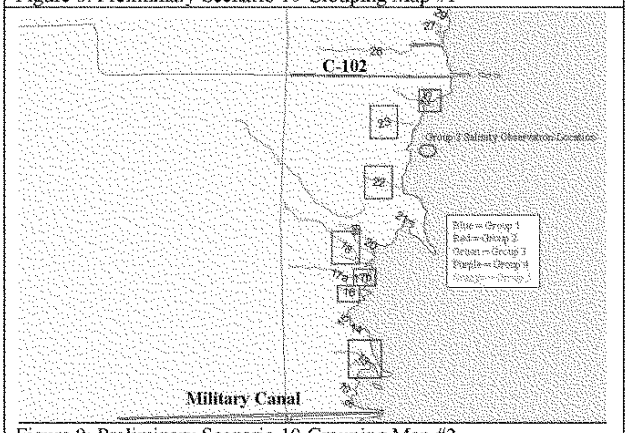


Figure 9: Preliminary Scenario 10 Grouping Map #2

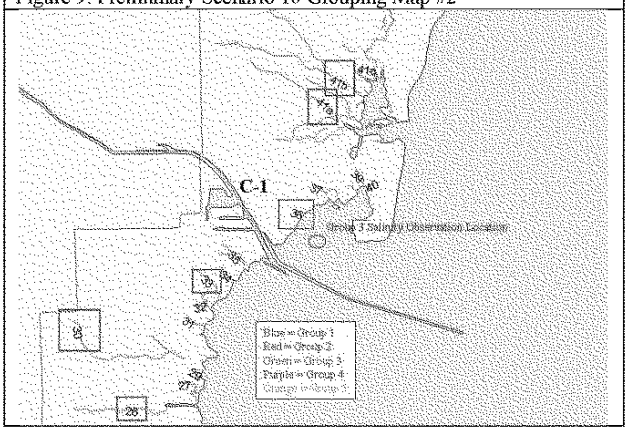


Figure 10: Preliminary Scenario 10 Grouping Map #3

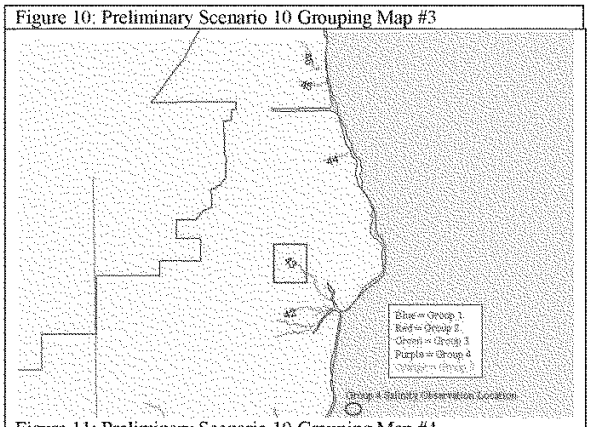


Figure 11: Preliminary Scenario 10 Grouping Map #4

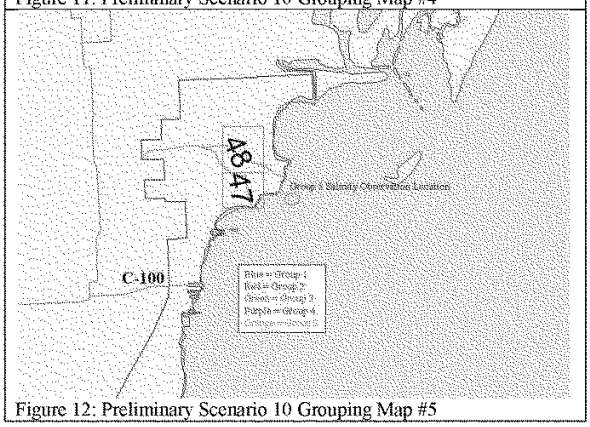
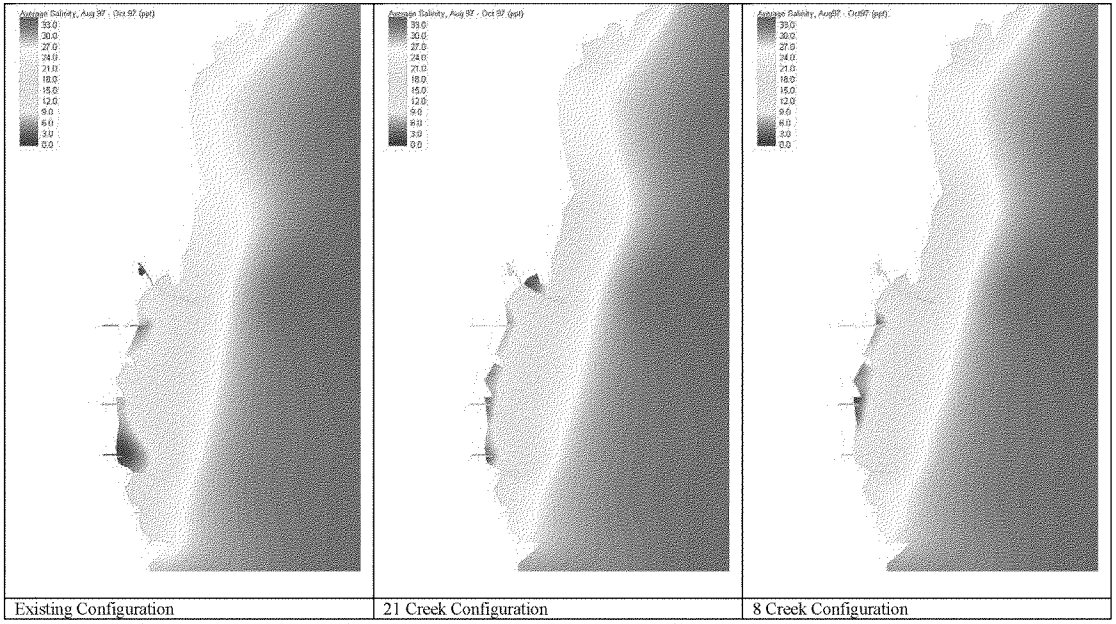
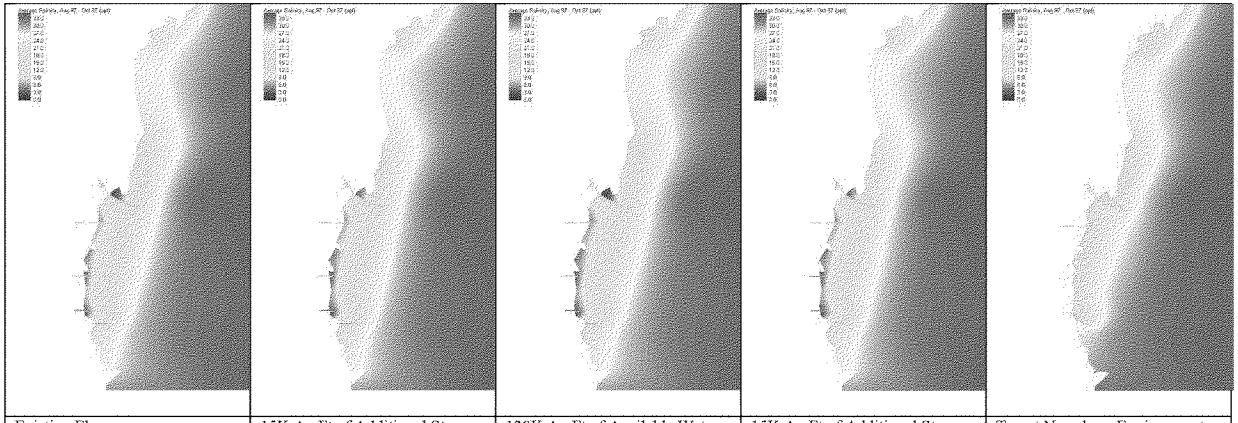


Figure 12: Preliminary Scenario 10 Grouping Map #5



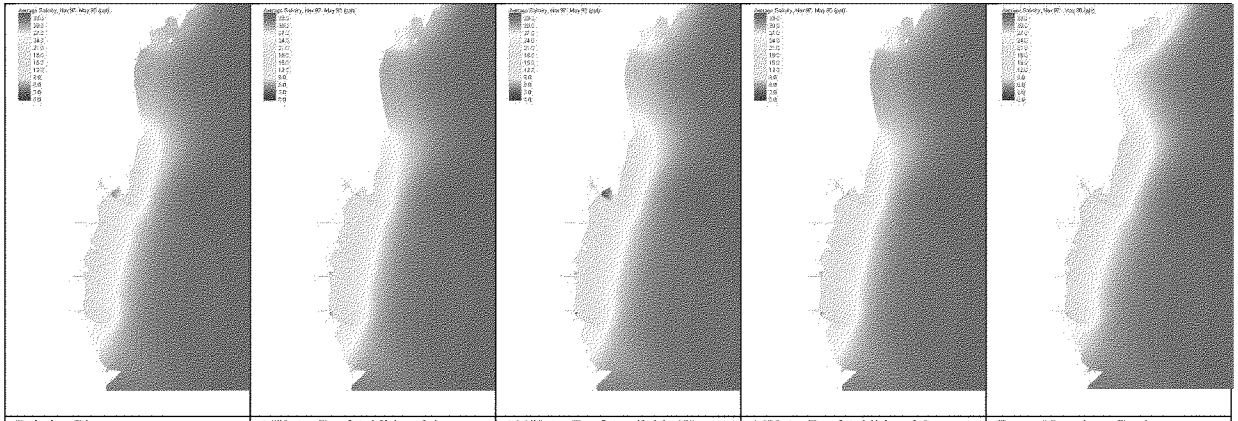
Existing Configuration	21 Creek Configuration	8 Creek Configuration

Figure 13: Inflow Distribution Configuration Comparison: Average Salinity, August 97 – October 97



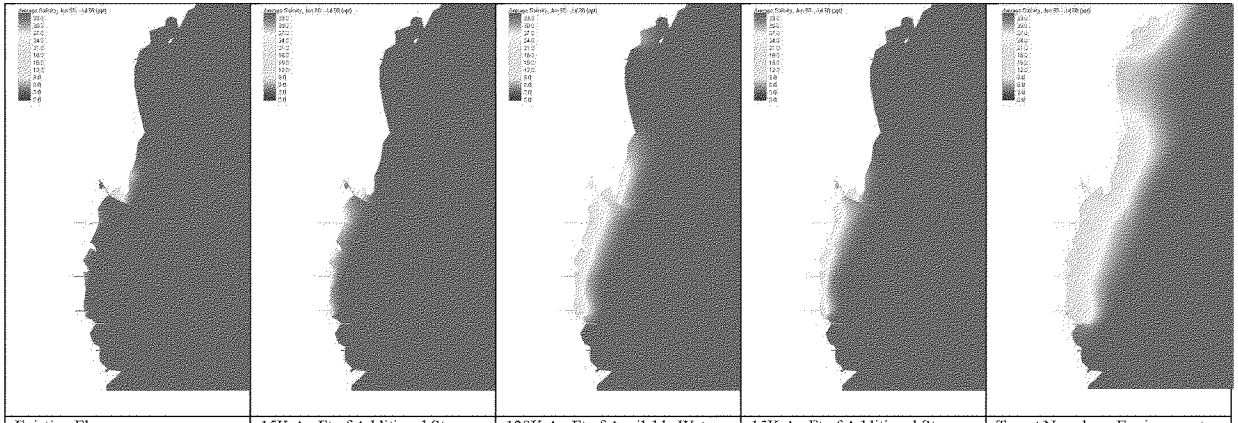
Existing Flows	15K Ac-Ft of Additional Storage	120K Ac-Ft of Available Water (85K Ac-Ft is actually utilized)	15K Ac-Ft of Additional Storage and 120K Ac-Ft of Available Water (7K Ac-Ft is actually utilized)	Target Nearshore Environment (Preliminary Scenario 10)

Figure 14: 21 Creek Simulation Comparison: Average Salinity, August 97 – October 97



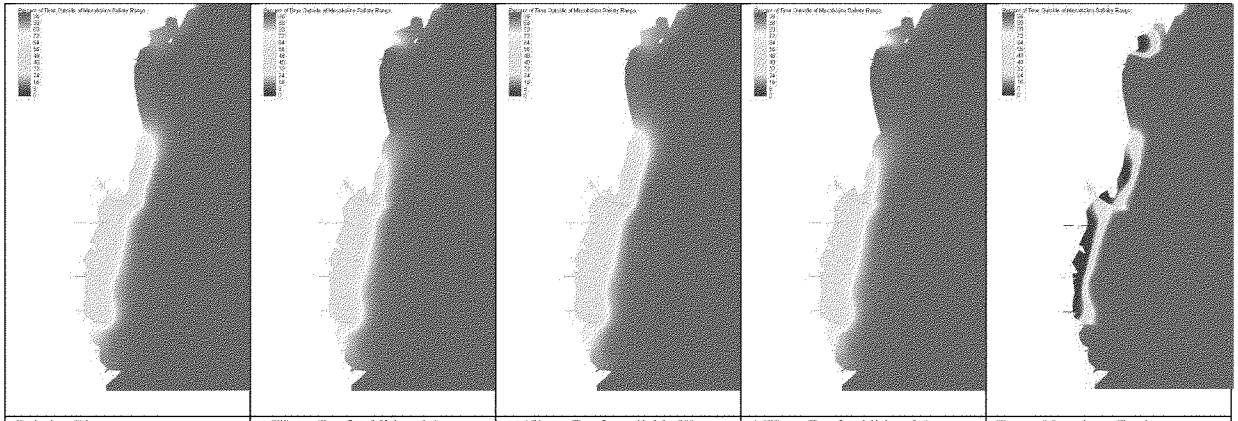
Existing Flows	15K Ac-Ft of Additional Storage	120K Ac-Ft of Available Water (85K Ac-Ft is actually utilized)	15K Ac-Ft of Additional Storage and 120K Ac-Ft of Available Water (7K Ac-Ft is actually utilized)	Target Nearshore Environment (Preliminary Scenario 10)

Figure 15: 21 Creek Simulation Comparison: Average Salinity, November 97 – May 98



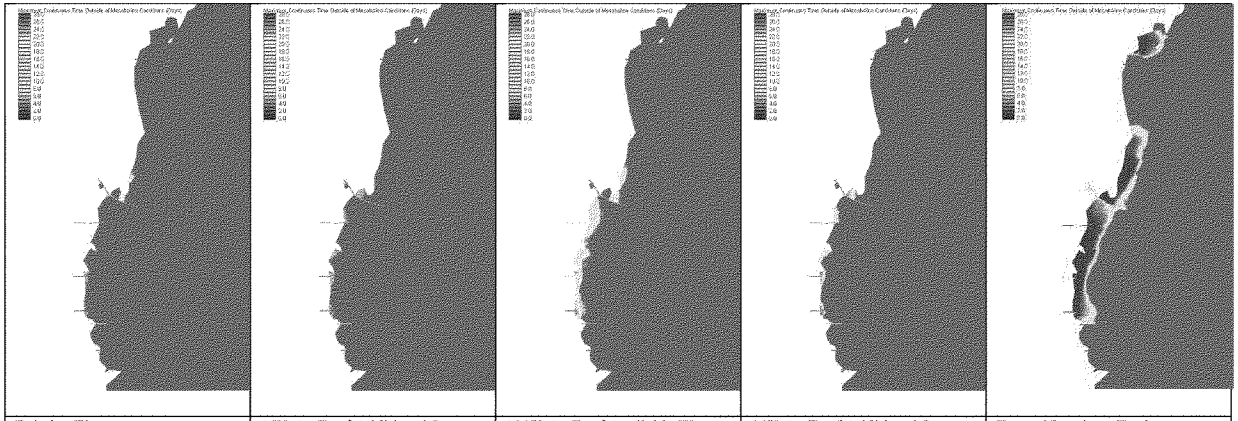
Existing Flows	15K Ac-Ft of Additional Storage	120K Ac-Ft of Available Water (85K Ac-Ft is actually utilized)	15K Ac-Ft of Additional Storage and 120K Ac-Ft of Available Water (7K Ac-Ft is actually utilized)	Target Nearshore Environment (Preliminary Scenario 10)

Figure 16: 21 Creek Simulation Comparison: Average Salinity, June 98 – July 98



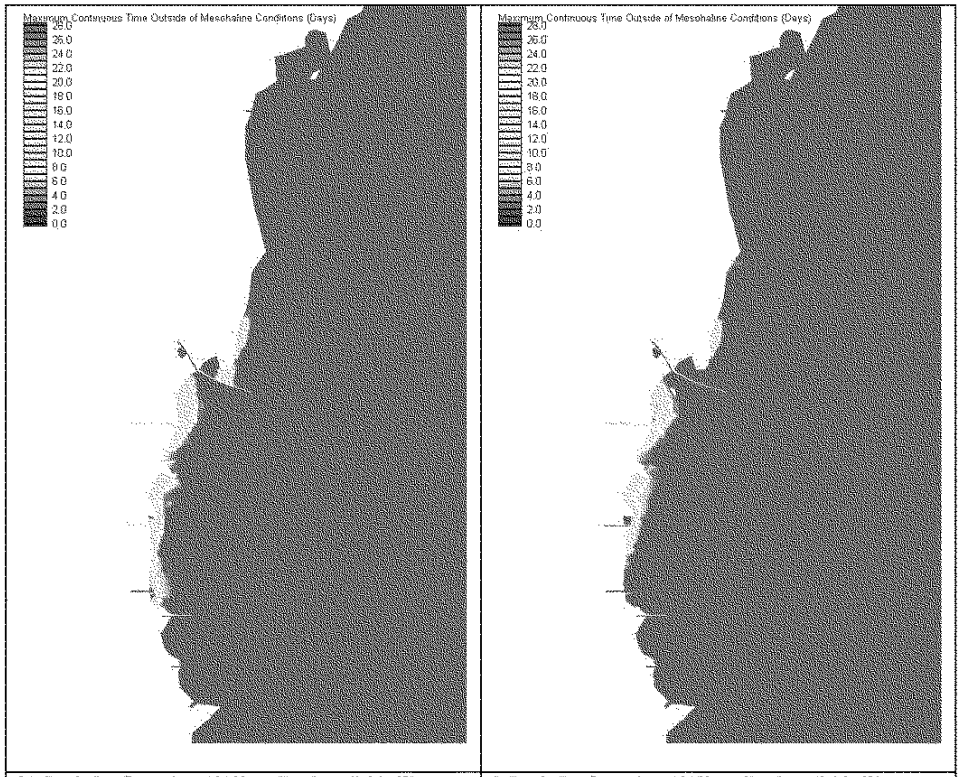
Existing Flows	15K Ac-Ft of Additional Storage	120K Ac-Ft of Available Water (85K Ac-Ft is actually utilized)	15K Ac-Ft of Additional Storage and 120K Ac-Ft of Available Water (7K Ac-Ft is actually utilized)	Target Nearshore Environment (Preliminary Scenario 10)

Figure 17: 21 Creek Simulation Comparison: Percent of Time Outside of Mesohaline Range



Existing Flows	15K Ac-Ft of Additional Storage	120K Ac-Ft of Available Water (85K Ac-Ft is actually utilized)	15K Ac-Ft of Additional Storage and 120K Ac-Ft of Available Water (7K Ac-Ft is actually utilized)	Target Nearshore Environment (Preliminary Scenario 10)

Figure 18: 21 Creek Simulation Comparison: Maximum Continuous Time Outside of Mesohaline Range (Days)



21 Creek Configuration, 120K Ac-Ft of Available Water (85K Ac-Ft is actually utilized)	8 Creek Configuration, 120K Ac-Ft of Available Water (85K Ac-Ft is actually utilized)

Figure 19: Comparison of 21 Creek Configuration and 8 Creek Configuration: Maximum Continuous Time Outside of Mesohaline Range (Days)

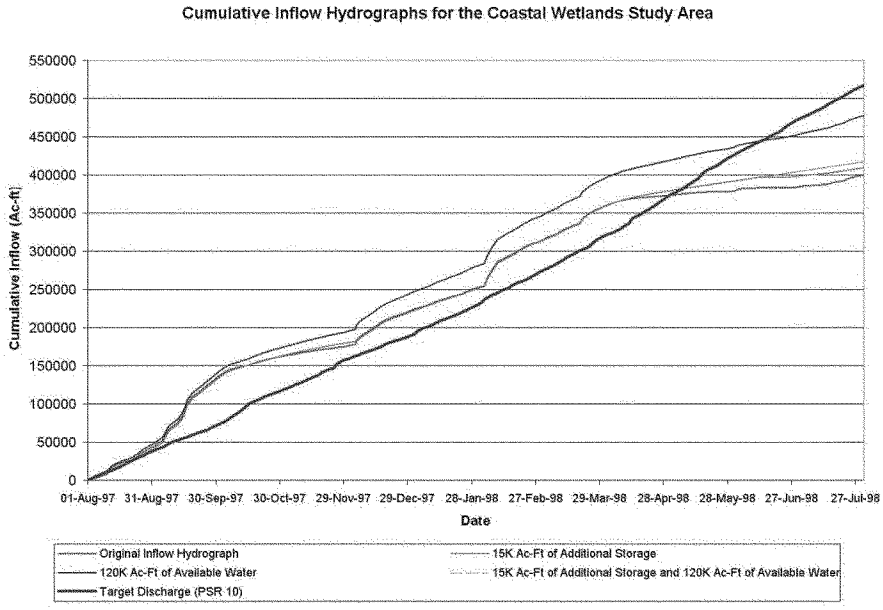


Figure 20: Cumulative Inflow Hydrographs for the Coastal Wetlands Study Area With Target Discharge Shown

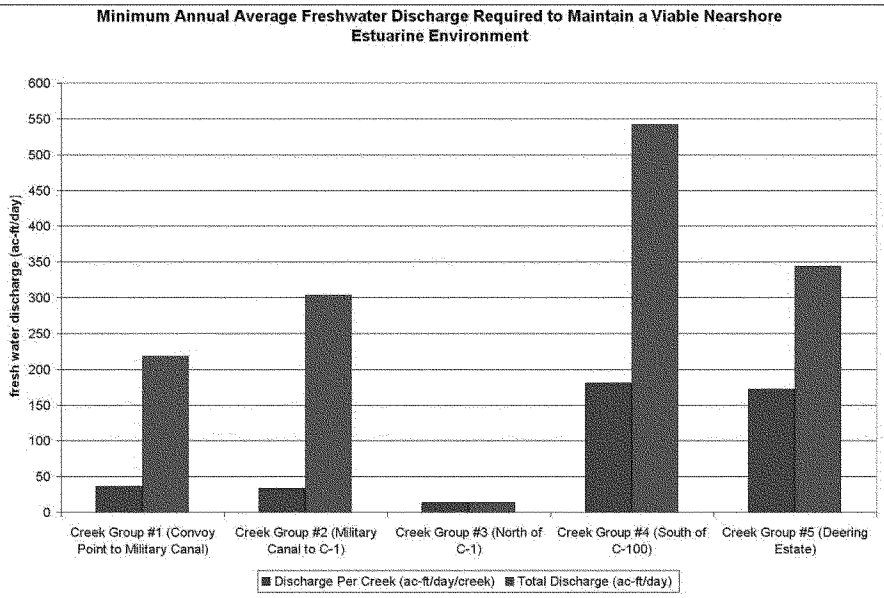


Figure 21: Minimum Annual Average Freshwater Discharge Required to Maintain a Viable Nearshore Estuarine Environment for Each of the 5 Creek Groupings in Preliminary Scenario #10

A.2 RESPONSES TO THE FISH AND WILDLIFE COORDINATION ACT REPORT

Annex A

Biscayne Bay Coastal Wetlands

Recommendations and Responses under the Fish and Wildlife Coordination Act

RECOMMENDATIONS/CONSERVATION MEASURES

Objectives identified by the Service in providing recommendations on this project are to protect and conserve fish and wildlife resources in the project area, while assuring that maximum ecological benefits are delivered to the BBCW Project area consistent with the basic project purpose. This includes developing recommendations to make this project more environmentally compatible and to further conserve and enhance the diversity and abundance of fish and wildlife resources in the study area. Some of the recommendations provided below are consistent with, and still relevant to, those provided by the Service in the FWCA Report that appeared as part of the Restudy (Service 1999b).

A. Water Availability, Storage, and Preferential Use

1. The storage of wet season flows to provide needed water during the dry season is one of the most critical ecological needs of the project area. Presently there are no natural or engineered storage features to meet this need in the BBCW NER Plan or the TSP. The Service recommends that every effort be made to identify and include adequate storage to meet dry season water needs in Phase 2 of the project. To that end, the elimination of the dry season drawdown would greatly benefit the project area by providing much needed fresh water storage. The elimination of the drawdown would provide other significant benefits, such as reducing saltwater intrusion, as noted in Section IV.B.5 above. The Service commends the District for initiating a study to reexamine the usefulness and practicality of this current water management practice, and we encourage the District to expedite this study to the extent possible.

Response: Concur. Freshwater storage to meet dry season ecological needs is a critical element to restoration in this area. Water storage and the elimination of dry season drawdown will be strongly considered during Phase 2 of this project.

2. Because Phase 1 does not address the critical water storage needs and has limited benefit to freshwater wetlands in the project area, the Service recommends planning and implementing Phase 2 as soon as possible. Planning for Phase 2 should allow reformulation beyond the NER Plan as necessary to include storage features and extensive freshwater wetland restoration.

Response: Noted. The scheduling for Phase 2 is yet to be determined in the integrated delivery schedule and will be updated once decisions are made on the River of Grass Land acquisition.

3. The Service recommends that the Corps continue to seek sources for additional freshwater for the BBCW Project to restore more natural flows to Biscayne Bay. Section IV.B.2 above describes the well-documented need for this water, particularly during the dry season.

Response: Noted. As required under WRDA 2000, the Project Delivery Team (PDT) has identified water to be reserved for ecosystem restoration. This requirement is addressed in ***Annex C*** *of this PIR/EIS.*

4. The BBCW study team is developing water reservations as stipulated in Section 601(h)(4)(A)(iii) of the WRDA of 2000. The Service believes that all of the existing water currently flowing to Biscayne Bay is required to protect the natural system. However, depending on the year, the volume of water that will be reserved for the project through the WRDA 2000 assurances process ranges from only about 48 percent to 88 percent of the water available (*i.e.,* water entering Biscayne Bay through the major conveyance canals in 103 of the project area) to the project area. The Service believes that the remaining water available to this system must be protected by the State of Florida from consumptive use.

Response: According to CERP Guidance Memoranda (July 2007), the operating criteria within the POM must be consistent with the operating criteria used to identify water made available to the natural system during wet, average, and dry periods; Therefore, The POM will be carefully reviewed prior to submittal of the final PIR to insure the operating criteria is consistent.

5. Given the lack of water necessary to obtain full restoration of the entire project area and the lack of storage features in the selected plan, the Service recommends that the water available for the project be preferentially used to ensure full restoration of the eight primary historic creek systems in the project as described in Section IV.B.3 above. Most of these creek systems empty into geomorphically protected areas along the western shoreline (*i.e.,* coves and embayments), so freshwater entering the bay in these areas will have a longer residence time, thus restoring the desired mesohaline salinity regime conducive to healthy estuarine flora and fauna.

Response: Concur. Restoration of the eight historic creek systems remains a priority and will be explored in the PED phase of the project.

B. Operations

1. Pump operating criteria as defined in the Project Operating Manual in the PIR should be carefully evaluated as the project is implemented to ensure the desired quantity, timing and distribution of freshwater to the coastal wetlands and nearshore region is attained.

Response: During each project phase, the POM will be evaluated to insure the operations outlined in the POM meet the project goals.

2. The Service recommends evaluating and implementing changes in water control operations to improve hydrologic conditions in the coastal wetlands as soon as practicable, including the incremental elimination of the dry season drawdown in the C-102 and C-103 basins and the increase in the S-20 opening trigger by 0.5 ft during the dry season.

Response: The current draft of the C-111 Spreader Canal Draft POM includes language for increasing the S-30 opening trigger by 0.5 ft during the dry season. Management SFWMD & CORPS would have to review, and provide implementation schedule.

3. As other features of the CERP are designed and operated (Lake Belt, L-31N Seepage, and C-111 Spreader Canal), water management protocols for the BBCW Project components need to be reconsidered in the context of the modified C&SF project. This may include provisions for a future increase in water availability, storage capacity and treatment, and modification of operations for elements of the selected plan to benefit Biscayne Bay and its coastal wetlands that are consistent with the BBCW goals and objectives.

Response: Refer to the response to Item # B.1

4. The Service recommends that the Corps evaluate the impingement and entrainment of fishes and other aquatic organisms at all project inflow pumps as a pilot project to estimate the significance of cumulative impacts on native fishes, and recreational and commercial fisheries, for all the pumps in the BBCW selected plan. The pilot project should evaluate intake designs, screens, and pump type (*e.g.,* screw-type pumps should injure or kill fewer fish than impeller-type pumps). Furthermore, the Service recommends that any new pumps that are installed prior to the end of the pilot project have the capability to be retrofitted with devices (such as screens) that will reduce or eliminate impingement and entrainment of fish and other aquatic life.

Response: Paragraph 6-4 of our Engineer Manual EM 1110-2-3102 indicates that conventional bar screens (trash racks) are the preferred method of screening. For

most pumps, the Corps has used 3 inch bar spacing. The potential use of fish screens can be further evaluated to see where they have been used successfully for similar applications. The Corps will determine whether they can be used in a manner that will not adversely affect the flow and head conditions of the pumps, can be readily cleaned, and are at a reasonable cost. Note that the suction bells at our pump stations generally pass water through them at no more than 5 or 6 feet per second. We have seen no indication that this relatively slow velocity has been causing significant numbers of fish to be drawn into pumps. Screw-type pumps will also be evaluated to see if they would be applicable to this project.

C. Protection and Recovery Measures for Listed Species

1. Standard construction precautions will be implemented for the eastern indigo snake and West Indian manatee during the construction phase for all components of the project to reduce the likelihood of adverse effects on those federally listed species.

Response: Concur. Conservation measures and/or standard procedures are included in both the Biological Assessment (Annex A) and the Environmental Commitments section of the PIR (Section 8.8). These measures will be implemented during construction and O&M phases to avoid adverse impacts to these species.

2. Because of the possibility of American crocodiles nesting or being present in the project area, and because vehicular traffic will temporarily increase during project construction, which may affect crocodiles if they are present, special protection measures for crocodiles are included as permit conditions for the project. These measures include pre-construction crocodile and crocodile nest surveys. If crocodiles or crocodile nests are detected in any survey, a protection plan will be developed in coordination with the Service and implemented prior to the initiation of construction.

Response: Concur. A pre-construction crocodile survey and nest inventory will be included in the construction contract. If either are present, the Corps will coordinate with the FWS on implementing a protection plan prior to construction.

3. Most of the proposed construction sites are presently on private or public properties for which we have limited information regarding the presence of federally listed species. Therefore, as those sites are acquired (or easements are negotiated), the Corps should ensure that more detailed surveys are conducted by a qualified biologist approved by the Service and the FWC to determine the presence of listed species. If listed species are found, the Corps and Service will determine if re-initiation of consultation in accordance with section 7 of the Endangered Species Act is necessary.

Response: Concur. As project properties are acquired, surveys for the presence of listed species will be conducted prior to construction in those areas. The USACE will invite appropriate resource agencies, including the FWS, to participate. As stated in the Environmental Commitments (Section 8.8), the USACE and the SFWMD will maintain an open and cooperative informal consultation process with the FWS and Florida Fish and Wildlife Conservation Commission (FWC) throughout the design, construction and operation of this restoration project.

4. The Service has concerns about the potential for the exposure of federally listed species, as well as other fish and wildlife, to contaminants when former agricultural lands are flooded. If the ecological risks from contaminants to listed species becomes evident, the Corps and Service will determine if re-initiation of informal, or initiation of formal, consultation in accordance with section 7 of the Endangered Species Act is necessary.

Response: Concur.

5. Any new canals that are constructed as part of this project that are hydraulically connected to Biscayne Bay (or any other water bodies inhabited by, or capable of being inhabited by, manatees) must have barriers to prohibit manatee movement into newly constructed canal reaches from the bay (or other relevant water bodies inhabited by manatees). This includes the new spreader canals proposed for this project. Such barriers will ensure that BBCW Project facilities will pose no additional threat of structure-caused mortality or injury, entrapment in culverts or canals, or any other form of take, as defined in the Endangered Species Act. Manatee barriers should be provided for all new pump stations, culverts, and other structures as appropriate.

Response: Concur. The USACE has included standard manatee protection measures in the Biological Assessment (Annex A). Additionally, manatee barriers for all new pump stations, culverts, and other structures will be added to the environmental commitments (Section 8) of the PIR/EIS.

6. The Corps will notify the Service's South Florida Ecological Services Office no later than one month prior to start of the construction phase for any of the components so that we may, if necessary, ensure that precautions are in place, and if necessary, monitor effects of construction activities on threatened and endangered species.

Response: Noted.

7. Should blasting be necessary, the Corps must follow the Service's "Guidelines for the Protection of Marine Animals During the Use of Explosives In the Waters of the State of Florida" and monitor local wildlife activity during this action.

Care should be taken to avoid unnecessary disturbance of roosting, foraging, or wading birds or other local wildlife such as perching birds, raptors, waterfowl, mammals, reptiles, amphibians, and fish that utilize associated habitats. A qualified fish and wildlife biologist, approved by the Service and the FWC, should be present throughout blasting activities to monitor fish and wildlife response and offer advice to construction personnel.

Response: Concur. If blasting is required, the USACE will follow the USFWS guidelines, as recommended.

8. The Service recommends adding wildlife corridors beneath or through roadways, particularly Card Sound Road, to reduce crocodile mortality caused by motorized vehicles. Mortality from automobiles account for a large number of crocodile deaths in south Florida, and it is particularly a problem along Card Sound Road, which is in the project area. The Service recognizes that this recommendation falls outside the spatial scope for the Selected Plan, but these corridors should be given a high priority for Phase 2 of the BBCW Project.

Response: Noted. Wildlife corridors will be strongly considered during Phase 2 of the BBCW Project

9. For additional species listed as threatened, endangered, or of special concern by the State of Florida, the Corps should consult with the FWC regarding those species' habitat needs and additional recommendations to conserve those species.

Response: Coordination with resource agencies, including the FWC, has been on-going throughout the planning process of this project. Additionally, the FWC will be providing formal comments on the draft PIR/EIS during the public and agency review period.

D. Monitoring and Adaptive Management

1. Given the lack of reliable modeling and the high level of uncertainty of the effects from implementing the NER Plan, the implementation of sound monitoring and adaptive management plans are critical to project success. The Service recommends close adherence to the water quality and ecological monitoring plans established for the BBCW Project, including the ecological monitoring specified in the RECOVER Monitoring and Assessment Plan and the project-level monitoring plans appearing in the PIR. This monitoring should be periodically evaluated for relevance and usefulness. Also, the Service recommends that the adaptive management plan developed for the project be implemented to maximize the restoration success of the project and to provide information for the planning and construction of Phase 2 of the project. This

adaptive management plan should also be periodically reviewed and revised as appropriate. This process should facilitate the restoration and enhancement of the BBCW Project's wetland and estuarine habitats.

Response: Concur. The intent in developing the water quality and ecological monitoring plans (Annex E of the PIR/EIS) is to evaluate the overall restoration progress of the project and to adaptively respond through operational changes, as needed.

2. Similarly, monitoring data obtained through the Acceler8 component of the BBCW Project, which includes the Deering Estate, the Cutler and Black Creek wetlands, and the L-31E culverts component should be evaluated closely for restoration effectiveness and for effects on fish and wildlife. This information should be used to help guide the design of the Phase 1 and Phase 2 BBCW Project components.

Response: Concur. It is unclear if the SFWMD will expedite construction of BBCW features. The project could therefore be implemented in three stages as this recommendation indicates (Acceler8 features, PIR 1 features, PIR 2 features) or two stages (PIR 1 features, PIR 2 features). Regardless, the project team will use opportunities to learn from early features to guide subsequent components.

E. Control of Non-native Vegetation

1. As noted in Section IV.B.12.a above, the removal and control of invasive non-native plant species is important to the success of this project. The Service recommends that sufficient project assets be provided for the initial physical or chemical removal of non-native vegetation. Changes in hydrology resulting from the project should contribute substantially to the control of non-native vegetation, but initial removal of mature stands will be required. Removal and control of invasive non-native vegetation also influences the survival and wellbeing of the listed plant species in the project area.

Response: Concur. The removal of exotic species is planned within the project area. A plan to control and manage exotic vegetation on project lands after construction would be implemented as part of the operations and maintenance plan for the project.

2. The Service recommends that an invasive non-native species management plan be implemented as part of the Selected Plan. This management plan should have four components: (1) construction practices that reduce the spread of the non-native plants; (2) initial aggressive treatment and management of substrates that are bared by restoration activities; (3) monitoring of non-native vegetation, and (4) extensive site management activities by the land manager,

including controlled burns. Without such a plan, invasive non-native vegetation would reinfest the project area, particularly the construction areas.

Response: Concur. See response to E-1 above.

F. Migratory Birds

As noted in section IV.B.6 above, the Lennar Wetland Mitigation site is a high-quality stopover and feeding area for migrating shorebirds. The Service recommends maintaining this site as high quality habitat for these birds. Generally, this will entail ensuring that the site does not become overgrown with vegetation. These shorebirds require shallow water mudflat habitat (including exposed surfaces) for foraging. Perhaps just as importantly, water depths should not exceed 0.5 ft in most of this wetland parcel. Also, the BBCW Project must be careful not to pump water onto this site at inappropriate times of the year (*e.g.*, August through October). The BBCW PDT should examine the project area for other sites suitable for preserving or restoring for migratory shorebirds, and manage those sites for migratory shorebirds. For example, the existing mitigation site could be expanded by adding the 42-ac parcel adjacent to and south of the mitigation site. This parcel would have to be cleared of the non-native vegetation that currently infests the site, and it would have to be graded to an elevation equal to the existing mitigation site to the north.

Response: This project is not planning to put water on the Lennar Wetland Mitigation site; therefore, this area will not be altered as a result of project operations. Although not a primary objective, the BBCW PDT can discuss other sites suitable for migratory shorebirds during the development of PIR 2.

G. Wastewater Reuse

1. The Service recommends that planning for Phase 2 of the BBCW Project should include sufficient flexibility to take advantage of all treated wastewater made available by the south Miami-Dade Wastewater Reuse Project, under the contingency that the treated water is deemed suitable for rehydrating coastal wetlands.

Response: Concur.

2. If treated wastewater from the south Miami-Dade Wastewater Reuse Project is made available to CERP, the BBCW water quality monitoring plan should be revised to ensure that the wastewater effluent meets all applicable water quality standards. The revised monitoring plan should utilize the latest science related to EPOCs. Project managers should adopt a similar sampling protocol to that developed for the Wastewater Reuse Pilot Project for water quality sampling for

EPOCs. Additionally, the monitoring plan should be used to determine if any agrochemicals are being mobilized from the soils into the surface water.

Response: The selected alternative does not include the use of reuse water at this time. If reuse water is incorporated into this project or another federal project, appropriate water quality protections including enhanced monitoring of wastewater specific compounds will be considered. Testing to determine the potential for mobilizing residual agricultural chemicals is presently required in order to certify lands for use in CERP projects.

H. Contaminants

1. As noted above, Phase 1 and Phase 2 Environmental Site Assessments have revealed significant contamination of soils on some of the properties in the project area that have been purchased and assessed by the District. In some cases, the contamination detected is at a level that is toxic to fish and wildlife. The Service's Environmental Contaminants staff has reviewed the assessment reports, and based on the potential risk indicated by limited soil sampling and food chain modeling, the Service has made specific recommendations in letters to the District. These letters and their recommendations have been summarized in Section II.B above.

Response: Actions have been completed or are pending to address all of the contamination recommendations made by USFWS. Additional information on the proposed measures are discussed in greater detail in Section 6.1.10 of the Final PIR/EIS.

2. Either the District or the Corps should continue to coordinate sampling plans, specifications, and techniques with the Contaminants Section of the South Florida Ecological Services Office prior to future Phase 1 and Phase 2 Environmental Site Assessment sampling. This recommendation refers to any construction activity related, but not limited to, STAs, new canals, pump installation, other excavation, and natural storage and water quality treatment areas.

Response: Concur.

3. We recommend the use of SQAGs during the Environmental Site Assessment for contaminants in order to facilitate the evaluation of environmental risk that will accompany any land acquisition for this project. If a Phase 2 analysis indicates the presence of contaminants at levels toxic to fish and wildlife, remediation to environmentally acceptable levels based on ecological risk to receptor organisms may be required.

Response: Concur; the use of SQAGs will continue in conducting ESAs.

I. Additional Recommendations

1. The Service views the project flexibility for plugging or filling of major east-west drainage ditches as one of the most important management measures that is planned for implementation as part of the BBCW Project. These ditches accelerate the drainage of these coastal wetlands, contributing to the unnatural and harmful dry conditions during the dry season. Decompartmentalization of the BBCW Project area, specifically the removal of mosquito and drainage ditches, has been recommended by various study reports as the first step in facilitating the management, restoration, and hydrologic re-connection of the wetlands in this part of the Biscayne Bay watershed (Ruiz et al. 2002; Ross et al. 2003; Meeder and Harlem 2004; Ruiz and Ross 2004). The Service recommends ensuring that resources are available for implementing this management measure as part of Phase 1, as needed.

Response: Concur. The Recommended Plan includes plugging and filling of ditches; specific details will be determined during the PED phase of this project.

2. The Service recommends that restoration efforts include fire as a means of maintaining and stimulating the expansion of the graminoid communities desired in the coastal wetlands of the project area, particularly in certain areas of the project as defined by Ruiz and Ross (2004). This may require periodic controlled burns as necessary to manage system. The Service recognizes the delicate nature of using this management measure, particularly given the project's close proximity to urban areas, but it will likely be necessary to control the woody vegetation in these wetlands to ensure successful restoration.

Response: Noted. The feasibility of controlled burns will be explored during the PED phase of the project. If approved, this effort will be coordinated with the USFWS.

3. As the project proceeds through the PIR phase, some lands that were previously anticipated to be available for project components may prove to be unavailable. The substitution of other areas, not previously evaluated for fish and wildlife habitat, would require further coordination with the Service to determine potential losses to ecologically valuable upland and wetland habitat.

Response: Concur. Any changes to land acquisition not previously evaluated for impacts will be coordinated with the FWS.

4. If land leases expire or change the performance of the plan, the Corps should evaluate the effect this will have on predictions about the future with project conditions.

Response: Concur. Effects resulting from any land changes within the boundaries of the selected plan will be properly evaluated.

J. Coordination with Other Programs

The Service encourages actions that promote basin-wide changes in both urban and agricultural land use practices in order to meet the water quality goals of the project. The efforts of various Federal, State, County, and local interagency groups should be recognized as a tool to assist in successfully achieving the objectives of the BBCW Project. We recommend that the Corps and District continue coordination with the following efforts.
1. Other Federal restoration plans and programs (*e.g.,* the Service's Multi-Species Recovery Plan, the U.S. Department of Agriculture's Wetland Reserve Program) or State land acquisition programs (*e.g.,* Program for Conservation and Recreation Land Acquisition, Save Our Rivers) can provide guidance or funding for the restoration aspects of this project.

Response: Noted.

2. The Biscayne Bay Regional Restoration Coordination Team, established by the Working Group of the South Florida Ecosystem Restoration Task Force, has recently completed an action plan for the restoration of Biscayne Bay. The team is comprised of members from local, State, and Federal agencies as well as nongovernmental organizations and individuals. The action plan includes detailed steps that address all facets for restoring or enhancing the bay and surrounding watershed ecosystems, including water quality, water management, fisheries resources, fish and wildlife habitat, and imperiled species.

Response: Noted.

K. Relevant Recommendations Appearing in Restudy FWCA Report

Many of the recommendations provided in the Restudy Draft and Final FWCA Reports for Everglades' restoration, in general, and for Biscayne Bay and the BBCW Project, in particular, remain applicable today. General recommendations in the Restudy Draft FWCA Report regarding water supply, land acquisition and non-native plant and animal control are still relevant for the BBCW Project. Other specific recommendations made in the Restudy Draft FWCA Report that remain particularly relevant include:

1. "The Comprehensive Plan is intended to provide surface water flows sufficient to meet restoration targets for BNP and Biscayne Bay. In the meantime, surface water flows should meet or exceed the 1995 Base condition, and there should be neither any annual or seasonal net loss in the total volume or any reduction in the spatial and temporal distribution of combined surface and groundwater flows."

Response: As of January 2009, incremental CERP implementation has not resulted in a reduction of surface and groundwater flows to Biscayne Bay relative to the 1995 Base Condition. Implementation of non-CERP management actions such as IOP, CSOP, etc., could potentially result in slight increases or decreases in flows to Biscayne Bay; however, these operations schemes have limited impact on flows to Biscayne Bay. The permitting of new (post 1995) water supply demands has an impact on flows to Biscayne Bay. In 2008, the SFWMD and DEP implemented a freeze on future water permitting in the basin.

2. "Every effort should be made to find sources, storage, and means of distribution of water to Biscayne Bay that (a) require minimal water treatment to reach ambient water quality in southern Biscayne Bay, (b) are likely to receive adequate funding, (c) have the greatest probability of success, (d) can achieve current and future restoration targets, and (e) for which the long-term environmental and economic consequences can be reasonably predicted (e.g., use reuse water as a last resort)."

Response Concur. Reference A-3 response.

3. "Although the D13R4 scenario presents many challenges with respect to water quality, the Department recommends that sufficient water treatment capacity be built into the plan to handle the increased water volumes needed to achieve the hydrologic characteristics as were observed in Biscayne Bay and BNP under D13R4. Additionally, more thorough monitoring of a variety of pollutants will be required in the basins from which this water will be derived. These data will provide better estimates of the sizes of storage areas needed for initial treatment. Selection of appropriate technology for supplemental treatment (in addition to the STAs) must consider the potential ecological effects of all pollutants, not just phosphorus."

Response: The inclusion of stormwater treatment areas (STAs) and water storage features were considered during the BBCW formulation process. The recommended plan, Phase I and later Phase II of Alternative O, does not include STAs or reservoirs due to high costs attributable to real estate values and construction costs resulting from unfavorable hydrogeology which requires lining the reservoirs. However, limited water quality treatment is provided in the

selected plan through the diversion of canal discharges into coastal wetlands which will result in some removal of nutrients and other pollutants.

A.3 PLANNING AID LETTERS

US Fish and Wildlife Service

United States Department of the Interior

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

June 21, 2002

James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

RE: Biscayne Bay Coastal
Wetlands Project

Dear Mr. Duck:

The U.S. Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) for the Biscayne Bay Coastal Wetlands Restoration Project (BBCW). This PAL is provided in accordance with the Fish and Wildlife Coordination Act (FWCA) of 1958, as amended (16 U.S.C. 661 *et seq.*) and section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). This PAL does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA. This PAL provides guidance and transmits some of our concerns with this project. Due to the conceptual level of detail for this project and the potential for future changes in design, the position of the Service in this and all subsequent PALs is subject to change.

Introduction

At the request of the Army Corps of Engineers (Corps), and as members of the BBCW Project Delivery Team (PDT), we have reviewed the first draft of the BBCW Project Management Plan (PMP) dated April 2002. The purpose of this PAL is to provide recommendations for revising the PMP and to document some of the Service's concerns regarding this project. Most of the recommendations appearing in this PAL were forwarded to the Corps' BBCW Project Manager (Jill Tefts) in an e-mail sent on May 8, 2002.

Project description

The primary purpose of the project is to reduce point-source discharge to Biscayne Bay and rehydrate wetlands along the southwestern margin of the bay. Presently, freshwater runoff from the watershed is discharged to the bay through a system of conveyance canals. This water management practice significantly reduces the amount of fresh water made available to coastal wetlands, and it causes abrupt freshwater discharges that are physiologically stressful to fish and benthic invertebrates in the bay near canal outlets. By redistributing surface water flow from

conveyance canals through a spreader system across a broad front, the project is expected to restore or enhance freshwater wetlands, tidal wetlands, and nearshore bay habitat. Specific restoration goals include restoring freshwater wetlands, enhancing mangrove wetlands, re-establishing the nearshore oyster reef community, and re-establishing productive nursery habitat for fishes and shellfish.

The project consists of two major components: 1) a land-based system that retains water, improves wetland hydroperiods, and directs water through alternative routes more like the original drainage system; and 2) an operational change to increase water elevations at the coastal water control structures in the dry season. The project may cover up to 60,000 acres from the Deering Estate at C-100, south into the undeveloped area, known as the Model Lands, southeast of Homestead and Florida City and into Barnes Sound. Five geographic sub-components have been identified and described. Project features include pump stations, spreader swales, stormwater treatment areas (STAs), flowways, levees, culverts and backfilling canals.

Fish and Wildlife Service coordination and the Comprehensive Everglades Restoration Plan (CERP) process

The Service is the principal Federal agency responsible for conserving, protecting and enhancing fish, wildlife, and plants and their habitats for the continuing benefit of the American people. The agency enforces Federal wildlife laws, administers the ESA, manages migratory bird populations, restores nationally significant fisheries, and conserves and restores wildlife habitat such as wetlands. Natural resource protection legislation relevant to the projects authorized under the CERP that affect the Service's trust resource responsibilities include the ESA, FWCA, the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 *et seq.*), the Migratory Bird Treaty Act (16 U.S.C. 703-712), the Estuary Protection Act (16 U.S.C. 1221-1226), and the Coastal Zone Management Act of 1972 (16 U.S.C. 1451-1464). In addition, several Executive Orders have established guidance to Federal agencies, including the Service, relative to fish and wildlife protection and conservation. For CERP projects authorized under the Water Resources Development Act of 2000, the ESA and the FWCA represent the primary authorities under which the Service cooperates and coordinates with project sponsors.

Sub-section 7.4.1.3 of the Functional Area Plans in the BBCW PMP provides the above paragraph as its description of the Federal activities and responsibilities under the ESA and the FWCA; however, the Service developed in conjunction with Corps staff additional language that more completely defines the Service's role in CERP. This additional information was omitted in PMP. We believe that it is important to include the additional regulatory information because it notifies the Corps Project Managers of their responsibilities under the ESA and the FWCA. Early coordination with the Service will reduce the likelihood of delays in project implementation. We recommend that sub-section 7.4.1.3 contain the complete text that we had e-mailed on May 8, 2002, to the Corps BBCW Project Manager and in which the Service's role in CERP is more completely characterized.

Federally and state-listed species

Several Federally listed species are either known or anticipated to occur within the project area. This PAL provides the following information for planning purposes only; it does not constitute the official list for ESA purposes. Federally listed species known or anticipated to occur in the project area include the American crocodile (*Crocodylus acutus*), West Indian manatee (*Trichechus manatus*), wood stork (*Mycteria americana*), eastern indigo snake (*Drymarchon corais couperi*), and Schaus swallowtail butterfly (*Heraclides areistodemus ponceanus*). Other threatened and endangered species that may be of concern regarding this project include, but are not limited to, the Florida panther (*Puma concolor coryi*), Everglade snail kite (*Rostrhamus sociablis plumbeus*), Cape Sable seaside sparrow (*Ammodramus maritimus*), bald eagle (*Haliaeetus leucocephalus*), roseate tern (*Sterna dougallii dougallii*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Dermochelys coriacea*), and loggerhead sea turtle (*Caretta caretta*). Federally listed plant species that may occur in the project area include the crenulated lead plant (*Amorpha herbacea* var. *crenulata*), Garber's spurge (*Chamaesyce garberii*), and tiny polygala (*Ploygala smallii*). There may be additional Federally listed species that potentially occupy the study area, but are unknown to us at this time. Areas bordering Card and Barnes sounds have been designated as critical habitat for the crocodile and manatee.

The project area also provides habitat for species that are listed by the State. In addition to the Federally listed species, the State lists as endangered the arctic peregrine falcon (*Falco peregrinus tundrius*) and Florida mastiff bat (*Eumops glaucinus floridanus*); and it lists as threatened the white-crowned pigeon (*Columba leucocephalus*), least tern (*Sterna antillarum*), piping plover (*Charadrius melodus*), Miami black-headed snake (*Tantilla olitica*), and Everglades mink (*Mustela vison evergladensis*). State-listed species of special concern include the roseate spoonbill (*Ajaia ajaia*), limpkin (*Aramus guarauna*), little blue heron (*Egretta caerulea*), reddish egret (*E. rufescens*), snowy egret (*E. thula*), tricolored heron (*E. tricolor*), white ibis (*Eudocimus albus*), brown pelican (*Pelecanus occidentalis*), black skimmer (*Rynchops niger*), mangrove rivulus (*Rivulus marmoratus*), gopher tortoise (*Gopherus polyphemus*), American alligator (*Alligator mississippiensis*), and Florida tree snail (*Liguus fasciatus*). The State does not list critical habitat for any of its species. Please contact the Florida Fish and Wildlife Conservation Commission for additional information about measures that may be needed to address protection of these species.

Hazardous, Toxic, and Radioactive Waste (HTRW) Assessment - Coordination with the Service

Sub-section 7.3.3 HTRW Assessment (pages 65-67) should be revised for clarification. We believe that a strong HTRW section in the PMP for the BBCW Project is vital because of the potential risks associated with 1) flooding former agricultural lands, 2) the South Dade Landfill

and South Dade Wastewater Treatment Facility being within the project footprint, 3) the Turkey Point Nuclear Power Plant being adjacent to the project boundary, and 4) the extensive land acquisition required for this project. The sub-section in the PMP indicates that Corps' South Atlantic Jacksonville's (CESAJ) Environmental and Hazardous, Toxic, and Radioactive Waste (HTRW) section within the Engineering Division's Geotechnical Branch will conduct the Phase I and Phase II assessments. The South Florida Water Management District (SFWMD) is working with the Service to establish a protocol for contaminants evaluation on CERP-related lands, and it is our understanding that the SFWMD has sub-contracted this work. The Service recommends that sub-section 7.3.3 be revised to reflect the Service's and SFWMD's protocol. The PMP should also note that HTRW activities include communication and coordination with the Service's Environmental Contaminants Program staff in Vero Beach, who are able to provide technical assistance. Service involvement with HTRW sampling procedures, especially early in the developmental stages, will ensure that the Service's concerns are taken into account regarding Environmental Site Assessments.

Other specific recommended changes, amendments, and suggestions for the PMP

We recommend that the acronym list be reviewed to correct errors and to ensure that acronyms listed are described in the document. For example, "FWS" should be deleted from the acronym list (page 1) as it does not occur anywhere else in the document. The Service is referred to under the acronym "USFWS."

Section 2.5 lists and describes related projects in the region; however, there is no discussion as to how these related projects tie in with the BBCW Project. We recommend that the revised PMP describe how the projects interrelate.

Section 2.5.6.6 (page 32): The current heading for this sub-section implies that the Service is conducting all of the monitoring studies; however, not all of the studies described in this sub-section are being conducted by the Service. We recommend that the heading be changed to "Monitoring projects and studies for two species Federally listed as endangered."

Section 7.2.1 (page 49): We recommend that the last sentence in the second paragraph be reworded. The sentence's meaning is unclear as written.

Section 7.2.30 (page 50): The last clause of the last sentence of the first paragraph reads "is there a need to meet or exceed water quality standards? We suggest that you contact the Environmental Protection Agency or the Florida Department of Environmental Protection to answer this question.

Section 7.3.1.4 (page 54): The second paragraph of the sub-section notes that the modeling plan will "undergo expert review." "Expert review" can refer to in-house review or independent peer

review. We recommend that this point be clarified.

Section 7.4.2.6 (pages 77-78): The second paragraph notes that "sediments in at least one of the project canals (Military Canal) are known to contain high levels of pesticides and heavy metals." We believe that sediment sampling should be conducted, or these data acquired if available, in all conveyance canals located within project boundaries since many of these canals convey water from agricultural and urban lands.

Section 3.2.3 Project Monitoring Plan (page 38): The sub-section notes that a monitoring plan will be developed at the PIR level. It seems reasonable to provide a basic outline of the monitoring plan be developed at the PMP level. If this is done, the Service would like the opportunity to comment on this section when it becomes available. At the very least, the PMP should earmark sufficient funding for project monitoring in the Work Breakdown Structure. Funds allocated for monitoring in the draft PMP seem inadequate for what will be required.

A second monitoring sub-section (7.7, page 90) appears under Section 7, Functional Area Plans. This sub-section includes additional general information regarding the monitoring plan. We recommend that these two sub-sections be combined to better organize and streamline the PMP. Also, sub-section 7.7 notes that "project related water quality and ecological impacts in the freshwater and estuarine systems will be demonstrated by post-construction monitoring of these water bodies..." The Service believes that it is important to include *pre-construction* monitoring in the plan as pre-construction monitoring is crucial for providing baseline information by which to assess ecological lift provided by the project.

Service concerns that will need to be addressed in the future

We would like to take the opportunity with this PAL to document several concerns that the Service has at this time regarding the BBCW Project. Although this project is still in the early planning stages, we believe these issues should be earmarked for detailed discussion at the next PDT meeting or at an appropriate time in the near future.

1. Several STAs are planned for the BBCW Project. The Service is developing recommendations with regard to improving STA design to make them more compatible with fish and wildlife, and will forward them to you when these guidelines are complete.

2. The PMP notes the planned use of a number of pumps in the project. Pumps can entrain fish, and they can serve as migration barriers. The Service recommends that the PDT look closely at alternatives that would reduce or eliminate the need for pumps.

3. The PMP calls for filling in mosquito ditches existing within project boundaries. Many of the ditches currently support coastal mangrove habitat. The Service is concerned about

effects on the existing habitat quality by the filling process (*i.e.*, destruction of mangroves by heavy equipment).

4. Given the fact that land within the project boundaries is under significant development pressure, we support investigating means by which land acquisition can be accelerated.

5. Florida Power and Light's Everglades Mitigation Bank lies within the project boundary of the BBCW Project. The Service is concerned about the possibility of the BBCW Project supplanting the benefits that this mitigation bank provides. Conversely, we would want to ensure that the BBCW Project does not affect the bank in a way that reverses credit already banked. If the latter occurs, then it is our understanding that the BBWC Project will have to provide that function elsewhere.

Summary of Service recommendations

This PAL provides a number of recommendations for revising the BBCW PMP to improve interagency coordination and assist in analyzing impacts to fish and wildlife resources. The BBCW Project will require coordination with the Service early in the planning process to ensure that changes in wildlife habitat conditions either enhance or, at a minimum, do not negatively impact threatened or endangered species. Early and close collaboration with Service biologists will facilitate project success under ESA and FWCA requirements. Early coordination and collaboration with the Service's Environmental Contaminants Program will ensure that Environmental Site Assessments are conducted with regard to threatened or endangered species. The Service recognizes that many important details of the BBCW Project will be presented and discussed at future PDT meetings; therefore, detailed descriptions of existing fish and wildlife resources, prediction of project impacts and restoration benefits, and evaluations of project alternatives will be included in subsequent PALs, and within the draft and final FWCA reports.

In closing, we look forward to seeing the above recommended changes included in the BBCW Project PMP. We fully support any beneficial actions the Corps can take on behalf of efforts to restore wetland habitat in southwest Biscayne Bay, and assist in the conservation and recovery of South Florida's threatened and endangered species. Please feel free to contact Patrick Pitts at (772) 562-3909 (extension 250) if you have any questions regarding this letter.

Sincerely yours,

For James J. Slack
Field Supervisor
South Florida Ecological Services Office

Annex A3-8

cc:
Corps, Jacksonville, Florida (Jill Tefts)
SFWMD, West Palm Beach, Florida (Jorge Marban)
Corps, Jacksonville, Florida (Brad Tarr)
FWC, Vero Beach, Florida (Joseph Walsh)
Miami-Dade County DERM, Miami, Florida
Florida Department of Environmental Protection, West Palm Beach, Florida

United States Department of the Interior

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

December 24, 2002

Colonel James G. May
District Engineer
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Dear Colonel May:

The U.S. Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) for the U.S. Army Corps of Engineers (Corps) regarding the Biscayne Bay Coastal Wetlands Restoration Project (BBCW), a sub-component of the Comprehensive Everglades Restoration Plan (CERP). This PAL is provided in accordance with the Fish and Wildlife Coordination Act (FWCA) of 1958, as amended (16 U.S.C. 661 *et seq.*) and section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). This PAL does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA. This PAL provides guidance and transmits some of our concerns with this project.

Introduction

On November 13, 2002, Service staff participated in the BBCW Project Delivery Team (PDT) meeting whose purpose was to review and discuss the hydrologic and hydrodynamic modeling strategy, describe preferred models, and identify data and information requirements to support project modeling efforts. The primary objective of the meeting was for the PDT to reach consensus on which hydrologic and hydrodynamic models should be selected for further development and use in the project area. The PDT was unable to reach consensus, but provided a number of recommendations for improving the process of model selection and development. The purpose of this PAL is to reinforce many of the PDT recommendations and provide further guidance regarding project modeling efforts, including recommendations for filling pertinent data and information gaps in support of project modeling. Most of the concerns and recommendations appearing in this PAL were forwarded to the Corps' and South Florida Water Management District's (SFWMD) BBCW Project Managers for review and comment in an e-mail sent on November 25, 2002. The Corps satisfactorily addressed many of the recommendations in an e-mail dated Dec. 10, 2002 (see enclosure). We provide our original recommendations in this letter to establish the Service's position regarding project modeling efforts, and we raise additional recommendations and concerns about project modeling.

Project description

The primary purpose of the project is to reduce point-source discharge to Biscayne Bay and rehydrate wetlands along the southwestern margin of the bay. Presently, freshwater runoff from the watershed is discharged to the bay through a system of conveyance canals. This water management practice significantly reduces the amount of fresh water made available to coastal wetlands, and the manner in which it is released causes abrupt freshwater discharges that are physiologically stressful to fish and benthic invertebrates in the bay near canal outlets (Irlandi *et al.* 1997, Montague and Ley 1993, Serafy *et al.* 1997). By redistributing surface water flow from conveyance canals through a spreader system across a broad front, the project is expected to restore or enhance freshwater wetlands, tidal creeks and wetlands, and nearshore bay habitat. Specific restoration goals include restoring freshwater wetlands, enhancing existing mangrove wetlands, re-establishing the nearshore oyster reef community, and re-establishing productive estuarine nursery habitat for fish and shellfish.

The project consists of two major components; 1) a land-based system that retains water, improves wetland hydroperiods, and directs water through alternative routes more like the original drainage system; and 2) an operational change to increase water elevations at the coastal water control structures in the dry season. The project may cover up to 60,000 acres from the Deering Estate at C-100, south into the undeveloped areas southeast of Homestead and Florida City known as the Model Lands and Barnes Sound. Five geographic sub-components have been identified and described. Project features include pump stations, spreader swales, stormwater treatment areas (STAs), flowways, levees, culverts and backfilling canals.

Recent Background Regarding Modeling Efforts

Because the project area includes freshwater wetlands, coastal mangrove wetlands, and nearshore areas of western Biscayne Bay, both a hydrodynamic model for simulating bay circulation and salinity and a groundwater/surface water model for wetland applications have been deemed necessary to fulfill the modeling requirements for the project. Prior to the November 13, 2002, PDT meeting, the Corps provided to PDT members a strategy paper for modeling applications and matrices for selecting appropriate models based on a number of criteria. The strategy paper recommended using the WASH123D model for groundwater/surface water simulations and the TABS-MDS model for hydrodynamic simulations of Biscayne Bay, both of which were developed by the Corps. The WASH123D model satisfied the greatest number of model selection criteria (25) appearing in the Corps' groundwater/surface water model selection matrix. However, other hydrologic models that have been developed for modeling the hydrology of south Florida were not evaluated, some of which may be well-suited for the project area. Perhaps just as importantly, the model selection criteria matrix included at least one inappropriate criterion and it omitted other important and appropriate selection criteria (see details below). Compared to the groundwater/surface water model selection matrix, the evaluation matrix for the Biscayne

Bay hydrodynamic model utilized a qualitative approach, and there was no ranking provided. The Service is concerned that model selection based on these insufficient criteria will compromise the PDT's ability to provide scientifically defensible plan evaluations.

Service Recommendations for Model Selection and Requirements

Based on the above information, it is unclear how the Corps justifies their recommendation for using the WASH123D and TABS-MDS models instead of other available models. Also, a number of other issues regarding model selection and requirements were voiced by representatives of various agencies at the PDT meeting on November 13. As a result, the Service provides the following recommendations for the selection and development of the hydrologic and hydrodynamic models to be used in the BBCW project:

1) Re-evaluate the available models using criteria that are more appropriate and applicable for the project. Some of the criteria appearing in the Corps' model selection matrix are not appropriate for the study area, while more suitable criteria were omitted. For example, one of the selection criteria appearing in the Corps' matrix called for the model to simulate the effects of back-pumping water into Lake Okeechobee. This criterion does not seem applicable to the BBCW project area and should be removed from the matrix. Also, in a recent PDT workshop, performance measures and project alternative evaluation criteria were identified and agreed upon by the PDT. Description, justification, target, and evaluation methodolgy for each evaluation criterion are currently being developed by the ecological sub-team of the PDT. Many of these criteria are also appropriate to apply as model selection criteria and should be considered.

2) Evaluate additional available sub-regional models that were not previously considered. For example, several U.S. Geological Survey (USGS) groundwater/surface water models have been developed for simulating the hydrology of south Florida that were not included in the Corps' initial evaluation including, SEAWAT, SICS, SWIFT2D, and TIME. These USGS models, as well as others, may be applicable to the study area and should be considered.

3) Ensure that groundwater/surface water and hydrodynamic models to be used in the project are initiated, calibrated, and perhaps most importantly, verified appropriately. It is critical that the models are able to satisfactorily reproduce observational data such as salinity, flow, and stage. The process describing how the models are verified should be documented and made available. Although some of the databases required for model verification are not available at this time, such as the salinity field in the nearshore areas of western Biscayne Bay, these data will be collected in the near future and should be utilized as they become available. Also, uncertainty or sensitivity analyses should be conducted on all models used in the project.

4) Perhaps one of the most important capabilities of the models is to accurately simulate the salinity field in the nearshore area of western Biscayne Bay, including the adjacent coastal

wetlands. Many of the project's evaluation criteria and performance measures are based on the restoration of the salinity envelope in the nearshore area to historic estuarine conditions. Restoring the nearshore salinity field is one of the main goals of the project. It is, therefore, critical that high-frequency salinity data be obtained from these areas prior to, or during the initiation, calibration, and verification of the model(s).

5) To minimize the effects of boundary conditions, every effort should be made to extend model domain beyond the immediate project study area. Due to the importance of linking the BBCW project area with upstream project areas, the Service recommends setting a western boundary for the sub-regional groundwater/surface water model that is as far westward as possible. A potential boundary would be L-31N. Model boundaries should be determined in consideration of adjacent project boundaries. Similarly, the linkages between the South Florida Water Management Model (SFWMM), the sub-regional groundwater/surface water model, and the Biscayne Bay hydrodynamic model should be thoroughly described. The SFWMM is a system-wide model that is linked to most of the U.S. Geological Survey (USGS) Across Trophic Level System Simulation (ATLSS) ecological models and will be used for regional evaluation of all CERP projects. Explaining the linkage between the SFWMM model and the BBCW sub-regional model is an important step in the project's modeling process.

6) Both the groundwater/surface water and hydrodynamic models should have multi-year output capability to account for inter- and intra-annual variability in the hydrology of the study area. Simulating this variability is important in evaluating project alternatives. For example, one of the evaluation criteria is to increase and improve the foraging habitat for wading birds, including roseate spoonbills. The target for the criterion is for substantial portions of the primary spoonbill foraging grounds in the BBCW project area (primarily the Model Lands) to have water depths of less than 12 cm from mid-November through the end of January (Lorenz and Burzycki 2002). Water levels should recede slowly without reversals throughout the project area, and reversals in water depth caused by canal discharge should be eliminated during this period. Water levels should meet the above criteria in 7 out of 10 years. Therefore, in order to determine which alternative will meet the target in 7 out of 10 years, the model must be able to provide output for a minimum of 10 years, and perhaps just as importantly, the model must include a continuous period of simulation.

7) The groundwater/surface water model should have a water level resolution and accuracy of no less than ±0.5 foot. WASH123D currently has a resolution of only ±1 foot. Given that the topography in the project area is so flat, and that some of the evaluation criteria rely on very specific water levels e.g.) 12 cm noted in the wading bird example above), fine resolution in water levels predicted by the model is imperative.

8) Refining the vertical resolution of the groundwater/surface water model will depend upon high resolution topography to calibrate and validate the model. According to the Work Breakdown

Structure in the BBCW Project Management Plan (PMP), topographic data collection using LIDAR is not scheduled for initiation until August 2003. Since these data are critical to the modeling efforts, the Service recommends accelerating the schedule for LIDAR data collection.

9) Hydrologic and hydrodynamic models should have the capability to link with appropriate ecological models. Several of the USGS ATLSS models may be appropriate for the project area including the freshwater fish model (ALFISH), the estuarine fish model (ALFISHES), American alligator model, American crocodile model, and the wading bird models. Also, a tool should be developed to predict vegetation changes or shifts to aid in project alternative selection.

10) Hydrologic and hydrodynamic models should be flexible enough to link with, or have the capability to be compared with, other sub-regional models that will be employed in adjacent CERP projects. Of particular importance will be the capability to link or compare models developed for the BBCW Project with those developed for the C-111 North Spreader Canal Project and the L-31N Project, given the significant geographic overlap among these three projects.

11) It is critically important that any hydrodynamic or hydrologic model used in the project be capable of differentiating between project alternatives. Without this fundamental capability, models are essentially useless as predictive tools for evaluating alternatives.

12) Thorough model documentation plays a vital role in their use and acceptance in the project. Documentation should include all aspects of the model, including function, operation, output, calibration, and validation.

Data and Information Needs to Support Modeling Efforts

As noted above, acquiring high-frequency (e.g. half-hourly) salinity data from a sufficient number of stations in the nearshore region of western Biscayne Bay is probably the most important data gap to fill for the BBCW project. At a minimum, data should be collected near the bottom and near the surface to capture any stratification in salinity. Without these data, describing baseline salinity conditions in this area will be nearly impossible, and more importantly, it will be impossible to calibrate and validate the hydrologic and hydrodynamic models discussed above. This crucial data need has been discussed at several past PDT meetings. Currently, Biscayne National Park and CERP's REstoration, COordination, and VERification (RECOVER) Program are planning to collect some of the needed salinity data. However, several spatial gaps remain to be filled.

High quality, high resolution bathymetric and topographic data is another important data gap that should be filled in support of modeling efforts. The PMP identifies LIDAR as the primary tool for collecting these data in the project area. It is understood that LIDAR represents the state-of-

the-art in topographic survey instrumentation and has a vertical resolution of ≤1 foot. However, the Service is concerned that LIDAR may not be appropriate for determining topography in the vicinity of certain vegetation types, such as forested areas having a moderate to heavy canopy. The BBCW project area contains relatively extensive areas of several types of forests, all of which can have dense canopy coverage, including the coastal mangrove fringe and Brazilian pepper (*Schinus terebinthifolius*) forests. It is critical that accurate topographic data are collected in all areas of the project, regardless of vegetation type. In addition, bathymetric LIDAR is only being collected from Shell Point south to Turkey Point. This excludes Manatee Bay and Barnes Sound, both of which are part of the project area. The Service recommends that these two water bodies also be included in the water-penetrating LIDAR bathymetric surveys.

Installation of groundwater/surface water wells in the coastal wetlands have been identified in the PMP. These wells will provide a variety of information valuable to the development of the groundwater/surface water model. Data from the wells will better quantify the geology of the area, groundwater elevation and movement, seepage of groundwater into Biscayne Bay, and other aquifer characteristics such as porosity of overlying soils.

Additional Concerns and Recommendations

The Service is sympathetic to the delay the above recommendation may invoke to the project's timetable. However, choosing and developing models most suitable to the project area is critical to the alternative selection process. We do not anticipate that this will prohibitively delay the project beyond the current PMP schedule. The Service understands the Corps' need to ensure timely completion of the Project Implementation Report (PIR). The sooner the PIR is completed the sooner a concerted effort can be made to acquire the lands necessary for the project, which the Service believes is of the utmost urgency. The Service supports any strategy for accelerating land acquisition due to the unusually high developmental pressures in the project area. To that end, an option to be considered is the simultaneous development of more simplified tools that are based on statistical relationships which can be utilized to initially screen project alternatives. It is important to keep in mind that the primary purpose of the models is to differentiate between project alternatives. If more simplified tools can be developed to perform this function, especially if they can be developed on an accelerated schedule when compared to the models, then they should be considered.

Summary of Service Recommendations

This PAL provides a number of recommendations for selecting and developing any hydrologic and hydrodynamic models to be used in the BBCW project. Utilizing the best available hydrologic and hydrodynamic models is of critical importance to selecting the most beneficial project alternative. To that end, the Service recommends an additional review and evaluation of all models applicable to the project area. The re-evaluation should fully consider how the models

address project goals and objectives, performance measures, and alternative evaluation criteria. Proper initiation, calibration, and verification of models is also of critical importance to ensure the most accurate simulations of hydrologic and hydrodynamic processes in the project area. Model calibration and validation will require filling the data gaps identified above, including nearshore salinity measurements, high-resolution bathymetric and topographic data, and groundwater information.

In closing, we are committed to providing timely assistance to the Corps and the PDT to ensure that appropriate hydrologic and hydrodynamic models will be selected and developed to aid in the evaluation of the project alternatives that will soon be proposed for the BBCW project. Through effective communication, consultation, and coordination the Service, the Corps, and the remainder of the PDT will successfully implement this project and succeed in conserving our valuable fish and wildlife resources. We fully support and appreciate the beneficial actions the Corps is taking to restore wetland habitat in southwest Biscayne Bay, and to conserve and recover South Florida's threatened and endangered species. Please feel free to contact Patrick Pitts at (772) 562-3909, extension 250 if you have any questions regarding this letter.

Sincerely yours,

James J. Slack
Field Supervisor
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Enclosure

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The following documentation was extracted from the Army Corps of Engineers' (Corps) revised "Strategy Paper for Modeling Application and Enhancement for the Biscayne Bay Coastal Wetlands Project, CERP, Florida," submitted to the Service December 10, 2002, via e-mail. For a copy of the entire 38-page document contact Mitch Granat (Corps, Jacksonville).

RESPONSE TO FWS COMMENTS ON BBCW STRATEGY PAPER

Introduction

On November 13, 2002, Service staff participated in the BBCW Project Delivery Team (PDT) meeting whose purpose was to review and discuss the hydrologic and hydrodynamic modeling strategy, describe preferred models, and identify data and information requirements for modeling efforts in support of the project. The primary objective of the meeting was for the PDT to reach consensus on which hydrologic and hydrodynamic models should be selected for further development and use in the project area. The PDT was unable to reach consensus, but provided a number of recommendations for improving the process of model selection and development. The purpose of this PAL is to reinforce many of the PDT recommendations and provide further guidance regarding project modeling efforts, including recommendations for filling pertinent data and information gaps in support of project modeling.

Recent Background Regarding Modeling Efforts

Because the project area includes freshwater wetlands, coastal mangrove wetlands, and nearshore areas of western Biscayne Bay, both a hydrodynamic model for simulating bay circulation and salinity and a groundwater/surface water model for wetland applications have been deemed necessary to fulfill the modeling requirements for the project. Prior to the November 13 PDT meeting, the Corps provided to PDT members a strategy paper for modeling applications and matrices for selecting appropriate models based on a number of criteria. The strategy paper recommended using the WASH123D model for groundwater/surface water simulations and the TABS-MDS model for hydrodynamic simulations of Biscayne Bay, both of which were developed by the Corps. The WASH123D model satisfied the greatest number of model selection criteria (25) appearing in the Corps' groundwater/surface water model selection matrix. However, other hydrologic models that have been developed for modeling the hydrology of south Florida were not evaluated, some of which may be well-suited for the project area (see below). Perhaps just as importantly, the model selection criteria matrix included at least one inappropriate criterion and it omitted other important and appropriate selection criteria (see

details below). Compared to the groundwater/surface water model selection matrix, the evaluation matrix for the Biscayne Bay hydrodynamic model utilized a qualitative approach, and there was no ranking provided.

Recommendations for Model Selection and Requirements

Based on the above information, it is unclear how the Corps justifies their recommendation for using the WASH123D and TABS-MDS models instead of other available models. Also, a number of other concerns regarding model selection and requirements were voiced by representatives of various agencies at the PDT meeting on November 13. As a result we have a number of recommendations regarding modeling efforts in the BBCW project area, including:

The proposed coupled modeling approach recommendation was based on a preliminary assessment of available modeling packages performed by South Florida Water Management District assisted by Kimley-Horn and Associates, Inc., (undertaken for the Everglades Agricultural Area Project Implementation Report) with the addition of some general Biscayne Bay Coastal Wetlands modeling needs included. The initial matrix array was maintained to avoid the perception of bias or conflict of interest in its development. Critical criteria necessary to meet the specific needs of the Coastal Wetlands Project were also identified from the overall list of criteria. The total number of criteria met and the total number of critical criteria met was then tabulated for each of the 17 models considered and is summarized in the last two columns of the refined matrix. The highest-ranking models were easily identified from this final summary and basically the same models stood out using either of the two sets of criteria. The specific technical engineering and design needs of the Biscayne Bay Coastal Wetlands (flexibility of models to address design planning and assessment) were then considered along with previously identified performance measure considerations (ability to assess flows, stage, hydroperiod, and associated salinity responses) in making the final recommendation for the selected models. An added benefit of the recommended modeling package was its ability to meet the desired fast track schedule for project design and implementation needs.

1) Re-evaluate the available models using criteria that are more appropriate and applicable for the project. Some of the criteria appearing in the Corps' model selection matrix are not appropriate for the study area, while more suitable criteria were omitted. For example, one of the selection criteria appearing in the Corps' matrix called for the model to simulate the effects of back-pumping water into Lake Okeechobee. This criterion does not seem to be applicable to the BBCW project area and should be removed from the matrix. Also, in a recent PDT workshop, performance measures and project alternative evaluation criteria were identified and agreed upon

by the PDT. Fact sheets for these performance measures and evaluation criteria are currently being developed by the ecological sub-team of the PDT. Some of the alternative evaluation criteria are appropriate for use as model selection criteria and should be considered.

As indicated in the above general response, the identified 17 models were evaluated using both sets of criteria with the same general results. A new matrix has been developed using specific criteria more appropriate and applicable to the specific Biscayne Bay Coastal Wetlands Project needs. As indicated above, the same models were identified as highest ranked using either the initial complete criteria or the specific critical project criteria. A natural grouping of models resulted from this analysis. The top five models with scores greater than 20 (out of the initial 25) for the total of criteria met and greater than 6 (out of the 8) for the more important criteria met, was carried forward to the final revised matrix that more adequately identified specific Coastal Wetlands modeling needs. The model's capabilities to address the identified performance measures associated with flows, stage, hydroperiod, and associated salinity response were also considered in selecting the recommended model. Based on the revised evaluation matrix,

2) Evaluate additional available sub-regional models that were not previously considered. For example, several U.S. Geological Survey (USGS) groundwater/surface water models have been developed for simulating the hydrology of south Florida that were not included in the Corps' initial evaluation including, SEAWAT, SICS, SWIFT2D, and TIME. These USGS models, as well as others that may be applicable to the study area, should be considered.

It is unfortunate that the complete USGS modeling package (FTLOADDS) was not previously identified or included in the initial matrix of considered models. It should be emphasized, however, that the underlying code to the USGS model, MODFLOW, was included in the original matrix. The referenced TIME and SICS codes are both site-specific applications of the SEAWAT (a combined version of MODFLOW and MT3D) and SWIFT2D (formerly SIMSYS2D) model codes. The SEAWAT code has been developed and applied in the earlier Biscayne Bay Feasibility Study for boundary data input to the TABS-MDS hydrodynamic model. The SWIFT2D application has not occurred for the Biscayne Bay area and in addition, the required 1-D component needed to address this project's specific requirements for canal flow assessments and project design would require a substantial amount of additional development time and funding.

We have had additional discussion with the USGS regarding their model's full capability to ensure our understanding of their model's capability. Following a more exhaustive review and analysis, the USGS has confirmed that their model is presently unable to

handle the Biscayne Bay Coastal Wetlands project modeling requirements and commitments. Their code does not appropriately handle the 1-D canal flow and structure assessment components required in the Coastal Wetlands project. This would require several code modifications and additional enhancements that presently are beyond their capabilities and workload. At this time, the USGS has therefore officially withdrawn their interest and desire to undertake any and all modeling tasks required as part of the BBCW project. They have also indicated their apology for any inconveniences they might have caused in this regard. A copy of their email response is attached to this response.

3) Ensure that whatever groundwater/surface water and hydrodynamic models to be used in the project are initiated, calibrated, and perhaps most importantly, verified appropriately. It is critical that the models are able to satisfactorily reproduce observational data such as salinity, flow, and stage. The process describing how the models are verified should be documented and made available. Although some of the databases required for model verification are not available at this time, such as the salinity field in the nearshore areas of western Biscayne Bay, these data will be collected in the near future and should be utilized as they become available. Also, uncertainty or sensitivity analyses should be conducted on all models used in the project.

As identified in the Project Management Plan (PMP), model validation (what was historically called model calibration and model verification) is part of the planned tasks and modeling scope of work for this project. Also as identified in the PMP, a draft validation report and an alternative assessment report will be developed for thorough review by the PDT and a model evaluation and oversight team of independent expert modelers and scientists. A revised final report will also be published documenting the entire study process. Sensitivity and uncertainty analyses are considered part of the validation process and will also be documented in these reports.

4) Perhaps one of the most important capabilities of the models is to accurately simulate the salinity field in the nearshore area of western Biscayne Bay, including the adjacent coastal wetlands. Many of the project's evaluation criteria and performance measures are based on the restoration of the salinity envelope in the nearshore area to historic estuarine conditions. Restoring the nearshore salinity field is one of the main goals of the project. It is, therefore, critical that high-frequency salinity data be obtained from these areas prior to, or during the initiation, calibration, and verification of the model(s).

The selected and proposed TABS-MDS model is an unstructured finite element code that is ideally suited to address the detailed nearshore needs of the study. The typical time-step used in the TABS-MDS code is 15 minutes, although a reduced time step is possible if needed. The unstructured mesh allows increased resolution wherever necessary and also allows more exact geometric schematization that will be critical in better resolving the tidal creeks. The WASH123D code is also an unstructured finite element code that nicely complements the TABS-MDS code simplifying the desired and required close linkages between the two modeling systems.

5) To minimize the effects of boundary conditions, every effort to extend model domain beyond the immediate project study area should be employed. Due to the importance of linking the BBCW project area with upstream project areas, we recommend investigating having a western boundary for the sub-regional groundwater/surface water model that is as far westward as possible. A potential boundary would be L-31N. Model boundaries should be determined in consideration of adjacent project boundaries. Similarly, the linkages between the South Florida Water Management Model (SFWMM or 2x2), the sub-regional groundwater/surface water model, and the Biscayne Bay hydrodynamic model should be thoroughly described. The SFWMM is a system-wide model that is linked to most of the ATLSS ecological models and will be used in many CERP projects. Explaining the linkage between the SFWMM model and the BBCW sub-regional model is an important step in the project's modeling process.

Appropriate modeling techniques and procedures will be followed in this study's modeling application. A critical issue in any modeling is to ensure that the model boundaries are sufficiently removed from the study area of interest, as far as practical and possible. The approach to take in this application will use the initial regional model that extends all the way out to L31N. A balanced approach will be followed in the model refinement process of increasing mesh resolution as required for engineering and design purposes. The WASH123D results can be consolidated as RECOVER sees fit to meet and accomplish their needs and requirements.

6) Both the groundwater/surface water and hydrodynamic models should have multi-year output capability to account for inter- and intra- annual variability in the hydrology of the study area. Simulating this variability is important in evaluating project alternatives. For example, one of the evaluation criteria is to increase and improve the foraging habitat for wading birds, including roseate spoonbills. The target for the criterion is for substantial portions of the primary spoonbill foraging grounds in the BBCW project area (primarily the Model Lands) to have water levels of less than 12 cm from mid-November through the end of January. Water levels should recede slowly without reversals throughout the project area, and reversals in water depth caused by canal discharge should be eliminated during this period. Water levels should meet the above criteria in

7 out of 10 years. Therefore, in order to determine which alternative will meet the target in 7 out of 10 years, the model must be able to provide output for a minimum of 10 years, and perhaps just as importantly, the model must include a continuous period of simulation.

Both the WASH123D and TABS-MDS models have the capability of multi-year runs and output capability. The specific needs of each model will need to be carefully determined in the development of the testing plans. The proposed coupled modeling approach will be able to provide the desired information identified. Documentation for the 7 out of 10 years is desired to better understand this full requirement.

7) The groundwater/surface water model should have a water level resolution and accuracy of no less than _0.5 feet. WASH123D currently has a resolution of only ±1 foot. Given that the topography in the project area is so flat, and that some of the evaluation criteria rely on very specific water levels (eg. 12 cm noted in the wading bird example above), fine resolution in water levels predicted by the model is imperative.

The accuracy of any model is generally dictated by the quantity and quality of the available field data. Such is the case in this study. The proposed modeling package codes have the capability to predict to, and beyond, the limitations of the field data. The +/- one-foot resolution identified at the 13 November 2002 presentation was misinterpreted. This interval was the assigned level of confidence based on the confidence of the field data. With the anticipated improved data collection, this interval will be tightened.

8) Refining the vertical resolution of the groundwater/surface water model will depend upon high resolution topography to calibrate and validate the model. According to the Work Breakdown Structure in the BBCW Project Management Plan (PMP), topographic data collection using LIDAR is not scheduled for initiation until August 2003. Since these data are critical to the modeling efforts, we recommend accelerating the schedule for LIDAR data collection.

Agree that this survey information is critical to the study efforts. The schedule for this survey tasking was in error and will be corrected. Water-penetrating LIDAR data collection has already been contracted and initiated for the required new bathymetric data collection in the nearshore regions of the study area. The topographic LIDAR data collection is also now anticipated to be collected this winter/spring as soon as low/no water levels permit. These data sets should provide the necessary high quality data needed to improve the overall confidence of field and modeling results.

9) Hydrologic and hydrodynamic models should have the capability to link with appropriate ecological models. Several of the USGS Across Trophic Level System Simulation (ATLSS) models may be appropriate for the project area including the fresh water fish model (ALFISH), the estuarine fish model (ALFISHES), American alligator model, American crocodile model, and the wading bird models. Also, a tool should be developed to predict vegetation changes or shifts to aid in project alternative selection.

Model output from both the WASH123d groundwater/surface water modeling and the TABS-MDS hydrodynamic modeling efforts will be available for use by staff to perform the desired ecologic modeling necessary. The development of predictive vegetation modeling is beyond the scope of the hydraulic modeling efforts, but the output information from these models could also be used in the development of the desired ecologic models.

Data and Information Needs to Support Modeling Efforts

As noted above, acquiring high-frequency (eg. half-hourly) salinity data from at least half a dozen stations in the nearshore region of western Biscayne Bay is probably the most important data gap to fill for the BBCW project. Without these data, describing baseline salinity conditions in this area will be nearly impossible, and more importantly, it will be impossible to calibrate and validate the hydrologic and hydrodynamic models discussed above. This crucial data need has been discussed at several past PDT meetings. Additionally, accurate bathymetry data from the nearshore area should be collected to assist modeling efforts.

The necessary salinity data collection is a topic that needs additional discussion and support from the PDT. The continued delays in reaching agreement on the modeling efforts, the identification of performance measures, and the data collection needs may cause an overall delay in the desired completion of this study. This data collection effort should be made a priority issue for the PDT to address. A joint PDT subteam meeting to address these needs has tentatively been scheduled for December 17 and 18, 2002. As stated above, the necessary water-penetrating LIDAR data collection in the nearshore study area has already been contracted and initiated. This new bathymetric information will cover a 2.5 mile wide and about 17 mile long area between Shoal Point and Turkey Point. New upland LIDAR data collection will also be undertaken as soon as water levels permit during 2003.

High quality, high resolution topographic data is another important data gap that should be filled in support of modeling efforts. The PMP identifies LIDAR as the primary tool for collecting

topographic data in the project area. It is understood that LIDAR represents the state-of-the-art in topographic survey instrumentation and has a vertical resolution of ≤1 foot. However, we are concerned that LIDAR may not be appropriate for determining topography in the vicinity of certain vegetation types, such as forested areas having a moderate to heavy canopy. The BBCW project area contains several types of forests, all of which can have dense canopy coverage, including the coastal mangrove fringe and Brazilian pepper (*Schinus terebinthifolius*) forests. It is critical that accurate topographic data are collected in all areas of the project, regardless of vegetation type.

The anticipated topographic LIDAR data collection, analysis, and data reduction will provide the necessary quality and quantity of information necessary to support the modeling effort. Data analysis and reduction is far more important and time consuming then the data collection aspect of this acquisition. Both groundtruthing and more sophisticated filtering and analysis routines will be incorporated into the scopes of work in this effort to ensure that the appropriate accuracy in topographic data will be available regardless of vegetation type. Previous problems with LIDAR data collection have been related to insufficient and/or inappropriate filtering and post-processing of the collected information. Presently planned collection and analysis routines have overcome these difficulties.

Installation of groundwater/surface water wells in the coastal wetlands have been identified in the PMP. These wells will provide a variety of information valuable to the development of the groundwater/surface water model. Data from the wells will better quantify the geology of the area, groundwater elevation and movement, seepage of groundwater into Biscayne Bay, and other aquifer characteristics such as porosity of overlying soils.

Agree that this information is also critical to the successful modeling application and adequate engineering design for this project. The location of these wells will be closely coordinated between the field effort staff and the selected modeling staff. Geotechnical data collection is also planned to be addressed at the December 17 and 18, 2002 joint PDT sub team meeting.

Project Schedule

We are sympathetic to the delay the above recommendations may invoke to the project's timetable. However, choosing and developing models most suitable to the project area is critical to the alternative selection process. We do not anticipate that this will prohibitively delay the project beyond the current PMP schedule. We understand the Corps' need to ensure timely completion of the Project Implementation Report (PIR). The sooner the PIR is completed the

sooner a concerted effort can be made to acquire the lands necessary for the project, which we believe is of the utmost immediacy. We support any strategy for accelerating land acquisition due to the unusually high developmental pressures in the project area. To that end, an option to be considered is the simultaneous development of more simplified tools that are based on statistical relationships which can be utilized to evaluate project alternatives. It is important to keep in mind that the primary purpose of the models is to differentiate between project alternatives. If more simplified tools can be developed to perform this function, especially if they can be developed on an accelerated schedule when compared to the models, then perhaps they should be considered.

Since this study and project requires predictive modeling assessment, simplified statistical relationships (regression modeling) will not be able to provide the needed assessments for appropriate design and selection of the recommended alternative for authorization. The South Florida Water Management District has been proactive in this regard and has been acquiring lands in the BBCW project area through the Save Our Rivers Willing Sellers Program and through funds allocated by the Florida Legislature for land acquisition in Biscayne Bay. In addition, Miami-Dade County Department of Environmental Resources Management (DERM) has also acquired land through the Environmentally Endangered Lands (EEL) Program.

United States Department of the Interior

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

June 5, 2003

Colonel James G. May
District Engineer
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Dear Colonel May:

The Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) for the U.S. Army Corps of Engineers (Corps) regarding the Biscayne Bay Coastal Wetlands Restoration (BBCW) Project, a component of the Comprehensive Everglades Restoration Plan (CERP). This PAL is provided in accordance with the Fish and Wildlife Coordination Act (FWCA) of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and section 7 of the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This PAL does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA. This PAL provides guidance and transmits some of our concerns with this project.

Introduction

The Project Delivery Team (PDT) of the Biscayne Bay Coastal Wetlands Project has been involved in identifying and developing ecological performance measures for the project. To facilitate this effort a 3-day workshop was conducted October 29-31, 2002. Based on information provided at the workshop by expert ecologists and hydrologists familiar with the project area, PDT members agreed upon a set of ecological performance measures. Each performance measure addresses at least one of the five primary project objectives (see below). Members of the PDT's ecological subteam were then tasked with documenting justification, targets, and evaluation methodology for each of the performance measures, with highest priority given to those performance measures that will be used in the evaluation of project alternatives (evaluation performance measures). The purpose of this PAL is to document those ecological performance measures to which the Service has contributed significantly or taken the lead role in developing. Note that the performance measures described in Appendix A represent only a partial list of the complete set of ecological performance measures being developed for the project. Documentation sheets for all ecological performance measures being developed for the BBCW Project can be found at ftp://ftp.sfwmd.gov/pub/ralleman. Also, the performance measures described below are still under development. Refinement of targets and evaluation methodology will be required during plan formulation.

Project description

The primary purpose of the project is to reduce point-source discharge to Biscayne Bay and rehydrate wetlands along the southwestern margin of the bay. Presently, freshwater runoff from the watershed is discharged to the bay through a system of conveyance canals. This water management practice significantly reduces the amount of fresh water made available to coastal wetlands, and the manner in which it is released causes abrupt freshwater discharges that are physiologically stressful to fish and benthic invertebrates in the bay near canal outlets (Montague and Ley 1993, Irlandi *et al.* 1997, Serafy *et al.* 1997). By redistributing surface water flow from conveyance canals through a spreader system across a broad front, the project is expected to restore or enhance freshwater wetlands, tidal creeks and wetlands, and nearshore bay habitat. Specific restoration goals include restoring freshwater wetlands, enhancing existing mangrove wetlands, reestablishing the nearshore oyster reef community, and reestablishing productive estuarine nursery habitat for fish and shellfish.

The project consists of two major components: 1) a land-based system that retains water, improves wetland hydroperiods, and directs water through alternative routes more like the original drainage system; and 2) an operational change to increase water elevations at the coastal water control structures in the dry season. The project may cover up to 60,000 acres from the Deering Estate at C-100, south into the undeveloped areas southeast of Homestead and Florida City known as the Model Lands and Barnes Sound. Five geographic subcomponents have been identified and described. Project features include pump stations, spreader swales, stormwater treatment areas (STAs), flowways, levees, culverts, and backfilling canals.

Project objectives

The BBCW project has the following five specific objectives, as defined in the Project Management Plan (approved September 2002):

1. Reestablish productive nursery habitat along the shoreline;

2. Redistribute freshwater flow to minimize point source discharges to improve freshwater and estuarine habitat;

3. Restore and improve quantity, quality, timing, and distribution of freshwater to the bay and Biscayne National Park;

4. Preserve and restore spatial extent of natural coastal glades habitat;

5. Reestablish connectivity between Biscayne Coastal Wetlands, C-111 Basin, Model Lands, and adjacent basins.

Performance measures developed by the Service

As noted above, each of the ecological performance measures addresses at least one of the five project objectives. The 11 performance measures to which the Service has contributed significantly or taken the lead role in developing are listed below. The first eight include those performance measures that were part of the original set agreed upon at the October workshop. Performance measure numbers correspond to the above project objectives that the measure addresses. The final three ecological performance measures were co-developed for the Model Lands region by the BBCW and C-111 Spreader Canal PDT ecological subteams, as the Model Lands represent a significant geographic overlap between these two projects.

1.C. Salinity concentrations in coastal wetlands become more compatible with juvenile crocodile and estuarine fish habitat.

2.A. Percentage of total freshwater flow through coastal canals is reduced by redirection through coastal wetlands.

3.E. The typical amplitude and frequency of extreme salinity excursions at canal mouths decreases.

4.C. Reduce areal extent of mangrove white zone in favor of other wetland types.

4.D. Increase available feeding habitat for roseate spoonbills or other wading birds without increasing the risk of collision with military aircraft.

4.E. Increase wetland bird prey fish abundance.

5.A. Establish hydrological connections within and among basins.

5.B. Establish wildlife corridors within and among basins.

ML1. Enhance hydroperiods for freshwater marshflats (excluding sloughs and depressional features) and bayhead tree island vegetation in Zone 3 and Zone 5 of the Model Lands, and appropriate areas north of the FPL cooling canals.

ML2. Restore historic areal extent and salinity regimes to the freshwater marshflats and bayhead tree islands in zones 3, 5, and 7 (the white zone) of the Model Lands.

ML3. Optimize feeding habitat and improve reproductive success for wading birds in freshwater, oligohaline, mesohaline marshflats (excluding sloughs and depressional features) in zones 2 through 6.

Documentation sheets for each performance measure listed above are provided in Appendix A of this letter. Documentation sheets include the following subsections: Evaluation Criterion Number and Name, Criterion Target and Description, Justification and Current Condition, Evaluation Method/Approach, Source/Contact Information, and Comments/Notes. As noted above, these performance measures require refinement, particularly their targets and evaluation methodologies, so they should not be considered complete.

Evaluation of Performance Measures

As noted in our PAL dated December 24, 2002, hydrodynamic and hydrologic models will play a crucial role in evaluating performance measures and setting targets. Models must be able to differentiate between project alternatives based on all project performance measures. Modeling tools to be used in the project include the subregional WASH123 hydrologic model and the TABS-MDS hydrodynamic model for Biscayne Bay, both of which are being developed by the Corps. The South Florida Water Management Model (SFWMM) (the 2x2 Model) will also be utilized to provide boundary conditions for the subregional models. Presently, physical data sets are being collected to calibrate and verify the two subregional models. These data include topographic and bathymetric surveys, stage, flow, and salinity parameters. High quality observational data are required for accurate model calibration and validation.

Summary

In closing, we believe that an excellent set of ecological performance measures has been identified for the BBCW Project. However, few of the performance measures have been fully developed; some are listed only by name and number with only cursory documentation. At this time, these undeveloped performance measures serve as placeholders only, and it is important that they be documented fully during the plan formulation process. Determining criterion targets and evaluation methodology is of particular importance. Appropriate development and documentation of ecological performance measures will require effective communication, consultation, and coordination with all PDT ecological subteam members. Given the expertise and professionalism of the subteam members, we are confident that the performance measures will be developed properly and in a timely manner.

We appreciate the opportunity to contribute to the development of the ecological performance measures for this important restoration project, and we acknowledge the beneficial actions the Corps is taking to restore wetland habitat in southwest Biscayne Bay, and to conserve and

recover South Florida's threatened and endangered species. Please feel free to contact Patrick Pitts at 772-562-3909, extension 250 if you have any questions regarding this letter.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
Corps, Jacksonville, Florida (Shelley Trulock)
SFWMD, West Palm Beach, Florida (Jorge Marban)
Corps, Jacksonville, Florida (Brad Tarr)
FWC, Vero Beach, Florida (Dr. Joseph Walsh)
Florida Department of Environmental Protection, West Palm Beach, Florida

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United States Department of the Interior

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

October 23, 2003

James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Duck:

The U.S. Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) for the U.S. Army Corps of Engineers (Corps) regarding the Biscayne Bay Coastal Wetlands Restoration Project (BBCW), a component of the Comprehensive Everglades Restoration Plan (CERP). This PAL is provided in accordance with the Fish and Wildlife Coordination Act (FWCA) of 1958, as amended (48 Stat. 411;16 U.S.C. 661 *et seq.*) and section 7 of the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884;16 U.S.C. 1531 *et seq.*). This PAL does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA. This PAL provides guidance and recommendations regarding resource conservation issues associated with the BBCW project. Additional natural resource protection legislation relevant to this project include the National Environmental Policy Act, as amended (42 U.S.C. 4321 *et seq.*), the Migratory Bird Treaty Act (16 U.S.C. 703-712), the Estuary Protection Act (16 U.S.C. 1221-1226), and the Coastal Zone Management Act (16 U.S.C. 1451-1464).

I. Introduction

The purpose of this PAL is to describe two concerns associated with the BBCW project and provide recommendations for resolving these concerns. The first concern is the need for the development of a high resolution, comprehensive, and current vegetation map for the project area. Such a map is critical for describing existing conditions, evaluating and differentiating project alternatives, and assessing project success. Existing vegetation maps available for the project area are either obsolete, utilize inappropriate vegetation classes, or are of insufficient spatial resolution. The second concern is the need and justification for additional fresh water for the project area and the identification of a potential source. The reduction in freshwater flows to the wetlands and nearshore waters of Biscayne Bay has been well documented, as has the need for additional water for this area. Obtaining water from upstream sources, such as those described in the CERP's Indian River Lagoon South Feasibility Study (IRLSFS), may provide the most practical, beneficial, and cost-effective option for providing additional water to the BBCW project.

II. Project description

The primary purpose of the BBCW project is to reduce point-source discharge to Biscayne Bay and rehydrate wetlands along the southwestern margin of the bay. Presently, freshwater runoff from the watershed is discharged to the bay through a system of conveyance canals. This water management practice significantly reduces the amount of fresh water made available to coastal wetlands, and the manner in which it is released causes abrupt freshwater discharges that are physiologically stressful to fish and benthic invertebrates in the bay near canal outlets. By redistributing surface water flow from conveyance canals through a spreader system across a broad front, the project is expected to restore or enhance freshwater wetlands, tidal creeks and wetlands, and nearshore bay habitat. Specific restoration goals include restoring freshwater wetlands, enhancing existing mangrove wetlands, re-establishing the nearshore oyster reef community, and re-establishing productive estuarine nursery habitat for fish and shellfish.

The project consists of two major components; 1) a land-based system that retains water, improves wetland hydroperiods, and directs water through alternative routes more similar to the natural hydrology of the area; and 2) an operational change to increase water elevations at the coastal water control structures in the dry season. The project may cover up to 60,000 acres from the Deering Estate at C-100, south into the undeveloped areas southeast of Homestead and Florida City known as the Model Lands and Barnes Sound. Five geographic sub-components have been identified and described. Project features and plans include pump stations, spreader swales, Stormwater Treatment Areas, flowways, levees, culverts and backfilling canals.

III. Vegetation Map

In order to plan for and assess the success of hydrologic and ecologic restoration in the BBCW project area, an accurate characterization and delineation of the area's vegetation is necessary prior to alternative selection and project construction. The map should be of the highest resolution practicable and be based on a hierarchical classification scheme that can be related to major environmental factors affected by restoration (*e.g.*, water level, hydroperiod, salinity). During the recent development of target end states for the project by the ecological subteam of the Project Delivery Team (PDT), the need for a current and comprehensive vegetation map was identified as a high priority. Such a map would serve numerous useful purposes including:

1. Defining and describing existing conditions in the project area. It is imperative to know what types and to what extent various vegetation types exists in the project area.

2. Evaluating all habitat types in the project area, with particular emphasis on freshwater and estuarine wetland types. For example, it is important to determine the location and types of graminoid marshes in the project area, since different graminoid species have different hydrologic and salinity requirements (*e.g.*, spike rush [*Eleocharis* spp.] versus sawgrass

[*Cladium jamaicense*]). Tree islands are known to exist within the project boundary, but it is important to know their extent and location so that alternatives can be designed to conserve these features. Furthermore, having a comprehensive and detailed vegetation map is critical to the process of quantifying habitat units for the project.

3. Evaluating and differentiating project alternatives. Changes in hydroperiod, water levels, and salinity produced by the project will affect plant communities in different ways, depending on the species' hydrologic requirements or preferences. The identification of vegetation type and location will help determine how hydrologic changes provided by given alternatives will affect ecology of the area.

4. Quantifying project benefits (*i.e.*, ecological lift) is another important reason for creating a current vegetation map. It has been suggested that conversion of areas presently dominated by invasive non-native vegetation to native species will likely provide one of the most important benefits to the freshwater wetlands through implementation of the project. To that end, accurate delineation of non-native vegetation coverage will be critical to quantifying the number of acres of non-native vegetation that can or will be converted to native habitat.

The general zonation of coastal vegetation in the project area is relatively well understood and has been described (Egler 1952; U.S. Environmental Protection Agency [EPA] 1994; Ross et al. 2000). One of the best available maps for the area between the Shoal Point and Turkey Point, which encompasses four of the five project geographic components, was created jointly by the EPA, the Corps, and the Miami-Dade County Department of Environmental Resource Management as part of the southwest Biscayne Bay Advanced Identification (ADID) project. This project was initiated to determine which, if any of the wetlands remaining along the southwest shore of Biscayne Bay might be potential future disposal sites for fill material, pursuant to authority in the Clean Water Act of 1977 and regulations outlined in 40 CFR Part 230 (EPA 1994). When completed, the ADID project provided an excellent and relatively detailed vegetation map for the Biscayne Bay coastal wetlands north of Turkey Point. However, for a number of reasons the map is now inadequate for use in the BBCW project. First, the ADID map is over 10 years old and was created prior to the passage of Hurricane Andrew. The center of this major hurricane made landfall at the project site and affected the entire ADID project area, resulting in extensive damage to natural areas (EPA 1994). Hardest hit were tall, forested areas, including mature mangrove forest and upland forest. Nearly 3000 acres of coastal band mangroves were severely affected, as the vast majority of the mature trees were snapped off near the base of the trunk. Furthermore, some freshwater graminoid marshes were significantly damaged from salt water inundation caused by storm surge. Thus, it is unclear to what extent the remaining natural vegetation coverage may differ from what appears on the ADID map as a result of the storm. Secondly, land use in the ADID project area has changed significantly over the past decade. Residential development and tree nurseries have encroached from the west and north into former natural areas. Finally, the ADID map covers only the project area north of

Turkey Point (approximately 12,000 acres), and there is virtually no coverage of the Model Lands Basin (approximately 43,000 acres).

Other land use maps available for the project area are also unsuitable for various reasons. The National Wetlands Inventory (NWI) maps do not provide adequate detail at an adequate scale. Although the wetland and upland polygons appearing on the recently updated NWI map were created and/or modified based on vegetative boundaries, each polygon was classified using the standard NWI classification system down to the "Class 1" level only. Thus, vegetation detail is limited to the broadest categories. For example, the NWI "forested wetland" classification does not distinguish between coastal mangrove fringe, mangrove transitional forest, and tree islands. Just as importantly, NWI's "emergent" classification does not distinguish between coastal marsh and freshwater marsh.

Another vegetation map, produced by the Florida Gap Analysis Program, was created primarily through an analysis of LANDSAT satellite imagery (Pearlstine et al. 2002). Unfortunately, LANDSAT does not provide the spatial resolution required to produce a vegetation map adequate for project planning purposes at the BBCW level. Also, LANDSAT spectral band widths are quite broad, necessitating the use of very broad vegetation classes such as wet shrubland and wetland coniferous forest. Like the ADID maps, the Florida Gap Analysis Program vegetation data are relatively old, having been collected in 1993-94. As noted above, significant land use changes have occurred in this area over the last decade.

Although the South Florida Water Management District (District) is planning to produce a new land use map (due in April 2004), the District currently uses the Florida Land Use, Cover and Forms Classification System (FLUCCS), which does not have the detail required for an adequate analysis of this project. For example, mangrove forests cover a significant portion of the project area and include all four species of mangrove common in south Florida. Characteristically, mangrove swamps in the BBCW are distinguished as 3 to 4 structural units that grade from tall forests along the coast to open shrublands far inland. On a given soil type, the structure of these communities is largely controlled by hydrology, and thus may represent viable targets for restoration. The hydrologic changes anticipated in the BBCW should produce subtle, yet significant, water level and hydroperiod changes that may cause significant shifts in the coverage of these various mangrove communities. Unfortunately, FLUCCS lumps all mangrove species into one category. Also, although the District is working with CERP's Adaptive Assessment Team to produce detailed vegetation maps for CERP, this map will include only relatively small indicator regions, few of which lie within the BBCW project boundary.

During recent meetings with staff from Florida International University (FIU), the BBCW PDT ecological subteam has identified an opportunity to have an accurate, high-resolution vegetation map created in a timely manner. Dr. Michael Ross of FIU has proposed a method for producing such a map in a fraction of the time that normal procedures would require. His team (including

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Dr. Keqi Zhang and Mr. Pablo Ruiz, also of FIU) proposes to integrate aerial photo-interpretation techniques with LIDAR to create the map, which significantly reduces the amount of ground-truthing normally required for verifying terrestrial vegetation coverage estimated solely from aerial imagery. Ground-truthing is normally one of the most significant time and cost requirements of such an effort. LIDAR is an airborne method that uses lasers to measure the elevation of the earth's surface and features attached to it, such as vegetation density, canopy height, and canopy texture. When used in conjunction with aerial photography it can provide relatively accurate estimations of specific vegetation coverage while reducing ground-truthing operations. Figure 1 shows an example of how LIDAR data can improve the accuracy and resolution of vegetation maps. Note especially the increase in complexity of transitional and interior mangrove forest coverage, and the refinement of tree island areal extent and location (see arrow). The techniques has been used successfully to analyze forest structure and growth, and in wetland vegetation mapping (MacKinnon 2001; Lefsky et al. 2002).

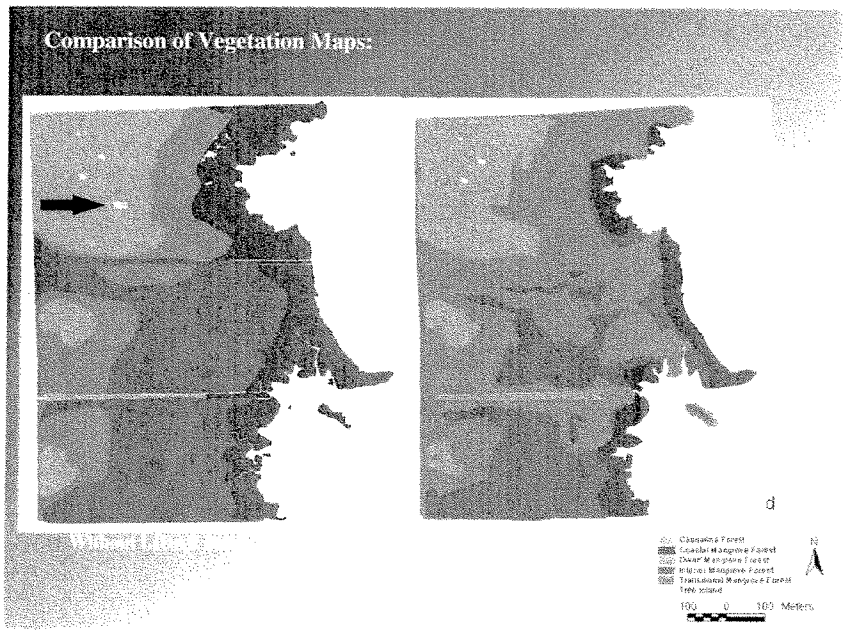

Figure 1. Comparison of vegetation mapping accuracy and resolution with and without integration of LIDAR data (figure by permission of Dr. Mike Ross).

Regardless of who is selected to produce the vegetation map, the Service believes, as do most other BBCW PDT members, that having a current, high-resolution vegetation map for the BBCW project area will be an invaluable tool for completing the project tasks listed above. We recommend the prompt initiation of the mapping process so that a usable product can be produced in time to aid in completing those tasks. The Service also recommends that the new vegetation map adheres closely with vegetation schemes and layers to be used by the AAT for the CERP indicator regions. An additional tier of complexity in the BBCW vegetation should be allowed, probably even encouraged, but the classes of any additional tiers should be able to be collapsed into the classes utilized by the AAT.

IV. Supplemental Water

Prior to the alteration of the natural system by human activities, central and southern Biscayne Bay received extensive freshwater input as both overland and groundwater flow. Overland flow occurred through a system of sloughs, known as the transverse glades, that penetrated the coastal ridge, connecting the bay with the Everglades. Flow through the transverse glades was controlled by water levels in and behind the coastal ridge and overflow through the coastal ridge from the Everglades. Historically, groundwater flow through the Biscayne Aquifer contributed a significant fraction of freshwater to the bay. Historical accounts and photographs from the nineteenth century indicate that some of the springs emanating from the bottom of the bay were of sufficient volume to allow the collection of drinking water for ships (Halley and Evans 1983). Figure 2 is an aerial photograph from 1938 showing a prominent freshwater spring just offshore from the bay's southwest coastline Together, the surface and groundwater flow in this area supported a healthy and diverse coastal marsh complex, including freshwater marshes that extended form the coastal ridge to nearly the bay's western edge, and a highly productive estuarine environment along the nearshore region of western Biscayne Bay. After construction of the Central and South Florida Project for Flood Control and the South Dade Conveyance System, both overland and groundwater flow to the bay decreased significantly. Studies indicate that freshwater flow to the bay decreased 20 percent between 1953 and 1976 (Buchanan and Klein 1976), and coastal wetland hydroperiods decreased. Altered hydrology through canal construction lowered the water table east of the coastal ridge by 5 to 6 feet (Leach et al. 1972), thus lowering the hydraulic head between the water table and the bay, which resulted in reduced groundwater flow to the bay. Inflow to the bay through the subterranean springs was essentially eliminated by the 1940s (Reark 1974).

The causes and affects of altered hydrology in this area were well described in Appendix B of the Service's Fish and Wildlife Coordination Act Report (FWCAR) that appeared as part of the Integrated Feasibility Report and Programmatic Environmental Impact Statement for the Central and Southern Florida Project Comprehensive Review Study (Restudy)(Service 1999). Some of the more significant ecological effects of reduced freshwater flow to the bay and a lowering of the water table east of the coastal ridge include: 1) increased salinity along the bay's western

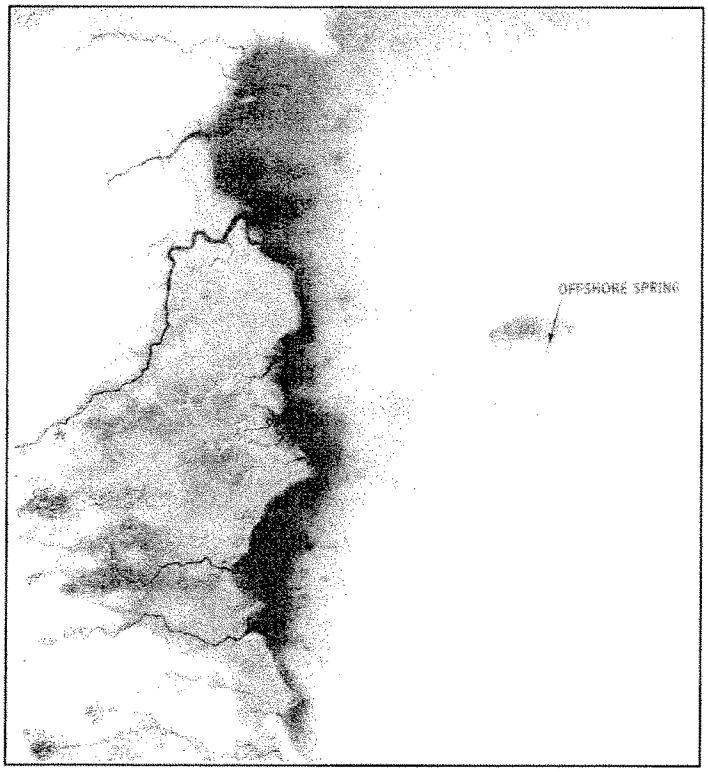

Figure 2. Aerial photograph from 1938 of southern Biscayne Bay and coastal wetlands showing presence of significant offshore spring (photo courtesy of the U.S. Department of Agriculture).

shore that has resulted in the slow conversion of a productive brackish estuary into a more marine, and occasionally hypersaline environment (Alleman et al. 1995); 2) loss of recreational and commercially important fishery species, such as red drum (*Sciaenops ocellata*), due to disruption of the historic salinity regime; 3) loss of oyster bars due to salinity changes; 4) loss of oligohaline graminoid marshes in the coastal wetlands; 5) expansion and landward intrusion of the "white zone" in the Model Lands Basin (Ross et al. 2002); and 6) intrusion of salt water into coastal well fields. See additional references in Appendix B of the Service's FWCAR (Service 1999).

Planning the BBCW project will require estimates of the quantity of freshwater needed to restore the wetlands and nearshore areas of western Biscayne Bay. A recent study by Meeder et al.

(2002) provides an example of the quantity of freshwater required to restore and conserve the Black Creek coastal wetlands and associated embayments (Figure 3). These wetlands lie within the BBCW project area and are arguably the most intact and important coastal wetlands in the project area north of Turkey Point. Historically, these wetlands received freshwater through a system of creeks associated with a major transverse glade. Today, the original watershed and glade is drained by the C-1 canal, thus starving the Black Creek wetlands of freshwater. The L-31E canal also captures and impedes freshwater originally discharged into these wetlands. Meeder et al. (2002) estimated that between 95 acre-feet/day (wet season, 5 months) and 70 acre-feet/day (dry season, 7 months) will be required to adequately restore appropriate salinity envelopes in the creek system alone (annual average of 80 acre-feet/day). If the associated wetlands are also rehydrated to appropriate salinity ranges, approximately 1,139 acre-feet/day during the wet season and 209 acre-feet/day during the dry season will be required (annual average of 595 acre-feet/day). The C-1 canal discharged an average of 180 acre-feet/day between 1979 and 1997. Therefore, the water available from the C-1 canal would be sufficient to restore the creeks, but an additional 417 acre-feet/day would be required to restore the associated wetlands. This additional water requirement represents a three-fold increase in the average

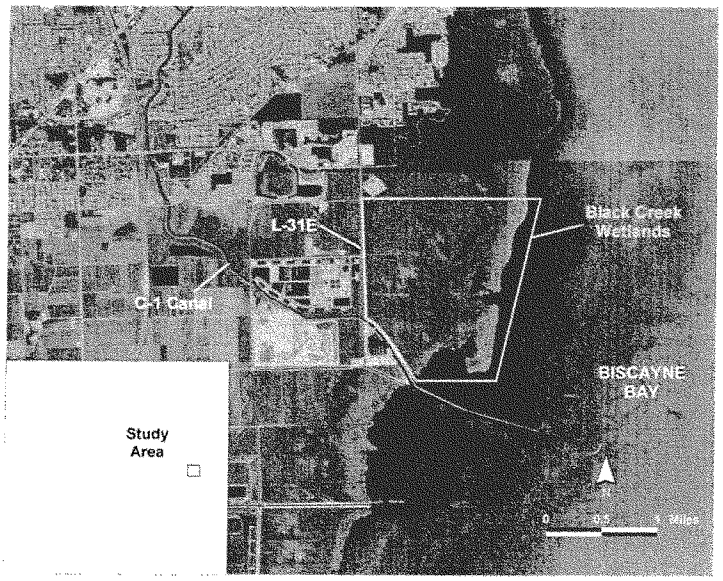

Figure 3. Map showing location of Black Creek wetlands.

annual flow through C-1 canal over a 19-year study period. It is likely that future estimates of freshwater requirements for other sections of the BBCW project area will indicate volumes greater than those flowing through adjacent canals. Also, it is noteworthy that freshwater estimates by Meeder et al. (2002) did not include volumes required to re-establish appropriate salinity envelopes in the nearshore estuarine zone of Biscayne Bay in the vicinity of the Black Creek wetlands. Restoring a more natural salinity regime in the nearshore zone may require additional freshwater needs beyond the discharge volumes predicted by Meeder et al. (2002).

The need to increase freshwater flows to improve ecological conditions in Biscayne Bay has been well documented. The Restudy's Draft Integrated Feasibility Report and Environmental Impact Statement (Corps 1998) and the Service's FWCAR of the Restudy's Final Integrated Feasibility Report and Environmental Impact Statement (Appendix B, Service 1999) described the need and justification for additional water for the bay. The FWCAR stressed that "Potential sources of water for providing target flows to the Bay should be identified and evaluated based on their ability to provide quality, quantity, timing, and distribution of target flows." The report also noted that "potential sources include, but not be limited to; operational modification of the existing or proposed system, 'new water' identified by the Alternative Development Team, Floridan aquifer water, and wastewater reuse." In response to this concern, Scenario D13R4 (also known as the 245K Scenario) was developed which included an additional 245,000 acre-feet of water for Biscayne Bay and ENP, which was obtained from urban stormwater sources in Palm Beach and Broward counties. Evaluation of this alternative revealed that although the additional water would be beneficial to Biscayne Bay, Florida Bay, Shark River Slough, and Taylor Slough, the routing of the additional water could cause harm to other natural areas of the Everglades ecosystem, such as WCA 2A and WCA 3B.

The Water Resources Development Act of 2000 addressed the D13R4 Scenario in Section 601(g)(1), which states that any project designed to capture and use the 245,000 acre-feet of additional water identified in Scenario D13R4 may not be implemented until, among other requirements, a project-specific feasibility study is completed. Consistent with this requirement, the Corps initiated a feasibility study to fully investigate the need for, quantity needed, possible distribution schemes, and potential impacts and benefits associated with providing additional water to ENP and Biscayne Bay in association with CERP. Results of the reconnaissance phase of this feasibility study appear in the December 2002 Preliminary Draft 905 (b) report for the Additional Water for ENP and Biscayne Bay (Additional Water Study). The report confirmed the Federal interest in providing additional water to Everglades National Park (ENP) and Biscayne Bay, and it described and evaluated conceptual alternatives, including D13R4. All alternatives evaluated considered additional urban water originating from Palm Beach and Broward counties only. The reconnaissance study recommended proceeding with the feasibility phase after completion of the modeling work associated with the Initial CERP Update and a commitment from a non-Federal sponsor to cost-share the study.

The Corps' commitment to providing adequate water requirements to Biscayne Bay is documented in the Project Management Plan for the BBCW. The PMP states that the "PDT will establish the optimal water requirements and identify unmet requirements" for the project, and that "RECOVER will recommend potential supplemental water supply options to meet the unmet demands." These tasks also appear as line items under "Water Availability Assessment" in the PMP's Work Breakdown Structure.

As noted above, one alternative proposed in the Restudy for providing additional water to central and southern Biscayne Bay is to recycle urban waste water. A pilot project is being conducted to examine the feasibility of using treated waste water in wetlands within the BBCW project boundary. However, there are a number of concerns regarding how the wetlands and coastal environment will respond to reuse water, particularly the response to any Emerging Pollutants of Concern (EPOCs) present in waste water, which include emulsifiers, antibacterial and antifungal agents, endocrine disrupters, pharmaceuticals, and others. It is unclear at this time if EPOCs can be removed by standard or advanced waste water treatment technology. Also, treatment of waste water to a level acceptable for use in the BBCW is likely to be expensive. Channeling water to the BBCW project area from CERP projects upstream may be a more practical and less costly solution than attempting to clean waste water to acceptable standards. If upstream water is available, it should be scrubbed of nutrients in any of several Stormwater Treatment Areas planned for the project before being introduced to the coastal wetlands and Biscayne Bay. This treated upstream water may be of better quality than treated waste water as it would probably contain little or no EPOCs. This is an extremely important issue since any additional water available for the project will eventually find its way into Biscayne National Park or Biscayne Bay Aquatic Preserve, both of which are classified as Outstanding Florida Waters.

One of the purposes of this PAL is to identify additional water that may be available for Biscayne Bay that was not previously considered or evaluated in the Additional Water Study. The IRLSFS has identified approximately 53,000 acre-feet of excess water that may be available from its watershed and from Lake Okeechobee discharges to the St. Lucie Estuary. At this time there are a number of options for placement of reservoirs and Stormwater Treatment Areas that will be used to store the excess water. Some options will make the water relatively accessible for channeling to south Florida where it may be used by CERP projects in need of water, such as the BBCW project. Other options that may be more practical and cost effective, render the excess water relatively inaccessible for channeling to the south, meaning the water may be used for non-restoration purposes only or eventually be lost to tide. Releasing the excess water into the St. Lucie Estuary will likely have negative impacts on the target salinity envelopes desired for the estuary. Thus, channeling the excess water to the south would serve two important purposes; it would rid the St. Lucie Estuary of unwanted water and it would make water available to water-deficient projects, such as the BBCW.

It is the Service's understanding that, as of the submittal of this letter, no downstream CERP project has officially expressed an interest in the excess water that may be available from the IRLSFS. Because there has been no interest expressed for the excess water, IRLSFS planners may be more likely to position storage features that render the water inaccessible to CERP projects to the south in order to lower project costs. This PAL serves to document the need for additional freshwater for the BBCW project and the Service requests that should additional water become available through the IRLSFS it should be considered for utilization by water-using CERP projects to the south, such as the BBCW project. It is important to note that the 53,000 acre-feet of water available from the IRLSFS is not included in any of the alternatives considered in the Additional Water Study, including Scenario D13R4.

The Service is aware that although additional water may benefit Biscayne Bay and other natural areas within ENP, if routed according to the D13R4 scenario this water has the potential to cause degradation of the current quality of fish and wildlife habitat within portions of WCA 2A and WCA 3B (according to modeling results for the D13R4 scenario). Although water routed south from the IRLSFS project area would take a different path than that described for D13R4, the path may cause problems for natural areas similar to those caused by D13R4. Therefore, while we support the concept of additional water for Biscayne Bay from IRLSFS project area, the potential harm to natural areas along the routing system would have to be determined and resolved. Also, the Service emphasizes that our support for routing excess water from IRLSFS project area to Biscayne Bay is contingent upon treatment of the water to acceptable standards and deliveries being made in ways that will not cause further harm to natural areas. Specific recommendations for minimizing impacts to natural areas caused by routing additional water via alternatives described and evaluated in the Additional Water Study appear in the Service's PAL dated October 7, 2002.

V. Summary of Recommendations

This planning aid letter provides recommendations that address two important issues related to the BBCW project. Due to the lack of an appropriate vegetation map for the BBCW project area, the Service recommends the creation of such a map so that it can be produced as soon as possible in order to facilitate: 1) characterization and description of existing conditions; 2) development, evaluation, and differentiation of project alternatives; and 3) evaluation of project success. The BBCW PDT is currently describing target end states and developing project alternatives. Once an acceptable vegetation map is available for use the PDT will be able to accomplish project tasks, such as those named above, accurately and more rapidly. This PAL has reviewed the need and justification for additional water to restore and conserve the coastal wetlands and nearshore area of central and southern Biscayne Bay. We have identified a possible source for this additional water–the IRLSFS project area–which is a source not previously considered in the Additional Water Study. As noted above, to our knowledge there has been no official request from other CERP projects for this water, and that such a request may be necessary to steer the

IRLSFS alternatives toward providing the water to downstream CERP projects. This PAL serves as an official request that consideration be given to utilizing excess water available from IRLSFS in water-using CERP projects to the south, such as the BBCW project. If this is deemed practical and desirable then the IRLSFS should consider designing water storage features positioned to allow practical, efficient and cost-effective capability for transporting excess water to downstream water-using CERP projects.

In closing, we appreciate the opportunity to coordinate and cooperate with the Corps and their project sponsors to conserve, protect, and enhance fish, wildlife, and plants and their habitats. We are committed to contributing scientific and technical guidance in the areas of ecological and biological assessment throughout the life of the BBCW project. Also, we fully support and appreciate the beneficial actions the Corps is taking to restore wetland and nearshore habitat in central and southern Biscayne Bay. If you have any questions regarding this letter, please feel free to contact Patrick Pitts at 772-562-3909, extension 250.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

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United States Department of the Interior

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

May 13, 2004

James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Duck:

The Fish and Wildlife Service (Service) has prepared this Planning Aid Report (PAR) for the U.S. Army Corps of Engineers (Corps) regarding the Biscayne Bay Coastal Wetlands Restoration Project (BBCW), a component of the Comprehensive Everglades Restoration Plan (CERP). This PAR is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and section 7 of the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This PAR does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA. Additional natural resource protection legislation relevant to this project includes the National Environmental Policy Act, as amended (42 U.S.C. 4321 *et seq.*), the Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 703-712), the Estuary Protection Act (16 U.S.C. 1221-1226), and the Coastal Zone Management Act (16 U.S.C. 1451-1464).

The primary purpose of this PAR is to document vertebrate wildlife resources in the BBCW project area. The report is submitted in fulfillment of tasks assigned to the Service in the BBCW Project Management Plan (Section 7.4.3.4.4.1). The PAR will accomplish the assigned tasks by: (1) describing dominant wetland and upland habitat types in the project area, and their associated wildlife value; (2) documenting vertebrate species known to exist, or potentially exist in upland and wetland habitats of the project area; (3) providing information on federally and State-listed threatened and endangered species, and species of special concern; and (4) documenting non-native wildlife occurring or potentially occurring in the project area.

As noted above, this PAR provides information on federally and State-listed species that are either known or anticipated to occur within the project area. This PAR provides the following information for planning purposes only; it does not constitute the official list for ESA purposes. However, the Service anticipates that significant portions of the report will be utilized in sections of the existing conditions document that is being prepared by the Corps.

TAKE PRIDE

In closing, we appreciate the opportunity to coordinate and cooperate with the Corps and their project sponsors to conserve, protect, and enhance fish, wildlife, and plants and their habitats. We are committed to contributing scientific and technical guidance in the areas of ecological and biological assessment throughout the life of the BBCW project. Also, we fully support and appreciate the beneficial actions the Corps is taking to restore wetland and nearshore habitat in central and southern Biscayne Bay. If you have any questions regarding this letter, please feel free to contact Patrick Pitts at 772-562-3909, extension 250.

Sincerely yours,

James J. Slack for
Field Supervisor
South Florida Ecological Services Office

Enclosures

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PLANNING AID REPORT

ON THE

BISCAYNE BAY COASTAL WETLANDS PROJECT

Submitted to:
U.S. Army Corps of Engineers
Jacksonville District
Jacksonville, Florida

Prepared by: Patrick Pitts and Sandra Sneckenberger
Approved by: James J. Slack, Field Supervisor

Fish and Wildlife Service
South Florida Ecological Services Field Office
Vero Beach, Florida

May 13, 2004

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LIST OF ABBREVIATIONS AND ACRONYMS USED IN THIS REPORT

BBCW	Biscayne Bay Coastal Wetlands Project
BNP	Biscayne National Park
CERP	Comprehensive Everglades Restoration Plan
CFA	Core Foraging Area
CFR	Code of Federal Regulations
Corps	U.S. Army Corps of Engineers
District	South Florida Water Management District
DERM	Miami-Dade County Department of Environmental Resource Management
ESA	Endangered Species Act
FPL	Florida Power and Light
FWC	Florida Fish and Wildlife Conservation Commission
FLUCCS	Florida Land Use, Cover and Forms Classification System
FWCA	Fish and Wildlife Coordination Act
PAR	Planning Aid Report
Service	Fish and Wildlife Service

I. PURPOSE, SCOPE AND AUTHORITY

A. Purpose and Scope

The primary purpose of this Planning Aid Report (PAR) is to document wildlife resources in the Biscayne Bay Coastal Wetlands (BBCW) project area. The report is submitted in fulfillment of tasks assigned to the Fish and Wildlife Service (Service) in the BBCW Project Management Plan (Section 7.4.3.4.4.1). The PAR will accomplish the assigned tasks by: (1) describing dominant submerged, wetland, and upland habitat types in the project area, and their associated wildlife value; (2) documenting vertebrate species known to exist, or potentially exist in these habitats types within the project area; (3) providing information on federally and State-listed threatened and endangered species, and species of special concern; and (4) documenting non-native wildlife occurring or potentially occurring in the project area. This report primarily focuses on vertebrate species utilizing, or anticipated to utilize, the estuarine wetlands, freshwater wetlands, and uplands habitat within the project area. It also includes vertebrate wildlife inhabiting or anticipated to inhabit the adjacent nearshore waters of Biscayne Bay. Information appearing in this report regarding invertebrate utilization of the various habitat types found in the project area is limited and invertebrates are not included in the wildlife species list compiled for this report.

Several federally and State-listed species are either known or anticipated to occur within the project area. This PAR provides the following information for planning purposes only; it does not constitute the official species list in accordance with section 7 of the Endangered Species Act of 1973, as amended (ESA)(87 Stat. 774; 16 U.S.C. 1531 *et seq.*). However, the Service anticipates that significant portions of the report will be utilized in sections of the existing conditions document that is currently being prepared by the U.S. Army Corps of Engineers (Corps).

B. Authority

The Service has prepared this PAR for the Corps as defined by the Scope of Work for the BBCW, a component of the Comprehensive Everglades Restoration Plan (CERP) as authorized under Section 601 of the Water Resources Development Act of 2000 (P.L. 106-541). This PAR is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and section 7 of the ESA. This PAR does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA. This PAR provides guidance and recommendations regarding resource conservation issues associated with the BBCW project. Additional natural resource protection legislation relevant to this project includes the National Environmental Policy Act, as amended (42 U.S.C. 4321 *et seq.*), the Migratory Bird Treaty Act (16 U.S.C. 703-712), the Estuary Protection Act (16 U.S.C. 1221-1226), and the Coastal Zone Management Act (16 U.S.C. 1451-1464).

II. PROJECT SETTING AND DESCRIPTION

A. Project Setting

The general geographic extent of the project is along the mainland coast of central and southern Biscayne Bay from Shoal Point near C-100 and the Deering Estate, south into undeveloped areas southeast of Homestead and Florida City known as the Model Lands. A number of conveyance canals, constructed as part of the Central and South Florida Flood Control Project and the South Dade Conveyance System, compartmentalize the northern half of the project area and serve as drainage conduits for the local watershed. These canals include, from north to south, the C-100, C-1 (Black Creek Canal), C-102 (Princeton Canal), Military Canal, C-103 (Mowry Canal), Florida City Canal, and North Canal. Perhaps more importantly, L-31E bisects the northern half of the project area, effectively creating a barrier to the historic west-to-east sheet flow. Conveyance canals serving the Model Lands area include the Florida Power and Light (FPL) Canal, Card Sound Canal, and the C-111 (Aeroject Canal). All sub-basins in the project area are isolated from one another to varying degrees due to roads, levees, and canals. Extensive mosquito ditching exists in many areas that cause disruption of natural flow patterns within sub-basins.

The BBCW project area encompasses a combination of degraded and relatively unimpacted submerged and wetland habitats. These include primarily seagrasses, mangrove forests, coastal herbaceous flats, freshwater wetlands, and non-native dominated wetlands. Areas north and northwest of the project area are heavily urbanized, whereas agriculture dominates the land use west of the project area. Significant anthropogenic features adjacent to the project area include Homestead Air Reserve Base, FPL's Turkey Point Nuclear Power Plant, extensive landscape nursery plant farms, and expanding residential development.

B. Project Description

The primary purpose of the BBCW project is to reduce point-source discharge to Biscayne Bay and rehydrate wetlands along the southwestern margin of the bay. Presently, freshwater runoff from the watershed is discharged to the bay through the system of conveyance canals identified above. This water management practice significantly reduces the amount of fresh water made available to coastal wetlands, and the manner in which it is released causes abrupt freshwater discharges that are physiologically stressful to fish and benthic invertebrates in the bay near canal outlets (Montague and Ley 1993, Irlandi et al. 1997, Serafy et al. 1997). By redistributing surface water flow from conveyance canals through a spreader system across a broad front, the project is expected to restore or enhance freshwater wetlands, tidal creeks and wetlands, and nearshore bay habitat.

Specific restoration objectives include: (1) reestablishing productive nursery habitat along the shoreline; (2) redistributing freshwater flow to minimize point source discharges to improve freshwater and estuarine habitat; (3) restoring and improving quantity, quality, timing, and distribution of freshwater to the bay, including Biscayne National Park (BNP); (4) preserving and restoring the spatial extent of natural coastal glades habitat; and (5) re-establishing

connectivity between the Biscayne Bay coastal wetlands, the C-111 Basin, the Model Lands, and adjacent basins. These objectives are consistent with the overall goals and objectives of CERP.

The BBCW project consists of two major components: (1) a land-based system that retains water, improves wetland hydroperiods, and directs water through alternative routes more similar to the natural hydrology of the area; and (2) an operational change to increase water elevations at the coastal water control structures in the dry season. The project may cover up to 60,000 acres from the Deering Estate at C-100, south into the undeveloped areas southeast of Homestead and Florida City known as the Model Lands and Barnes Sound. Five geographic sub-components have been identified and described. Project features and plans include pump stations, spreader swales, stormwater treatment areas, flowways, levees, culverts, and backfilling canals.

III. FISH AND WILDLIFE RESOURCES

This section provides an overview of existing ecological conditions in the project area. Habitat types are described mainly in the context of vegetation types that dominate a given area. General information on vertebrate and invertebrate wildlife utilization of those habitat types is provided. The discussion of wildlife resources includes only vertebrate species that have been observed or are anticipated to occur in or very near the project area; invertebrates are not addressed in this sub-section. Appendix A provides a list of the vertebrate species compiled from various area surveys and reports.

A. Habitat Types

Generally, five habitat types dominate the project area. They include submerged aquatic vegetation (primarily seagrasses), mangrove forests, coastal herbaceous flats, freshwater wetlands, and non-native dominated wetlands (primarily wetlands dominated by Australian pine [*Casaurina* sp.] or Brazilian pepper [*Schinus terebinthifolius*]). Of these, mangrove forests cover the majority of the project area north of Turkey Point, while herbaceous flats occupy the majority of the project area south of Turkey Point in the area known as the Model Lands. A brief description of these five habitat types, and their associated wildlife value, are provided below. It should be noted that other habitat types exist in the project area, such as tree islands and melaleuca (*Melaleuca quinquenervia*) dominated wetlands, but as they occupy only a small fraction of the project area, they will not be described in this document. Figure 1 provides a map of the project area which shows the primary land use/vegetation coverage as mapped by the South Florida Water Management District (District) in 1995 using the Florida Land Use, Cover and Forms Classification System (FLUCCS) (District 1995). Estimates of areal coverage (in acres) of each /land use/vegetation coverage category are provided.

1. Seagrasses

Ecosystem function of the bay is supported by seagrass beds consisting of turtle grass (*Thalasssia testudinum*; Figure 2), shoal grass (*Halodule wrightii*), manatee grass (*Syringodium filiforme*), and mixed hardbottom species of plants and animals. Seagrass comprises the major benthic plant community and source of primary productivity in Biscayne Bay (Thorhaug 1976). These highly productive seagrass beds are important not only in terms of the plant biomass

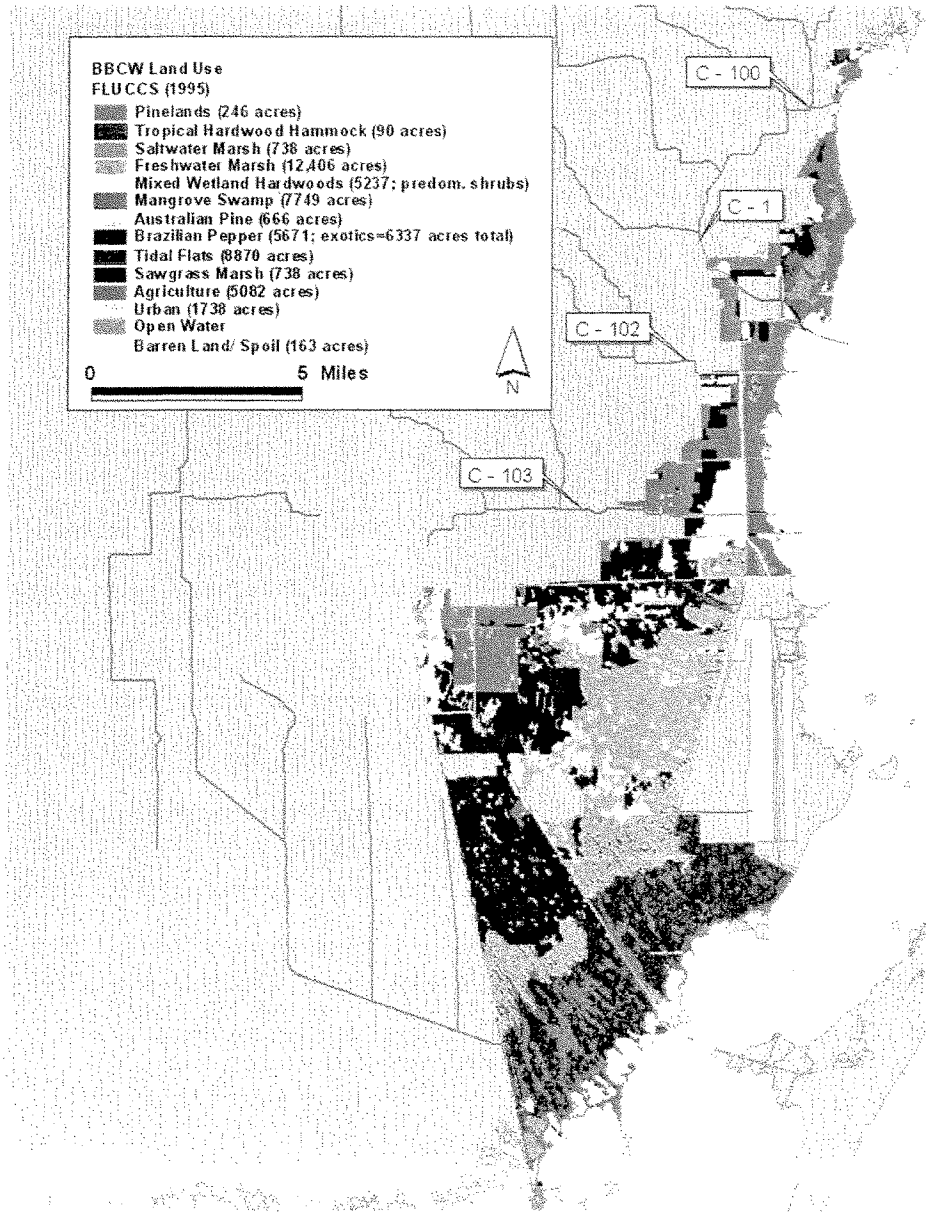

Figure 1. Land use coverage of the BBCW project area. Acreages of each vegetation/land use type are provided based on FLUCCS codes and mapped by the District using 1995 imagery.

produced to supply the bay food web, but also as a physically stable refuge and nursery ground for fish, shrimp, crabs, and their predators (Zieman 1982; Thayer et al. 1984; Kenworthy et al. 1988). There are tens of thousands of acres of seagrass beds and hard bottom communities in the bay that are at risk from degraded inflow water quality.

Turtle grass predominates in central and southern Biscayne Bay (Alleman et al. 1995), although shoal grass is relatively common along the western shore. Widgeon grass (*Ruppia maritima*) is also found along the bay's western nearshore areas, although it is relatively sparse. Manatee grass is also relatively sparse in this area of the bay. Unpublished data collected by the Miami-Dade Department of Environmental Resource Management (DERM) indicates that turtle grass blade densities can exceed 2,000 per square meter in the bay, with a pronounced seasonal variability. During winter months blade densities decrease to approximately 50 to 60 percent of the summer maximum.

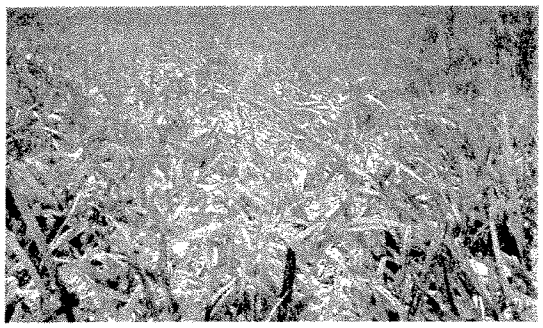

Figure 2. A healthy turtle grass bed.

Species diversity and densities of organisms are typically very high in seagrass beds. Numerous species of small shrimp, crabs, worms, clams, snails, and echinoderms inhabit these areas. The majority of commercial and recreational fish species spends at least some portion of their life histories using seagrass beds or relies on their products (Laney 1997). Other commercial fishery species, such as stone crab (*Menippe mercenaria*), various shrimp species, and spiny lobster (*Panulirus argus*) depend on seagrass for both nursery and adult habitat. Seagrass meadows also provide important habitat for other species, including wading birds, waterfowl, and manatees.

2. Mangrove forests

The dominant coastal wetland community along the mainland shore of the project area is mangrove forest. Mangroves are shoreline trees that live in the intertidal zone and form an extensive forest of emergent shoreline vegetation. Four species of trees are considered to comprise the mangrove community in south Florida: red mangrove (*Rhizophora mangle*; Figure 3), white mangrove (*Laguncularia racemosa*), black mangrove (*Avicennia germinans*), and buttonwood (*Conocarpus erectus*). The majority of this mangrove forest is contiguous, forming an important habitat corridor for coastal wildlife.

Most of the mangrove habitat in the project area can be subdivided into four forest types (Gaiser and Ross 2003). Closest to the bay shoreline is the coastal mangrove forest whose canopy is comprised mainly of black and white mangroves exceeding 30 feet in height and sometimes reaching 45 feet. The understory is mostly red mangroves. Landward of this zone is the interior

mangrove forest that is dominated by black and white mangroves approximately 15 to 30 feet tall, again with an understory of red mangrove. Brazilian pepper can sometimes occur as an understory species. Adjacent to and landward of the interior mangrove forest is the transitional mangrove forest. This forest type is dominated by white mangroves approximately 7 to15 feet high, but red and black mangroves and buttonwood can be found emerging from the canopy. The most landward forest type is the dwarf mangrove forest, which is dominated by red mangroves generally less than 6 feet in stature.

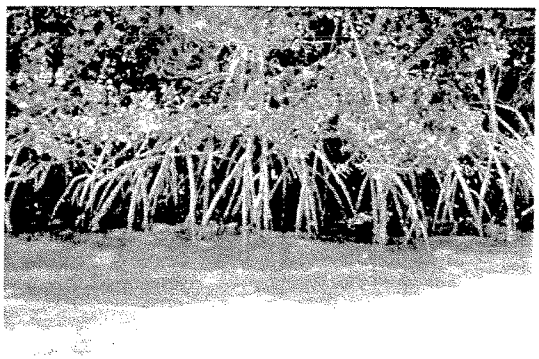

Figure 2. Red mangroves.

Mangrove-dominated ecosystems are among the most productive natural systems in the world (Odum et al. 1982). Mangroves generate significant amounts of organic matter that is processed by microorganisms and invertebrates, which in turn provide food for upper trophic level species such as fish and shorebirds. The high ecological value of mangroves has long been recognized, as they provide both a food base and stable habitat for a complex food web (Thayer et al. 1997). The mangrove system along Biscayne Bay produces about 6.7 tons of organic matter per year (Teas 1974) to fuel local and coastal food webs. In south Florida, this native coastal biotic community is vital in the support of bay fisheries, including shrimp, tarpon (*Megalops atlanticus*), and gray snapper (*Lutjanus griseus*) (Odum and Heald 1972), and invertebrate-wading bird food webs (Heald et al. 1984). In Biscayne Bay, sport and commercial fisheries rely on mangrove community function to support 11 important species of fish, such as red grouper (*Epinephelus morio*), gray snapper, and common snook (*Centropomis undecimalis*), and shellfish such as the spiny lobster, blue crab (*Callinectes sapidus*), and stone crab. Red mangroves provide physical support for an extensive invertebrate community on its prop roots in the intertidal zone. These extensive encrusting communities consist of sponges, oysters, mussels, clams, barnacles, snails, shrimp, crabs, juvenile spiny lobster, polychaete worms, hydroids, and hydrozoan Cnidarians.

The mangrove community provides habitat for federally and State-listed threatened and endangered species, as well as species of special concern. For example, bald eagles (*Haliaeetus leucocephalus*) and ospreys (*Pandion haliaetus*) are top carnivores that utilize mangrove forest (Heald et al. 1984). Wading birds such as great blue herons (*Ardea herodias*), little blue herons (*Egretta caerulea*), tricolored herons (*E. tricolor*), and roseate spoonbills (*Ajaja ajaia*) feed on small forage fish that occupy the tidal creeks and open areas of mangrove forests. Furthermore, mangroves in the Caribbean have a strong influence of coral reef fish community structures (Mumby et al. 2004). The biomass of several species of commercially important fish was found to be twice as great when coral reef habitat was connected to mangrove habitat.

Significant areas within the project boundary can be characterized as a low-productivity dwarf mangrove forest known as the "white zone" (Egler 1952; Ross et al. 2002). The white zone is a region of low vegetative cover and canopy height that is common in the Model Lands Basin. This area, comprised primarily of dwarf red mangrove and sparse graminoids, occurs between more densely vegetated coastal, interior, and/or transitional mangrove forests and more interior freshwater wetlands, and it is so named because it appears as a distinct reflective white band on remotely sensed images. The white zone has been present in the wetlands near Card Sound, Barnes Sound, and northern Florida Bay since at least the time when described by Egler (1952). Recent studies in this area by Ross et al. (2000) indicate that the inner boundary of the white zone has moved inland by an average of 1.5 kilometers (0.9 mile) since 1940, and the zone is expanding. The most significant changes to the white zone boundary and width occur in areas cut off from fresh water sources by canals or roads. For example, the expansion is greater on the Biscayne Bay side of U.S. Highway 1 than to the west. Ross et al. (2002) suggest that the low productivity of the white zone may be primarily the result of wide seasonal fluctuations in salinity and moisture content and the absence of freshwater input from upstream sources, among other factors.

3. Coastal herbaceous flats

Also referred to as saline herbaceous wetlands, this habitat type lies between mean sea level and the mean high water level, and so therefore is continuously flooded only during the annual water level peak that occurs in the fall. The vegetation is generally dominated by herbaceous, halophytic species such as sea oxeye (*Borrichia frutescens*), cordgrass (*Spartina* spp.), saltgrass (*Distichlis spicata*), and common rush (*Juncus* spp.) and sometimes spike rush (*Eleocharis* spp.). There is often a mixture of succulent herbaceous species such as saltwort (*Batis maritima*) and glasswort (*Salicornia virginica*) with scattered black mangrove (Lewis et al. 1985). Historically, this habitat type was widespread in the project area north of Turkey Point, but it is poorly represented in this area today. However, coastal herbaceous flats are a prominent feature in the Model Lands Basin.

Coastal herbaceous flats are heavily utilized by wildlife during periods of salt and fresh water inundation. Many species of larval or juvenile vertebrate and invertebrate species utilize the temporary available habitat, including fishes (some of which depend on the marsh for at least some phase of their life cycle), decapod crustaceans, and birds. Gilmore (1987) has documented 84 species of fish, 29 species of decapod crustaceans, and 38 species of birds utilizing subtropical coastal herbaceous flats associated with the Indian River Lagoon.

These periodically flooded marshes serve as important habitat for various species of fiddler crab, considered by some to be a keystone species in this habitat type. Fiddler crabs are extremely important to the coastal ecosystem as a major prey item, a recycler of nutrients, and as an agent in oxygenating the soils. As many as six species of the genus *Uca* may exist in the coastal marsh of the project area. Small fishes feed on the larval forms, whereas wading birds, particularly the night herons, prefer adult fiddler crabs as a food source. Snakes, various predator crab species, clapper rails, and raccoons have also been documented feeding on *Uca* (MacIntosh 1980).

Because the herbaceous flats are infrequently flooded, productivity occurs in pulses, which is important to certain species, such as the mummichog (*Fundulus heteroclitus*) (Weisberg and Lotrich 1982). This pulse productivity is also important to various other fishes and wading birds, and may play a crucial role in determining whether local wading birds successfully nest. Important lower trophic level food components in this habitat include saltwort and mangrove detritus, as well as live periphyton. Copepods, arthropod zooplankton, and mosquito larvae provide other important food sources in the coastal herbaceous flats.

4. Freshwater wetlands

The freshwater wetlands in the project area can be comprised of various freshwater wetlands vegetation types, including sawgrass (*Cladium jamaicense*), cattail (*Typha* spp.), and coastal plain willow (*Salix caroliniana*). This habitat type is found mostly south of the Mowry Canal (C-103), and includes extensive areas of the Model Lands Basin. These vegetation types can be found as monocultures, but more often occur as mixed species. Even cattail, which is known for its ability to crowd out other plant species when conditions are favorable, apparently is found mixed with species such as water hyssop (*Bacopa* spp.), mermaid weed (*Proserpinaca* spp.), willows (*Salix* spp.), and sawgrass. A variety of other freshwater wetland plant species, including numerous periphyton species, occur in this vegetation type. It is noteworthy that areas dominated by willow generally indicate freshwater areas that have been disturbed.

These wetland types provide a variety of habitats for fish, amphibians, reptiles, birds, and mammals. Under the appropriate conditions, they can support a relatively large biomass of freshwater fish species, such as mosquito fish (*Gambusia affinis*) and sailfin molly (*Poecilia latipinna*), which in turn provide critical prey for the large variety of wading birds utilizing these wetlands. Freshwater wetlands are a preferred habitat for the American alligator (*Alligator mississippiensis*). For additional information on the wildlife value of these wetland types see Schomer and Drew (1982).

5. Non-native dominated wetlands

There are primarily two types of non-native dominated wetlands in the project area; namely Australian pine dominated wetlands and Brazilian pepper dominated wetlands. The type of non-native species that dominates a given area is generally related to the topography of the wetland. The majority of the Australian pine dominated wetlands occur in artificially elevated mangrove areas. Often the pines occur as linear features along berms created by the digging of drainage and mosquito ditches. Brazilian pepper dominated wetlands are generally intermediate in elevation, hydroperiod, and function between the native wetland and upland types in the project area (EPA 1994). They can occur as dense monospecific stands that are difficult to penetrate or as stands mixed with willow, buttonwood and/or other mangrove species.

The wildlife value for the Australian pine dominated areas is primarily provided by the food and habitat contributions of the associated native plant species occurring as co-dominants in the canopy and the understory. These associated species are generally a combination of the four mangrove species, and they provide significant food and habitat value as discussed above in the mangrove section. The pines themselves have been noted to provide shade for ground dwelling

animals, and habitat for a variety of insects and spiders (EPA 1994). They also provide some roosting and nesting habitat for birds, such as the great blue heron, brown pelican (*Pelecanus occidentalis*), and double-crested cormorants (*Phalacrocorax auritus*). Pileated woodpeckers (*Dryocopus pileatus*) have been observed to nest in the trunks of dead Australian pines in the project area (EPA 1994).

The limited habitat value provided by Australian pines is offset by negative impacts that include the loss of higher value native habitat, the loss of primary productivity of the native species, and change in elevation due to build-up of organic matter (EPA 1994). A particular problem with this non-native is the accumulation of fallen leaves that appear to resist breakdown by local microbes. This "duff" layer can become several inches thick, which suppresses understory development. It is unclear if the duff physically smothers native seedlings or if some sort of allelopathic chemical is leached from the leaves, which retards seedling germination. The duff build-up may also slightly increase the local elevation, which results in more favorable habitat for the pines and may help the species increase its areal expansion.

Investigations on the wildlife habitat value of Brazilian dominated wetlands are limited. A survey of herptofauna found in Brazilian pepper habitat in Everglades National Park revealed a total of 21 species of reptiles and amphibians, out of a total of 37 species occurring over all habitat types in the area (Dalrymple 1988). By comparison, 30 species of herptofauna were found in nearby freshwater prairie, which was the highest number of species found in any one habitat type. Curnutt (1989) compared breeding bird usage of this habitat type with pinelands in Everglades National Park. His results indicate that 35 percent fewer breeding pairs were utilizing the Brazilian pepper habitat compared with the pinelands habitat. Also, only 6 bird species were found to breed in the pepper habitat compared to 28 species in the pinelands.

Although the studies described above document certain wildlife value of Brazilian dominated wetlands, most ecologists would agree that the habitat value of the native habitat type that has been supplanted by the pepper would carry a higher value than the pepper habitat. The species does produce an edible fruit that is consumed by a variety of wildlife, particularly avifauna and raccoons. However, the fruit has relatively low food value as evidenced by the large numbers of intact berries observed in raccoon scat. Most of the food value of this habitat type is derived from the native plant species, such as willow, that sometimes co-occur with the pepper.

B. Wildlife Resources

One of the primary purposes of this PAR is to provide a comprehensive list of vertebrate wildlife that occur, or are anticipated to occur, in the BBCW project area (Appendix A). This list has been assembled by combining species lists from available surveys and reports conducted in or near the project area over the last decade. Where available, habitat type and geographic location for each species are provided. It should be noted that wildlife studies within the project footprint are lacking, and most of the surveys and reports from which the data appearing here were assembled were performed outside the project footprint. Primary references from which the species list appearing in this report was compiled include:

1. Cotleur Hearing. 1997. Mitigation Banking Instrument for the Everglades Mitigation Bank. Prepared for Florida Power and Light Company by Cotleur Hearing, Juno Beach, Florida.

2. Cotleur Hearing. 1998. Everglades Mitigation Bank Phase I: Annual Progress and Mitigation Success Report, 39 pp plus figures and tables. Prepared for Florida Power and Light Company by Cotleur Hearing, Jupiter, Florida.

3. Cotleur Hearing. 1998. Prospectus of the Florida Power and Light Everglades Mitigation Bank Phase II, 197 pp. Prepared for Florida Power and Light Company by Cotleur Hearing, Jupiter, Florida.

4. Dalrymple, G.H. 1998. An evaluation of wildlife diversity and wildlife habitat values in relation to existing conditions and potential recreational development opportunities at Dade County's Chapman Field Park. Final report submitted to Miami-Dade County Parks and Recreation Department, 19 pp plus tables and figures.

5. Dalrymple, G.H. and N.K. O'Hare. 1998. An evaluation of wildlife diversity and wildlife habitat values in relation to existing conditions and potential recreational development opportunities at Dade County's Matheson Hammock Park. Final report submitted to Miami-Dade County Parks and Recreation Department, 17 pp. plus tables and figures.

6. Goldman, S. 2002. Natural resource profile information: Biscayne National Park Unpublished data.

7. Hofstetter, S. 2003. The birds of the South Dade Wetland Basin. 5 pp. plus tables. Unpublished data.

8. Metro-Dade County Park and Recreation Department. Bird Surveys of Deering Estate at Cutler (including Chicken Key) – 1999 through 2003. Unpublished data.

9. U.S. Air Force and Federal Aviation Administration. 2000. Final Supplemental Environmental Impact Statement for the Disposal of Portions of the Former Homestead Air Force Base, Florida. Appendix G, pp. G-1 to G-78.

10. U.S. Environmental Protection Agency. 1994 (EPA). Technical summary document for the advance identification of possible future disposal sites and areas generally unsuitable for disposal of dredged or fill material in wetlands adjacent to southwest Biscayne Bay, Dade County, Florida, 93 pp. plus appendices and maps.

Appendix A lists the vertebrate species that have been observed in or are anticipated to occur in the BBCW project area based on the above references. The table includes the habitat type where the species was observed, when available, and it includes the source(s) of information from

which the species appears. Appendix A also specifies if the species is a federally or State-listed endangered or threatened species, or species of special concern, and it indicates if the species is a non-native (*i.e.* exotic).

The mainland coastal zone of central and southern Biscayne Bay, which defines the BBCW project area, supports a high diversity of tropical and subtropical species of vertebrates. A minimum of 35 mammalian species, 294 avian species, 57 reptilians, 16 amphibian species, and 268 fish species have been observed in or near the project area. An additional 11 mammalian, 10 bird, 7 reptilian, 1 amphibian, and 9 fish species may exist in the area. The following subsections describe in greater detail the occurrence and habitat utilization in the project area of the five major classes of vertebrates.

It should be noted that a review of the reference species lists revealed several entries of species that are extremely unlikely to occur in the project area. Some are even unlikely to occur in south Florida. These species include, but are not limited to, the white-faced ibis (*Plegadis chihi*), scarlet ibis (*Eudocimus ruber*), Key Largo wood rat (*Neotoma floridana smalli*), Lower Keys marsh rabbit (*Sylvilagus palustrus hefneri*), Florida black bear (*Ursus americanus floridanus*), silver rice rat (*Oryzomys argentatus*), and Key Largo cotton mouse (*Peromyscus gossypinus allapaticola*). For purposes of this report, these species appear in Appendix A, but caution should be used when referring to these animals as inhabitants of the project area.

1. Mammals

Mammals constitute a relatively small number of the vertebrate wildlife associated with the BBCW project area. However, the few species that do exist are important to the overall ecology of the area. Species diversity is relatively low, with only 35 species having been observed in the project area (Appendix A). Of those species, there are several that would not be of concern to the project. Namely, the whales appearing on the list were likely observed in the open ocean environment of BNP (they appear only on BNP's species list). Another 11 species may exist in the area according to the supporting documents.

A total of 12 of the 46 mammalian species utilizing the area are federally or State-listed threatened or endangered species. Some of the most notable species include the Florida panther (*Puma concolor coryi*) and West Indian manatee (*Trichechus manatus*). Others, such as the Lower Keys marsh rabbit and Key Largo cotton mouse, are extremely unlikely to be found in the project area. However, both of these species can be found on Elliot Key across the bay. See Section V for more detailed information on threatened and endangered species.

Probably the most common large mammals observed in the project area are the West Indian manatee and the bottlenose dolphin (*Tursiops truncatus*). Both species are protected by the Marine Mammal Protection Act of 1972, as amended (16 U.S.C. 1461 *et seq.*) making it illegal to take, injure, molest, or kill any marine mammal. The bottlenose dolphin is common to inshore Florida waters, and normally forages in the open waters of the bay, feeding on mullet and other available fishes (Odell 1976). Biscayne Bay is considered important habitat for this species. White-tailed deer ((*Odocoileus virginianus*) are likely found predominately in the Model Lands Basin portion of the project area. Although suitable habitat

exists in the Model Lands for the Florida panther, no panthers have been observed in the area since the late 1980s. See Section V for more information on the endangered manatee and Florida panther.

With few exceptions, most of the mammalian species occurring in the project area are small to medium-sized. Probably the most common medium-sized mammal is the raccoon (*Procyon lotor*). They are often observed foraging throughout the wetland and upland areas. They are excellent climbers and utilize crevices and tree cavities for shelter and for breeding sites. Another species often spotted in the project area is the river otter (*Lutra canadensis*), which utilizes the extensive and complex network of canals, drainage ditches, and mosquito ditches found in the project area for hunting fish and other prey. Some of the more common small mammals include the cotton rat (*Sigmodon hispidus*) and gray squirrel (*Sciurus carolinensis*).

2. Birds

Avifauna is particularly well documented in and around the BBCW project area, and they represent the most diverse group of vertebrates that utilize the area. Appendix A indicates that 294 bird species have been observed in or near the project area, and 10 additional species may exist. The species list includes a wide variety of bird groups including gulls, wading birds, water birds, raptors, warblers, woodpeckers, and thrushes. Many of the species are migratory birds and winter residents, which commonly swell the avian populations during the late fall to early spring months.

The most commonly observed birds are water and wading birds, such as the great blue heron, great egret (*Ardea alba*), brown pelican, double-crested cormorant, and osprey. Common grackles (*Quiscalus quiscula*) and boat-tailed grackles (*Quiscalus major*) are also highly visible birds in this area. Less noticeable, but also relatively common are the mockingbird (*Mimus polyglottos*), northern cardinal (*Cardinalis cardinalis*) and various warbler species during spring and fall migration periods.

Appendix A shows 16 non-native avian species existing or potentially existing in the project area. These are comprised mostly of a variety of tropical species such as parrots and parakeets. For example, the monk parakeet (*Myiopsitta monachus*) is particularly common in south Florida. Other common non-native avian species include the Eurasian collared dove (*Streptopelia decaocto*) and the European starling (*Sturnus vulgaris*). These non-native birds are discussed in greater detail in Section VI.

There are four species of federally listed endangered birds and four species of federally listed threatened birds in Appendix A. Appendix A also includes an additional 1 endangered, 4 threatened, and 12 species of special concern listed by the State of Florida. Section V provides greater detail regarding the federally and State-listed threatened and endangered species.

3. Reptiles

A total of 57 reptile species were observed in or near the project area (Appendix A). Another seven reptile species are anticipated to occur in the area. These numbers represent a relatively

large fraction of the total number of reptile species present in the State of Florida, which likely is a reflection of the diversity of habitat types found in the project area. Of the 63 reptile species appearing in Appendix A, seven are considered non-native to Florida. The brown anole (*Anolis sagrei*) and spectacled caiman (*Caiman crocodilus*) are likely the most abundant and problematic of these non-native reptiles in the project area.

The American alligator and endangered American crocodile (*Crocodylus acutus*) likely assume the dominant ecological position in the project area. Alligators, in particular, are important to the ecosystem because they create "gator holes" that support a large variety of fauna. These small ponds are particularly important in the dry season as they provide habitat for aquatic organisms and serve as staging areas for recolonization of the marshlands when the rainy season returns. More in depth information on crocodile status and habitat utilization in the project area appears in Section V of this report.

Two additional high-profile reptile species that occur in the nearshore bay area are the green sea turtle (*Chelonia mydas*) and loggerhead sea turtle (*Caretta caretta*). These two species are the most common of the sea turtles inhabiting south Florida. The seagrasses and algae that are abundant along the shoreline of the project area represent suitable foraging habitat for the green sea turtle. Loggerhead sea turtles occupy a variety of habitat types, including sandy bottoms and clear water that can be found in the project area. Their diets consist primarily of benthic invertebrates and they prefer gastropod and pelecypod molluscs and decapod crustaceans, all of which occur in the nearshore waters of the project area. A third species of sea turtle, the hawksbill sea turtle (*Eretmochelys imbricata*), could utilize the nearshore waters of the project area, as it has been documented to inhabit mangrove-fringed bays and estuaries, particularly along the eastern shore of continents where coral reefs are absent (Carr 1952). However, individuals of this species likely utilize the well-developed coral reefs found just seaward of Biscayne Bay in preference to the western bay areas.

Appendix A indicates that reptiles have been observed in over half of the habitat types for which information is available from the project area. These include cattails, disturbed and filled areas, exotics, herbaceous flats, mangroves, open water, sawgrass, and willow.

4. Amphibians

The extensive, yet degraded wetlands of the project area support a relatively large variety and number of amphibians. These include 16 species that have been observed and one species that is anticipated to occur in the project area (Appendix A). Of the observed species, three are non-native, including the Cuban tree frog (*Osteopilus septentrionalis*), greenhouse frog (*Eleutherodactylus planirostris*), and giant toad (*Bufo marinus*).

Amphibians associated with deep marsh systems observed in the project area include the pig frog (*Rana grylio*), which feeds extensively on crayfish, and the green tree frog (*Hyla cinerea*), which can congregate in large choruses of several hundred individuals. Other amphibians, such as the little grass frog (*Limnaoedus ocularis*) and eastern narrow-mouthed frog (*Gastrophryne carolinensis*) prefer the slightly drier shallow marsh and wet prairie systems.

Appendix A indicates that generally most of the amphibians were observed in the Barnes Sound wetlands area or outside the project boundary. This finding is likely more a reflection of the lack of studies or surveys within other parts of the project area rather than a lack of these species in those areas. Also, little information is available from the specific habitat types in which the observed amphibians were found. Only two habitat types, tree islands and disturbed and filled areas were reported in the surveys.

5. Fish

Appendix A indicates that 268 species of fish have been observed in or near the project area and another nine species may exist there. Of these, 10 species are non-natives that primarily inhabit relatively deep freshwater habitats provided by conveyance canals. Non-native fishes appearing in Appendix A include various cichlids, goldfish (*Carassius auratus*), walking catfish (*Clarias batrachus*), among others. Appendix A also shows three species that are listed by the State of Florida as species of special concern and include the common snook, mangrove rivulus (*Rivulus marmoratus*), and Key blenny (*Starksia starcki*).

It is important to note two qualifiers when discussing information concerning fish species appearing in Appendix A. First, a relatively large number of the fish species appearing in the table are primarily associated with coral reef habitats. Although hardgrounds, a type of submerged habitat that is usually comprised of a few scattered coral species, exists within the project area, the main reef tract is located well offshore of the barrier islands that separate the bay from the open ocean. These reefs are likely outside the influence of the project. Secondly, Appendix A may omit a number of other fish species that likely exist in the project area. DeSylva (1976) documented at least 512 species of fish occurring in Biscayne Bay. Both temperate and tropical species are represented, and somewhat seasonal fluctuations occur with tropical species more prevalent in the summer and temperate species partially replacing them in winter (Alleman et al. 1995).

Historically, bay waters in the project area would have supported primarily estuarine species. Recent studies have shown that estuarine fishes and shellfishes have precipitously declined in abundance within the project area due to loss of estuarine habitat along the bay's southwestern shore (Serafy et al. 2001). Abrupt canal-driven salinity fluctuations have also deleteriously affected fish populations (Serafy et al. 1997). In southern Biscayne Bay, the salinity of marine waters (30 to 35 parts per thousand [ppt]) downstream of flood canal locks frequently drops 20 ppt within 60 minutes and returns almost as rapidly (Wang et al. 1988). As currently operated, these dramatic salinity fluctuations can occur several times per day during the wet season (May to October). Redfish and other species of sciaenids that rely upon estuarine areas were "abundant at all seasons" during the late 19th Century (Smith 1896) but are conspicuously absent today. Restoration of redfish to the bay failed due in large part to the release (stocking) of juveniles to areas that no longer contained suitable (consistently brackish) estuarine environments (Serafy et al. 1996). Still, seagrass beds and intertidal mangrove forests in the area support a variety of fish species, including recreationally or commercially important ones such as spotted seatrout (*Cynoscion nebulosus*), common snook, permit (*Trachinotus falcatus*), and various members of the grunt, snapper, mullet, and grouper families.

Small, minnow-sized fish species dominate most of the freshwater wetlands in the project area. This dominance is most likely due to the water level fluctuations and periodic dry downs that naturally and unnaturally occur in this area. Many of the small native fish are adapted for survival in shallow stagnant water that is typically low in oxygen and has relatively high temperatures, especially in summer months. A good example of this is the mangrove rivulus, which exists in mangrove habitats and spends most of its life in land crab burrows.

IV. THREATENED AND ENDANGERED SPECIES

Several federally and State-listed species are either known or anticipated to occur within the project area. This PAR provides the following information for planning purposes only; it does not constitute the official list for ESA purposes. Additional life history and status information on all federally listed threatened and endangered species can be found in the Service's South Florida Multi-species Recovery Plan (Service 1999).

A. Federally listed species

We have reviewed our current digitized data, the South Florida Multi-Species Recovery Plan, Florida Natural Areas Inventory, and other sources to identify the following federally listed threatened and endangered species in or near the project area. For access to federally listed species occurring in Florida by county, see: http://verobeach.fws.gov/species_lists/countyfr.html.

Federally listed animal species known to exist or potentially exist within the project area are provided in Table 1. The list includes nine endangered vertebrate and invertebrate species and three threatened vertebrates. Other federally threatened or endangered animal species that are known to exist or potentially exist in Miami-Dade County, but which will not likely be of concern in this study due to the lack of suitable habitat in and within close proximity of the project area, include the Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*).

Table 1. Species listed by the Service or the National Marine Fisheries Service (NOAA Fisheries) as endangered (E) or threatened (T) existing or potentially existing in the project area.

Common Name	Scientific Name	Status
MAMMALS		
Florida panther	*Puma concolor coryi*	E
West Indian manatee	*Trichechus manatus*	E
BIRDS		
Wood stork	*Mycteria americana*	E
Everglade snail kite	*Rostrhamus sociablis plumbeus*	E
Bald eagle	*Haliaeetus leucocephalus*	T
Roseate tern	*Sterna dougallii dougallii*	T

Table 1 (continued)

Common Name	Scientific Name	Status
REPTILES		
American crocodile	*Crocodylus acutus*	E
Loggerhead sea turtle	*Caretta caretta*	E
Green sea turtle	*Chelonia mydas*	E
Hawksbill sea turtle	*Eretmochelys imbricata*	E
Leatherback sea turtle	*Dermochelys coriacea*	E
Eastern indigo snake	*Drymarchon corais couperi*	T
INVERTEBRATES		
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	E

Table 1 includes four federally listed endangered sea turtles, including the green sea turtle, hawksbill sea turtle, and leatherback sea turtle (*Dermochelys coriacea*). The loggerhead sea turtle, a threatened species, is also known to exist or potentially exist in the project area. The Service's jurisdiction over listed sea turtles is limited to beach and shoreline habitat above Mean High Water. Since it is highly unlikely that suitable nesting habitat exists for sea turtles in, or in close proximity to, the project area, these animals will not likely be of concern to the Service with regards to this project. However, these animals should be considered in project design and implementation as they occur or potentially can occur in waters within the project area. NOAA Fisheries should be consulted as it has jurisdiction over sea turtles below Mean Low Water.

1. Critical habitat

The BBCW project area overlaps critical habitat for two federally listed endangered species, as defined by the Code of Federal Regulations (CFR) 50 Parts 1 to 199. The northern boundary of critical habitat for the American crocodile begins at the easternmost tip of Turkey Point and extends southeast and southwest across the southern part of the BBCW project area. Thus, the Model Lands, including the wedge area between U.S. Highway 1 and Card Sound Road, lie within critical habitat for this species.

The project area also overlaps critical habitat for the West Indian manatee. According to CFR 50, "all waters of Card, Barnes, Blackwater, Little Blackwater, Manatee, and Buttonwood Sounds between Key Largo, Monroe County, and the mainland of Miami-Dade County" are included as part of the critical habitat for this species. The southern part of the project area includes Card Sound and Barnes Sound. Also, the northern part of the project area lies close to another segment of manatee critical habitat This component is defined as "Biscayne Bay, and all adjoining and connected lakes, rivers, canals, and waterways from the southern tip of Key Biscayne northward to and including Maule Lake, Miami-Dade County." The northern boundary of the BBCW project area lies only 4 miles from the southern boundary of this critical habitat component.

2. Ecology and local status of federally listed species

This section provides an overview of the ecology and local status of the federally listed threatened and endangered species that exist in the project area and are most likely to be affected by the project. These include the Florida panther, West Indian manatee, bald eagle, wood stork (*Mycteria americana*), American crocodile, eastern indigo snake (*Drymarchon corais couperi*), green sea turtle, and loggerhead sea turtle. Detailed information on the other listed species that appear in Table 2 is not provided because it is extremely unlikely that they exist in the project area.

Florida Panther

The Florida panther, a subspecies of mountain lion, is one of the most endangered large mammals in the world (Figure 4). A small population in south Florida represents the only known remaining wild population of an animal that once ranged throughout most of the southeastern United States from Arkansas and Louisiana eastward across Mississippi, Alabama, Georgia, Florida and parts of South Carolina and Tennessee (Service 1999). The latest documented panther population, obtained from data collected between July 1, 2002 and June 30, 2003, places the adult and subadult Florida panther population at 87 individuals, not including kittens observed at the den (Florida Fish and Wildlife Conservation [FWC 2003]).

For over a decade, it has become increasingly evident that the Florida panther shares the south Florida landscape with a rapidly growing human population, and humans have played the primary role in degrading the panther's environment. Environmental factors affecting the panther include: habitat loss and fragmentation, contaminants, prey availability, human-related disturbance and mortality, disease, and genetic erosion (Dunbar 1993).

The Florida panther is a medium-sized puma or mountain lion that is described as being relatively dark tawny in color, with short, stiff hair (Bangs 1899), and having longer legs and smaller feet (Cory 1896) than other subspecies. Adult male panthers reach a length of 2.15 meters from their nose to the tip of their tail and may reach or exceed 68 kilograms in weight, but typically average around 54.5 kilograms. They stand approximately 60 to 70 centimeters at the shoulder. Female panthers are considerably smaller with an average weight of 34 kilograms and length of 1.85 meters. The coat of an adult Florida panther is unspotted and typically rusty reddish brown on the back, tawny on the sides, and pale gray underneath.

Figure 4. Florida panther.

Telemetry monitoring and ground tracking indicate that panthers use the mosaic of habitats available to them as resting and denning sites, hunting grounds, and travel routes, including cypress swamps, hardwood hammocks, pine flatwoods, seasonally flooded prairies, freshwater marshes, and a variety of agricultural

lands (Service 2002). Cover for panther denning and resting sites is typically dense vegetation close to the ground, such as saw palmetto (Maehr 1990, 1997), cocoplum thickets, fern beds, sawgrass, oak scrub, or exotic vegetation (McBride 2001). A mosaic of upland and wetland habitats support prey species such as white-tailed deer (*Odocoileus virginianus*), feral hogs (*Sus scrofa*), raccoon, and nine-banded armadillo (*Dasypus novemcinctus*).

According to FWC telemetry data, panther #21 utilized a large portion of the Model Lands Basin between the FPL's Turkey Point Power Plant cooling canals and Card Sound Road in 1988. Unfortunately, this individual was a victim of a motor vehicle collision and perished the same year. Since that time, there have been no other reported panthers in the study area. The portion of the project area utilized by panther #21 remains suitable panther feeding and shelter habitat. Project effects to this area will likely be in the form of increasing the quality of freshwater wetland habitat by introducing more natural volumes of freshwater into this system, while leaving adequate high ground for panther resting and shelter habitat.

West Indian Manatee

West Indian manatees are massive fusiform-shaped animals with skin that is uniformly dark grey, wrinkled, sparsely haired, and rubber-like (Figure. 5). Manatees possess paddle-like forelimbs, no hind limbs, and a spatulate, horizontally flattened tail. Females have two axillary mammae, one at the base of each forelimb. Their bones are massive and heavy with no marrow cavities in the ribs or long bones of the forearms (Odell 1982). Adults average about 11.5 feet in length and 2,200 pounds in weight, but may reach lengths of up to 15 feet (Gunter 1941) and weigh as much as 3,570 pounds (Rathbun et al. 1990).

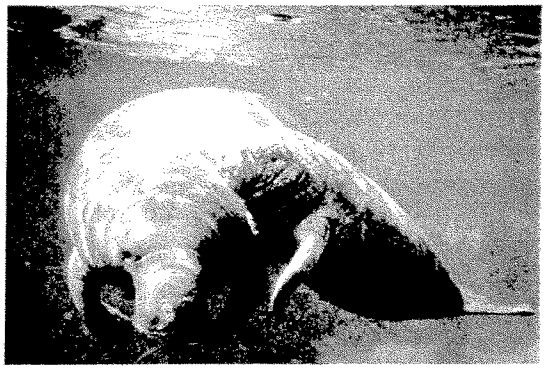

Figure 5. West Indian manatees.

Reproduction can occur throughout the year, but most calves are born in the spring and summer. Gestation takes 12 to 14 months with newborns averaging 4 to 4.5 feet in length and about 66 pounds (Odell 1981). The calves remain with their mothers for several years. The manatee population in the United States is confined during the winter months to the coastal waters of the southern half of peninsular Florida and to springs and warm water outfalls as far north as southeast Georgia. However, during the summer months, they may migrate as far north as coastal Rhode Island on the east coast and Texas on the Gulf of Mexico (Service 1999).

Manatees occur throughout Biscayne Bay on a year-round basis, but are most consistently observed in tributaries (*i.e.*, conveyance canals) and nearshore seagrass beds, which are used as foraging areas. The extensive acreages of seagrass beds in the bay provide important feeding areas for manatees. Manatees also depend upon canals as a source of freshwater and resting sites. Also, it is highly likely that the species depend on the deep canals as a cold-weather refuge. The relatively deep waters of the canals respond more slowly to temperature fluctuations at the air/water interface than the shallow bay waters. Thus, the canal waters remain warmer than open bay waters during the passage of winter cold fronts.

Manatees have been observed in virtually all conveyance canals lying within the project boundary according to data collected by the FWC and Miami-Dade County DERM. These include (from north to south), the C-100, C-1 (Black Creek Canal), C-102 (Princeton Canal), Military Canal, C-103 (Mowry Canal), Florida City Canal, North Canal, FPL Canal, Card Sound Road Canal, and C-111 (Aerojet Canal). Manatee sightings are especially high in Black Creek Canal, Mowry Canal, North Canal, FPL Canal, Card Sound Road Canal, and Aerojet Canal. Unfortunately, the water control structures associated with the canals are directly responsible for a significant percentage of reported manatee deaths (boating-related mortality is the other leading cause of manatee deaths). The FWC and Miami County DERM data also include mortality information. Of the canals within the project area, manatee mortality appears to be particularly high in Black Creek Canal and Mowry Canal (FWC 2004: www.floridamarine.org). It is unclear from the data if the cause of death in the canal is due to the water control structures or collisions with boats utilizing the canals.

The West Indian manatee was listed as endangered on March 11, 1967, under a law that preceded the ESA. Additional Federal protection is provided for this species under the Marine Mammal Protection Act of 1972.

Wood stork

The wood stork is a large, long-legged wading bird with a length of 33 to 45 inches, and a wingspread of 59 to 65 inches (Figure 6). With the exception of black primary and secondary wing feathers and a short black tail, all the plumage is white. On adults, the head is not feathered and is covered with black, rough, scaly skin. The legs and bill are dark and the feet are pink (Service 1999).

Wood storks are seasonally monogamous, probably forming a new pair bond every season. Females lay a single clutch per breeding season, but will renest if the nest fails early in the breeding season. They typically construct their nests in medium to tall trees that occur in stands located either in swamps or on islands surrounded by relatively broad expanses of open water. The average clutch size is three to five eggs, and incubation takes about 30 days. Wood storks tend to use the same colony sites over many years, as long as the sites remain undisturbed and sufficient feeding habitat remains in the surrounding wetlands. Bald cypress (*Taxodium distichum*), red mangrove, buttonwood, and custard apple (*Anona glabra*) are commonly used as nesting substrates in the Everglades. Wood storks have also been observed to nest in dead oaks (*Quercus* spp.), pond cypress (*Taxodium ascendens*), black gum (*Nyssa biflora*), black

mangrove, and willow (Service 1999). During the non-breeding season, wood storks are found throughout Florida, with interchange between north and south Florida and between neighboring states.

The forging behavior of wood storks, referred to as tactolocation or grope feeding, requires a high concentration of prey items. To forage, a wood stork wades through the water with its beak immersed and partially open. When it touches a prey item, the mandibles shut; the bird raises its head, and swallows what it has caught. In order to increase feeding efficiency, the stork requires foraging depths of 2 to 15 inches, and a high density of fish, their primary prey item, concentrated in these shallow ponds or wetlands. This high prey concentration is critical during the breeding season when sufficient feeding sites in close proximity to the rookeries are necessary to provide enough food to the young, thereby reducing the probability of nestling mortality due to starvation. Although wood storks have been known to fly distances of up to 75 miles to feed, foraging habitat closer to colony areas allows more feeding time and less expenditure of energy to reach the foraging location. This species is known to feed in estuarine and freshwater habitats although it is primarily associated with freshwater areas for nesting, roosting, forging, and rearing young.

Figure 6. Wood stork.

Wood storks are commonly observed in the project area. Appendix A indicates virtually all references utilized to create the table include wood storks on its species list. Wood storks have been observed feeding in the project area near FPL's Turkey Point Power Plant (Toby Obenaur, BNP, personal communication, 2003). Enhancing freshwater wetlands and re-establishing mesohaline conditions in the mangrove wetlands by redistributing freshwater flow and restoring more natural hydroperiods should increase the available prey base for wood storks, as well as other wading birds, throughout the project area.

The wood stork was listed as federally endangered in February 1984. It is also listed as endangered by the State of Florida. No critical habitat has been designated for this species. In evaluating project effects to wood storks in Florida, the Service considers effects to the colony, the primary zone, the secondary zone, and the core foraging area (CFA) as direct effects, and effects to foraging areas outside the CFA as indirect effects. The BBCW project lies well outside all known wood stork colonies, as well as the colonies' primary and secondary zones. However, the BBCW project area lies within the CFA of two wood stork colonies (Service, 2001 data). The CFA is defined as a 30-kilometer diameter (18.6 mile) zone surrounding the colony boundary. According to the Service's Draft Standard Local Operating Procedures for Endangered Species for Wood Storks, it is recommended that restrictions in the CFAs correspond to nesting and non-nesting season cycles. The two colonies affected by

the BBCW project are located approximately 16 and 18 miles northwest of the Deering Estate, so the CFAs overlap only Subcomponent 1 and parts of Subcomponent 2 of the project. All other project subcomponents lie south and east of these two CFAs.

Bald eagle

Bald eagles are large raptors, reaching lengths of 32 inches with a wingspan of 80 inches. They have rounded wings and thick, hooked bills. An adult eagle has a white head and upper neck and a white tail. The body is dark brown and the bill is yellow. Immature birds have dark brown body plumage, including the head and tail. The white head and tail plumage are gradually acquired over 4 years.

Eagles are monogamous, and usually initiate nesting in the beginning of October. Nesting habitat includes the nest tree, usually a live pine (*Pinus* spp.) or bald cypress, and perch and roost sites. Eagles will, however, nest in dead trees, and recently have been observed nesting on towers. In Florida, most nests are found within 2 miles of water (Service 1999). In areas with a high human population, the distance between the nest site and water may be greater. The cone-shaped nest may be 6 feet across and 8 feet from top to bottom and is usually lined with grasses or Spanish moss. Egg laying is complete by the end of December with clutches usually composed of one or two eggs. Incubation takes approximately 35 days and fledging occurs at 10 to 12 weeks, usually by mid-May. Bald eagles generally nest near large rivers, lakes or estuaries where they feed primarily on fish and water-dependent birds. Eagles are considered a water-dependent species, but feed opportunistically on both live prey and carrion. In south Florida, their primary diet is fish, but they also prey on turtles and waterfowl (Service 1999).

Man's use of dichlorodiphenyltrichloroethan (DDT) and other pesticides was considered the greatest threat to the bald eagle. The toxic compounds interfere with successful nesting and hatching of young. Hunting and habitat alteration also contributed to the eagle's decline. DDT was banned for most uses in the United States in 1972. Since then, the bald eagle population has steadily increased from 450 nesting pairs in the early 1960s to 4,500 adult bald eagle pairs and an unknown number of young and subadults (Service 1995).

The bald eagle was designated as an endangered species on March 11, 1967. The species status was reclassified to 'threatened' in 1995 (Service 1995). No critical habitat has been designated for this species. The bald eagle remains listed as a threatened species, and as such, there are management guidelines specified by the Service for maintaining and improving the population of the bald eagle. The guidelines specify primary and secondary management zones for protection of nest trees with specific restrictions on human activities within these zones.

The BBCW project footprint is outside the primary and secondary zones of known bald eagle nest sites. The most proximal site is located on West Arsenikcr Key, which is southeast of Turkey Point and approximately 3.4 miles from the project boundary (T. Obenaur, BNP, personal communication, 2003). Due to the proximity of this nest to the project area, bald eagles undoubtedly utilize the project area for foraging habitat. The next closest known nest is located

13 miles northeast of the Deering Estate Flowway subcomponent. It is unclear whether or not project restoration efforts will improve the eagle's prey base, but they should not negatively affect it.

American crocodile

The American crocodile is a large, greenish-gray crocodilian with black mottling (Figure 7). Adults reach lengths of 12.5 feet and males are larger than females (Service 1999). Adults also have a hump over the eyes and non-uniform dorsal armoring. Compared to the American alligator, the snout of the crocodile is longer, narrower and the fourth tooth of the lower jaw is exposed when the jaw is closed.

Found primarily in mangrove swamps, creeks and bays during nesting and breeding season, the crocodiles tend to remain farther inland in fresh and brackish-water during the non-nesting season. During nesting season, females lay nests of 8 to 56 oval eggs in areas where well-drained soils consisting of sands, marl, peat or rocky spoil are available above the normal high water level. Incubation lasts approximately 86 days. During this time, the female will visit the nest and must be present to excavate the young after hatching. Hatchling success appears to be related to the close proximity of suitable nursery habitat, which provides cover and forage habitat. Raccoons are known to be a nest predator although they are probably not the limiting factor. Wading birds, gulls, blue crabs, sharks, and other crocodiles also eat the hatchlings. Juvenile crocodiles typically forage on fish, crabs, snakes and other small invertebrates. Adults eat fish, crabs, snakes, turtles, birds, and small mammals although generally they are considered opportunistic feeders.

Crocodiles were listed as endangered throughout their range in 1975 and critical habitat was established in 1979. Critical habitat in Biscayne Bay starts at the easternmost tip of Turkey Point and extends south. The proposed project is located 2.5 miles north of the Turkey Point. The listing of this species documented that habitat alterations and human disturbances to crocodiles and their nests were most likely the predominant cause of population declines.

Figure 7. American crocodile.

Crocodiles are known to exist throughout the project area at densities ranging from 0.0 to 0.29 crocodile per 0.6 mile (Cherkiss 1999). Although no nests are known to occur within project boundaries, the cooling canals of FPL's Turkey Point Power Plant, which are in close proximity to project boundaries, support the most successful crocodile nesting population in south Florida (Mazzotti et al. 2002). Individuals from this population disperse northward and southward into the BBCW project area.

Some have been seen as far north as the Miami River and Key Biscayne (M.S. Cherkiss, University of Florida, personal communication, February 2003). These cooling canals offer premium nesting habitat because they satisfy the crocodile's two primary nesting requirements–suitable substrate that lies above the normal high water level and adjacent deep-water refugia. While crocodiles prefer sandy substrates, they will often utilize canal spoil banks (Kushlan and Mazzotti 1989).

One of the primary BBCW project objectives is to restore a more natural salinity gradient to the coastal wetlands. Watershed flow through conveyance canals has robbed these wetlands of vital freshwater for the last several decades, creating an unnaturally high salinity environment, which has caused a loss of graminoid marshes and a landward migration of mangrove wetlands. Juvenile crocodiles require low salinities for growth and survival presumably because they have limited physiological capability to osmoregulate. The ideal salinity range for crocodiles is 0 to 20 ppt (Mazzotti et al. 2002). As salinity levels increase above 20 ppt, habitat suitability decreases. Redirecting freshwater from conveyance canals into the coastal wetlands will lower salinities there, which should increase suitable habitat for juvenile crocodiles.

As noted above, an extensive mosquito and drainage ditch system that interferes with historic flow patterns exists in much of the project area between Shoal Point and Turkey Point. This ditch system is a gridwork of relatively shallow (<1 meter deep), closely spaced, north-south oriented mosquito ditches that are crossed by larger, deeper (up to 2 meter deep), and more widely spaced (every 400 meter) east-west oriented drainage ditches. The smaller mosquito ditches are particularly disruptive to flow, and to restore a more natural flow pattern in this area, some or all of these ditches should be filled. Because the mosquito ditches are relatively shallow, they offer little, if any, crocodile refuge. Restoring a more natural flow across these ditches should enhance the restoration of the mangrove wetlands by providing a more stable mesohaline condition, which will enhance overall crocodile habitat. The larger east-west drainage ditches are more suitable as crocodile refuge areas, and backfilling these ditches could eliminate potential deep water crocodile refuge. However, it is unclear at this time if any of these ditches will be backfilled, and it is highly likely that some will be integrated into the restoration of the historic creek systems in this area.

Sea turtles

Of the four species of sea turtles listed in Table 1, none nest within the project area since there is no suitable habitat for nesting in the area. The green sea turtle feed on seagrasses in the project area, and the loggerhead may be found foraging in the area for crustaceans or mollusks. The hawksbill may be found feeding in the hardgrounds areas generally located in the middle of the bay, but this species prefers sponges associated with well developed coral reefs the nearest of which are located in the Atlantic waters several miles seaward of the Biscayne Bay. The leatherback may be the least likely to be found since it is a more open ocean species that feeds on pelagic jellyfish. The remainder of this section will discuss the green and loggerhead sea turtles only, as they are the most likely to be found in the project area.

The green sea turtle is a worldwide species in tropical and subtropical waters. In Atlantic waters adjacent to the United States, green turtles are found around the U.S. Virgin Islands, Puerto Rico,

and the continental United States from Texas to Massachusetts. Important feeding areas in Florida include the Indian River Lagoon, Florida Keys, Florida Bay, Homosassa, Crystal River and Cedar Key (NOAA Fisheries and Service 1991). The green sea turtle is among the largest turtles with adults averaging 3.28 feet (carapace length) and 330 pounds. The upper surface is black, but changes color during the life of the turtle and may become grey, green, brown, or black with a variety of patterns. The under surface remains yellowish-white throughout the turtle's life. Distinguishing characteristics of the green sea turtle include a smooth carapace with four pairs of lateral scutes and a single pair of elongated scales between the eyes (Service 1999). Like other sea turtle species, green sea turtles have paddle-like front limbs for swimming, a thick neck and head that cannot be drawn back into the body, and special respiratory mechanisms and organs to excrete excess salt taken in with seawater when they feed.

Since the reproductive cycles of all sea turtles are similar, a generalized version encompasses all. Mating takes place offshore, and the turtles must only mate once to fertilize all eggs laid during the nesting season. When nesting, the female crawls onto a high-energy beach, usually at night, and digs a hole in the sand above the high water line. After laying about 100 (number of eggs varies among species) white, leathery eggs, she covers them and returns to the sea. A single female may nest several times a season, usually at 2-week intervals. The eggs incubate about 60 days, depending on the weather. Hatchlings dig out of the sand at night and make their way to the sea using light cues for guidance. Destruction of nests and hatchling mortality at sea are usually high. It appears sea turtles' high number of eggs per clutch and several nestings per season have evolved to offset this high mortality rate. Most sea turtles do not nest every year, but return on either a 2 or 3-year cycle to the same general area or beach.

Green sea turtle clutch size averages 110 to 115 eggs with 2 to 4 or more years between breeding seasons. Hatchlings leave the beach to assume a pelagic existence for an undetermined number of years. It is assumed that during this time, the young turtles are omnivorous. However, as the turtles mature and shift to benthic feeding grounds, they become herbivorous, feeding on seagrasses and algae.

As these seagrass meadows are seldom near their nesting beaches, turtles migrate hundreds of miles from feeding grounds to nest. The location of foraging grounds for turtles that nest in Florida is unknown (Service 1999), although a population of juveniles is known to forage in the central Indian River Lagoon from Mosquito Lagoon to Palm Beach County. Natural predators include raccoons, feral hogs, foxes, ants, ghost crabs (*Ocypode quadrata*), marine birds, and fish. On land, the raccoon is the primary predator, destroying the nests to forage on the eggs. Human interference, exploitation, and degradation of the nesting and feeding habitats continue to be a serious problem for the green sea turtle population.

The green sea turtle was listed as a federally endangered species in July 1978. Although critical habitat is designated for this turtle around Puerto Rico, there is no critical habitat designation in Florida.

The loggerhead sea turtle is the most common sea turtle in south Florida. The upper side of the carapace in adults and subadults reddish-brown, and the plastron is medium yellow. Carapace length of adult loggerheads is 36 inches with a body weight of approximately 250 pounds. The

loggerhead has an unusually large head in comparison with their bodies, which provides for the attachment of strong jaw muscles for crushing conchs and crabs. The loggerhead has a worldwide distribution in temperate and tropical waters, and can be found in estuarine areas and on the continental shelves of the Atlantic, Pacific and Indian oceans.

The loggerhead nests from North Carolina to south Florida. In south Florida, the predominant counties utilized for nesting include Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties. Mean clutch size varies from 100 to 126 eggs averaging 53 to 55 days for incubation in Florida (Service 1999). As with the other species of sea turtles, loggerhead hatchlings assume a pelagic existence until they reach a length of approximately 18 inches. Evidence suggests that post-hatchlings eat macro plankton, gastropods, and crustaceans associated with sargassum seaweed as well as the seaweed itself. Adults and subadults primarily forage on benthic invertebrates, gastropods, mollusks, and crustaceans.

Threats to the loggerhead result from the destruction of nests and hatchling predation by raccoons, feral hogs, opossums (*Didelphis virginiana*), foxes, ghost crabs, ants, fish, sharks, orca whales (*Orcinus orca*), bass, and grouper. Human interference in regards to nesting in south Florida is similar to that of the leatherback. The loggerhead sea turtle was listed as federally threatened in July 1978. There is no critical habitat designated for this species.

Eastern indigo snake

The eastern indigo snake is a large, blue-black, nonvenomous snake with a cream, orange, or red chin and throat (Figure 8). Throughout most of its range, this species is found in a variety of habitats from pine and scrubby flatwoods, high pine, dry prairie, edges of freshwater marshes, agricultural fields, coastal dunes, and human altered habitats. This species requires sheltered "retreats" from winter cold and desiccating conditions, frequently using gopher tortoise burrows as refugia. Throughout peninsular Florida, the eastern indigo snake may be found in all terrestrial habitats (Service 1999). Adult male snakes have larger home ranges than adult females and juveniles; their summer season ranges may encompass as much as 550 and 390 acres, respectively.

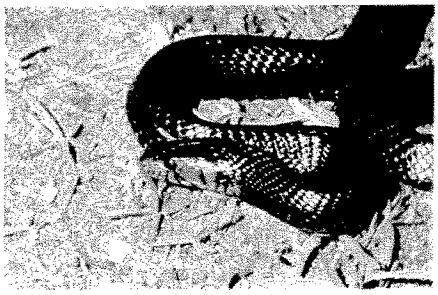

Figure 8. Eastern indigo snake.

This species is an active carnivorous predator that will eat any vertebrate that it can consume. Adults prey on fish, frogs, toads, snakes, lizards, turtles, turtle eggs, birds, and small mammals. The indigo can eat venomous snakes because they are immune to the venom. Juvenile indigo snakes eat mostly invertebrates. The indigo eats its prey live as opposed to other species, which kill their prey by constriction prior to eating it. In northern Florida, breeding usually occurs between

November and April. Females deposit 4 to 12 eggs during May or June, which incubate for approximately 3 months. In south-central Florida, evidence suggests that the breeding season is extended from June to January with egg laying in April to July. The eastern indigo snake was listed as a federally threatened species in January 1978. No critical habitat has been designated for this species.

Indigo snakes are known to occur in the project area. They are regularly sighted along some of the levees, particularly the L-31E levee (Dr. J.F. Meeder, Florida International University, personal communication. 2003). Indigos utilize a wide variety of habitats, including various wetland types, many of which are found in the BBCW project area. However, some believe that the indigos occurring in the project area comprise an artificial population due to manmade effects on topography (*e.g.* levees and other artificial high ground; G.H. Dalrymple, The Everglades Group, personal communication, February 26, 2003). This project area is at the southern extreme of the indigo's range, and the snakes in this area survive in suboptimal environments. Dr. Dalrymple believes this population is on the brink of extinction and the redirection of water from canals into wetlands may reduce or degrade feeding habitat in this area enough to eliminate the population. Although the project is supposed to remove manmade upland such as the levees associated with Military and North Canals, the creation of new levees are included in the project.

B. State listed species

The project area also provides habitat for species that are listed by the State of Florida. These species are recognized as either endangered, threatened or as species of special concern, and are protected or otherwise given special consideration under Chapter 39-27.003, 39-27.004, and 39-27.005, Florida Administrative Code. These State-listed species are provided in Table 2, which are in addition to the federally listed species. Birds comprise the majority of the State-listed species associated with the project. Most of these are wading birds, which are generally dependent upon shallow open water for foraging on aquatic invertebrates and small fishes. The State does not list critical habitat for any of its species.

Table 2. Species listed by the FWC as State endangered (E), threatened (T), or of special concern (SSC), excluding federally listed species, potentially occurring within the C-7 project area (FWC 1997).

Common Name	Scientific Name	Status
MAMMALS		
Florida mastiff bat	*Eumops glaucinus floridanus*	E
Everglades mink	*Mustela vison evergladensis*	T
BIRDS		
Arctic peregrine falcon	*Falco peregrinus tundrius*	E
Piping plover	*Charadrius melodus*	T
White-crowned pigeon	*Columba leucocephala*	T
Least tern	*Sterna antillarum*	T
Roseate spoonbill	*Ajaia ajaja*	SSC
Limpkin	*Aramus guarauna*	SSC

Table 2 (continued)

Common Name	Scientific Name	Status
BIRDS		
Little blue heron	*Egretta caerulea*	SSC
Reddish egret	*Egretta rufescens*	SSC
Snowy egret	*Egretta thula*	SSC
Tricolored heron	*Egretta tricolor*	SSC
White ibis	*Eudocimus albus*	SSC
Brown pelican	*Pelecanus occidentalis*	SSC
Black skimmer	*Rynchops niger*	SSC
REPTILES		
Miami black-headed snake	*Tantilla oolitica*	T
American alligator	*Alligator mississippiensis*	SSC
Gopher tortoise	*Gopherus polyphemus*	SSC
FISHES		
Mangrove rivulus	*Rivulus marmoratus*	SSC
INVERTEBRATES		
Florida tree snail	*Liguus fasciatus*	SSC

The Service recommends that the Corps contact the FWC to solicit input for species under their jurisdiction that may potentially be present in the study area or affected by the project. Of the State listed species appearing in Table 2, the wading birds and American alligator are arguably the most common and ecologically important in the BBCW project area.

V. NON-NATIVE WILDLIFE

The BBCW project area is known to provide habitat for numerous species of non-native vertebrate wildlife (Appendix A and Table 3). Many of these species have been introduced to the area through accidental release from fish wholesale houses into south Florida canals while others are intentionally released as unwanted pets. In many cases, these animals have adapted to the subtropical environment of south Florida and have established themselves as breeding residents. Whereas some species pose little or no known threat to natives, others are particularly invasive, presenting a predatory threat or competing with indigenous species for food, territory, nest sites, or other resources. Feral hogs, for example, destroy native vegetation (Singer et al. 1984) and may disturb sea turtles, gopher tortoises, and shorebird nests (Cuthbert 2002). They may also transmit diseases, such as pseudorabies, eastern equine encephalitis, and bacterial brucellosis, and trichinosis. Despite these negative attributes, hogs are a common prey item for the Florida panther (Maehr et al. 1990, Dalrymple and Bass 1996). Other non-native mammals,

Table 3. Known and potential non-native species occurring within the BBCW project area. Species listed are confirmed as breeding and have achieved status of "permanence" in Miami-Dade County.

MAMMALS	
Feral hogs	*Sus crofta*
Norway rat	*Rattus norvegicus*
Black rat	*Rattus rattus*
House mouse	*Mus musculus*
Nine-banded armadillo	*Dasypus novemcinctus*
BIRDS	
European starling	*Sturnus vulgaris*
House finch	*Carpodacus mexicanus*
House sparrow	*Passer domesticus*
Spot-breasted oriole	*Icterus pectoralis*
Red-whiskered bulbul	*Pycnonotus jocosus*
Eurasian collared dove	*Streptopelia decaocto*
Muskovy duck	*Carina moshschata*
Monk parakeet	*Myiopsitta monachus*
REPTILES	
Spotted caiman	*Caiman crocodilus*
African redhead agama	*Agama agama*
Giant amieva	*Amieva amieva*
Cuban brown anole	*Anolis sagrei*
Puerto Rican crested anole	*Anolis cristatellus*
Bark anole	*Anolis distichus*
Knight anole	*Anolis equestris equestris*
Cuban green anole	*Anolis porcatus*
Brown basilisk	*Basiliscus vittatus*
Mexican spiny-tailed iguana	*Ctenosaura pectinata*
Green iguana	*Iguana iguana*
Tropical house gecko	*Hemidactylus mabouia*
Indopacific gecko	*Hemidactylus garnotii*
Mediterranean gecko	*Hemidactylus turcicus*
Northern curlytail lizard	*Leiocephalus carinatus armouri*
Common boa	*Boa constrictor*
Brahminy blind snake	*Ramphotyphlops braminus*
AMPHIBIANS	
Greenhouse frog	*Eleutherodactylus planirostris*
Cuban treefrog	*Osteopilus septentrionalis*
Giant toad	*Bufo marinus*

Table 3 (continued)

FISHES	
Oscar	*Astronotus ocellatus*
Pike killifish	*Belonesox belizanus*
Butterfly peacock	*Cichla ocellaris*
Black acara	*Cichlasoma bimaculatum*
Midas cichlid	*Cichlasoma citrinellum*
Jaguar guapote	*Cichlasoma managuense*
Mayan cichlid	*Cichlasoma urophthalmus*
Blue tilapia	*Oreochromis aureus*
Spotted tilapia	*Tilapia mariae*
Walking catfish	*Clarias batrachus*
Sailfin catfish	*Pterygoplicthys multiradiatus*
Asian swamp eel	*Monopterus albus*
INVERTEBRATES	
Lobate lac scale	*Paratachardina lobata*
Red imported fire ants	*Solenopsis invicta*

the Norway rat (*Rattus norvegicus*) and the black rat (*Rattus rattus*), are vectors of murine typhus, salmonellosis and leptospirosis. Black rats are also known to prey on native birds and bird eggs.

Non-native bird species carry diseases and often compete with native species for nest sites. The European starling, for example, competes aggressively with native species for tree cavities. The monk parakeet has been established in Miami-Dade County for over 30 years. This parrot feeds on fruits, seeds, and insects, and its effect on native species is unknown. In one instance in the 1990s, however, a bald eagle nest failure was attributed to a disease transmitted by a monk parakeet colony (Buhler et al. 2001). Several other non-native birds have been observed in the vicinity of the project area (Appendix A). These birds (*e.g.*, orange-winged parrot [*Amazona amazonica*], blue and gold macaw [*Ara ararauna*]) are not considered established or breeding within the project area. Many of these birds are released unwanted pets or unintentional releases from zoos and pet stores resulting from Hurricane Andrew, which made landfall in south Miami-Dade County in September 1992. As many parrot and parakeets are such long-lived species, these individuals may be present for many years and some may have the potential to establish breeding populations.

Several non-native reptilian species are of particular concern in the project area. The spectacled caiman is known to exist in the project area. This reptile has a wide-ranging diet (Ellis 1980) and may compete with the American alligator for food and territory. Cuban brown anoles (*Anolis sagrei*) are present in the project area and evidence suggests that brown anoles displace and prey upon green anoles (*Anolis carolinensis*) (Gerber 1991, Echternacht 1999, Campbell 2000). The tropical house gecko (*Hemidactylus mabouia*) is also known to prey upon native anoles (Bartlett and Bartlett 1999). The common boa (*Boa constrictor*) readily feeds upon native

birds, mammals, and other reptiles. Numerous boas, including gravid females and neonates, have been collected at the Deering Estate at Cutler since the 1990s (A. Warren-Bradley, Miami-Dade Parks and Recreation Department, personal communication, 2003).

Native amphibian populations are at risk due to the Cuban tree frog (*Osteopilus septentrionalis*) and the giant toad. The Cuban tree frog has been known to prey upon the southern toad (*Bufo terrestris*), the narrow mouthed toad (*Gastrophryne carolinensis*), the southern leopard frog (*Rana sphenocephala*), the green treefrog, and the squirrel treefrog (*Hyla squirella*) (Austin 1973, Dalrymple 1994, Meshaka 1994). The prolific breeding strategy of the Cuban tree frog may disrupt the breeding ecology of native anurans. Toxic skin secretions may deem it undesirable as prey to both birds and snakes (Dalrymple 1994), though a variety of birds, mammals, and snakes can eat them (Bartlett and Bartlett 1999). Besides eating invertebrates, this species will prey on smaller frogs (Allen and Neill 1953, Austin 1973) and other vertebrates. Like the Cuban tree frog, the giant toad secretes toxins through the skin which can be fatal to animals attempting to feed on them (including native snakes, birds, and mammals). The giant toad preys aggressively upon small vertebrates and competes with native anurans for food resources and breeding areas. In addition, the consumption of giant toad eggs causes mortality of tadpoles of native anurans (Punzo and Lindstrom 2001).

Numerous non-native fishes have inhabited the canal systems in south Florida for several decades. The impact of these species is largely unknown. Non-native species are often more tolerant of fluctuating salinity and low dissolved oxygen levels. They may compete with native fishes for food resources and spawning areas. Some non-natives that are firmly established in south Florida include the butterfly peacock (*Cichla ocellaris*), spotted tilapia (*Tilapia mariae*), pike killifish (*Belonesox belizanus*), and the oscar (*Astronotus ocellatus*). A more recent non-native fish species introduction to south Florida is the Asian swamp eel (*Monopterus albus*). Its introduction into Florida was probably the result of either an aquarium release or a fish farm escape or release, or a combination of all of the above. The impact of this species to the local ecology is presently unknown. The distribution, biology, and impacts of Florida populations are being investigated by U.S. Geological Survey researchers in conjunction with university biologists. Because they are generalized predators, this species is a potential threat to native fishes, frogs, and aquatic invertebrates. This eel is a voracious piscivore capable of living out of water for a considerable length of time (Day 1958).

Two invertebrate species of emerging concern are the lobate lac scale (*Paratachardina lobata*) and the Mexican bromeliad weevil (*Metamasius callizona*). The lobate lac scale was first detected in Florida (Broward County) in 1999 and currently ranges from Palm Beach County south. Numerous ecologically important native plant species are affected by this scale insect including wax myrtle (*Myrica cerifera*), myrsine (*Myrsine floridana*), white mangrove, buttonwood, and willow (Pemberton 2003). Some plant species appear to tolerate dense infestations, though long-term effects of such infestations are unknown at this time. Mild infestations can result in branch dieback, though in severe cases, highly infested shrubs and small trees have died. This insect is having severe impacts on native plant communities, especially tree islands and hardwood hammocks. The Mexican bromeliad weevil, though not currently known to occur in the project area, has had a devastating effect on rare and endangered bromeliad populations in 17 counties, including Miami-Dade (Frank 1999). In addition to this

pest's effect on rare bromeliad species, many invertebrate animals rely on the microhabitat created by native bromeliads. Staff at the Deering Estate currently conducts surveys for this weevil (Dallas Hazelton, personal communication, 2004). Red imported fire ants (*Solenopsis invicta*) have expanded from their site of accidental introduction at the port of Mobile in the 1930s to occupy most of the southeastern United States. Fire ants displace native ants and have been associated with hatchling mortalities in birds and turtles.

VI. SUMMARY OF FINDINGS

From the description above it is apparent that the BBCW project area contains a broad and diverse representation of habitat types common in the south Florida ecosystem. Two of these habitat types, seagrasses and mangrove wetlands, are extremely important in terms of supplying plant biomass to the food web of Biscayne Bay. Both also serve as vital refuge and nursery grounds for a wide variety of marine and estuarine fish and invertebrate species, including recreationally and commercially valuable ones, such as stone crab, pink shrimp (*Farfantepenaeus duorarum*), spiny lobster, snook, gray snapper, and others. The BBCW project objectives of re-establishing a more natural salinity regime and reducing point source discharges of fresh water in the nearshore areas of western Biscayne Bay should serve to restore and enhance seagrasses and mangrove forests, thus increasing the function of these habitats as nursery grounds. It is also anticipated that a return of more natural and more stable mesohaline conditions in the nearshore area will result in the re-establishment of oyster communities that once existed along the shoreline, and provide enhanced habitat for threatened and endangered species such as the American crocodile.

Other habitats found in the project area provide equally important ecological functions. For example, freshwater and oligohaline graminoid marshes foster the production of large numbers of mosquito fish, sailfin mollies, and other small fishes that serve as the prey base for many of the region's wading birds and higher trophic level predators. Current water management practices have resulted in altered hydroperiod and water levels in these marshes, which has reduced prey fish production and impacts breeding capabilities of wading birds. Restoring more natural salinities, hydroperiods, and water levels to these marshes, as planned in the BBCW project, should serve to increase prey fish production and further enhance these habitats for wading birds.

The BBCW project represents an opportunity to restore, enhance and preserve the various habitats that comprise the project area. This report documents the tremendous diversity of wildlife that these habitats support. In the broader picture, the BBCW project is an important component of CERP because it encompasses such a large area and includes diverse habitat types in a region that is otherwise heavily urbanized. Furthermore, the project is an appropriate representative of the fundamental purpose of CERP—the restoration, protection, and preservation of the south Florida ecosystems.

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VII. Appendix A. Vertebrate species that have been observed or are anticipated to occur in or near the BBCW project area. The list is a concatenation of species lists from ten separate reports and surveys as identified in Section III of this report. The table includes the habitat type where the species was observed, when available, and it includes the source(s) of information. Appendix A also specifies if the species is a federally or State listed endangered or threatened species, or species of special concern, and it indicates if the species is a non-native (exotic). Keys for interpreting location, habitat type, and source codes appear at the end of the list. Species appear in alphabetical order according to genus and species under each vertebrate class.

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
MAMMALS							
Right whale	*Balaena glacialis*			E	E	B	Y
Sei whale	*Balaenoptera borealis*			E	E	B	Y
Finback whale	*Balaenoptera physalus*			E	E	B	Y
Domestic dog	*Canis familiaris*	5,7			Exotic	F,H,M	N
Least shrew	*Cryptotis parva*					B,H	Y
Nine-banded armadillo	*Dasypus novemcinctus*	7			Exotic	M	Y
Virginia opossum	*Didelphis virginiana*	5,7	DF			B,C,F,H,M	Y
Florida mastiff bat	*Eumops glaucinus*	5			E	B,F,H	Y
Domestic cat	*Felis domesticus*	7	DF			C,H,M	Y
Southern flying squirrel	*Glaucomys volans*	1				B,D	Y
Eastern yellow bat	*Lasiurus intermedius*					H	N
Seminole bat	*Lasiurus seminolus*					B	Y
River otter	*Lutra canadensis*	1,5,6,7	DF,MV			A,B,C,D,F	Y
Bobcat	*Lynx rufus*	1,5,6	EX			A,B,D,F,H	Y
Humpback whale	*Megaptera novaengliae*			E	E	B	Y
Striped skunk	*Mephitis mephitis*					B,H	Y
House mouse	*Mus musculus*	5				F	Y
Mink	*Mustela vison*					H	N
Everglades mink	*Mustela vison evergladensis*	5			T	F	Y
Round-tailed muskrat	*Neofiber alleni*	5				F	Y
Woodrat	*Neotoma floridana*					H	N
Key Largo woodrat	*Neotoma floridana smalli*	5		E	E	F,H,B	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Evening bat	*Nycticeius humeralis*					H	N
White-tailed deer	*Odocoileus virginianus*	5,6	SG			A,B,F,H	Y
Muskrat	*Ondatra zibethicus*					H	N
Silver rice rat	*Oryzomys argentatus*	5		E	E	F	Y
Marsh rice rat	*Oryzomys palustris*	5				F	N
Cotton mouse	*Peromyscus gossypinus*					B,H	Y
Key Largo cotton mouse	*Peromyscus gossypinus allapaticola*	5		E	E	B,F,H	N
Sperm whale	*Physeter macrocephalus*			E	E	B	Y
Raccoon	*Procyon lotor*	1,5,6,7	DF,EX,HF,MV			A,B,C,D,F,H,M	Y
Florida panther	*Puma concolor coryi*	5		E	E	F,H	Y
Norway rat	*Rattus norvegicus*	7	DF,MV		Exotic	C,M	Y
Black rat	*Rattus rattus*	5				B,F	Y
Harvest mouse	*Reithrodontomys humulis*					H	N
Mexican red-bellied squirrel	*Sciurus aureogaster*				Exotic	B	Y
Gray squirrel	*Sciurus carolinensis*	1,7				B,D,H,M	Y
Cotton rat	*Sigmondon hispidus*	5,7				B,F,H,M	Y
Spotted skunk	*Spilogale putorius*	1,7				D,H,M	Y
Marsh rabbit	*Sylvilagus palustris*	7	DF			B,C,H	Y
Lower Keys marsh rabbit	*Sylvilagus palustris hefneri*	5		E	E	F	N
Brazilian free-tailed bat	*Tadarida brasiliensis*					B,H	Y
West Indian manatee	*Trichechus manatus*	6,7	MS	E	E	B,C,H	Y
Bottlenose dolphin	*Tursiops truncatus*					B,H	Y
Gray fox	*Urocyon cinereoargenteus*	1,5,7	DF			B,C,D,F,H	Y
Florida black bear	*Ursus americanus floridanus*	5			T	F,H	N
BIRDS							
Cooper's hawk	*Accipiter cooperii*	1,5,6				A,B,D,H,S	Y
Sharp-shinned hawk	*Accipiter striatus*	1,5,6				A,B,D,F,H,S	Y
Spotted sandpiper	*Actitis macularia*	5,6,7	OW,MS			A,B,C,F,M	Y
Red-winged blackbird	*Agelaius phoeniceus*	1,5,7	MV,TI			A,B,C,D,F,H,M,S	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Wood duck	*Aix sponsa*	6				A	Y
Roseate spoonbill	*Ajaia ajaja*	1,5,6	CT,OW		SSC	A,B,D,F,H	Y
Orange-winged parrot	*Amazona amazonica*	1			Exotic	D	Y
Red-crowned parakeet	*Amazona ochrocephala*	6			Exotic	A	Y
Sharp-tailed sparrow	*Ammodramus caudacutus*	5				F,H	Y
Cape Sable Seaside sparrow	*Ammodramus maritimus mirabilis*			E	E	H	N
Grasshopper sparrow	*Ammodramus savannarum*	5				B,F,H	Y
Northern pintail	*Anas acuta*	5				B,F,H,S	Y
American widgeon	*Anas americanus*	5				F	Y
Northern shoveler	*Anas clypeata*	5				F,S	Y
Green-winged teal	*Anas crecca*	5				F,S	Y
Blue-winged teal	*Anas discors*	1,5,6				A,B,D,F,H,S	Y
Mottled duck	*Anas fuligula*	5,6				A,F,H,S	Y
Mallard	*Anas platyrhynchos*	5,7				F,M	N
American black duck	*Anas rubripes*	5				F	Y
Anhinga	*Anhinga anhinga*	1,5,7	DF,LP,MV			B,C,D,F,H,M,S	Y
Blue gold macaw	*Ara ararauna*	7			Exotic	M	Y
Limpkin	*Aramus guarauna*	1,5,6,7	MV		SSC	A,B,C,D,F,H,S	Y
Red-masked parakeet	*Aratinga erythrogenys*	1			Exotic	D	Y
Green-cheeked parakeet	*Aratinga holochlora*	6			Exotic	A	Y
Hispaniola parakeet	*Aratinga personata*	6,7			Exotic	A,M	Y
Ruby-throated hummingbird	*Archilochus colubris*	1,5,6				A,D,F,H,S	Y
Great egret	*Ardea alba*	1,5,6,7	CT,DF,LP,MV,OW,TI			A,B,C,D,F,H,M,S	Y
Great blue heron	*Ardea herodias*	1,5,6,7	CT,DF,HF,LP,MV,OW,TI			A,B,C,D,F,H,M,S	Y
Great blue heron (white race)	*Ardea herodias occidentalis*	1,5,6				A,D,F,H,S	Y
Ruddy turnstone	*Arenaria interpres*	1,5,6,7	MS			A,B,C,D,F,H	Y
Ruddy turnstone	*Arenaria interpres*					H	Y
Short-eared owl	*Asio ammeus*					H	N
Burrowing owl	*Athene cunicularia*	1			SSC	D,H	Y
Lesser scaup	*Aythya affinis*	5				F,B	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Ring-necked duck	*Aythya collaris*	5				S	Y
Upland sandpiper	*Bartramia longicauda*					B	Y
Cedar waxwing	*Bombycilla cedrorum*	1,5,6				A,B,D,F,H,S	Y
American bittern	*Botaurus lentiginosus*	5,7	DF			C,F,S	Y
Brandt's Goose	*Branta bernicla*					B	Y
Canada goose	*Branta canadensis*	5				F	Y
Yellow-chevroned parakeet	*Brotogeris chiriri*	1			Exotic	D	Y
Canary-winged parakeet	*Brotogeris versicolurus*	6			Exotic	A,H	Y
Great horned owl	*Bubo virginianus*	1,5,6				A,D,F,S	Y
Cattle egret	*Bubulcus ibis*	1,5,6,7	MV,OW,TI			A,B,D,F,H,M,S	Y
Bufflehead	*Bucephala albeola*					B	Y
Short-tailed hawk	*Buteo brachyurus*	1,5				B,D,F,H	Y
Red-tailed hawk	*Buteo jamaicensis*	1,5,6,7	DF,MV,TI			A,B,C,D,F,H,M,S	Y
Rough-legged hawk	*Buteo lagopus*	5				F	Y
Red-shouldered hawk	*Buteo lineatus*	1,5,6,7	DF,EX,TI			A,B,C,D,F,H,M,S	Y
Broad-winged hawk	*Buteo platypterus*	1,5,6,7	EX,MV			A,B,D,F,H,M,S	Y
Ferruginous hawk	*Buteo regalis*	5				F	Y
Swainson's hawk	*Buteo swainsoni*	5,6				A,F,H	Y
Green heron	*Butorides virescens*	1,5,6,7	DP,LP,MV,TI			A,B,C,D,F,H,M,S	Y
Muscovy duck	*Cairina moschata*	6,7			Exotic	A,H,M	Y
Sanderling	*Calidris alba*					B,H	Y
Dunlin	*Calidris alpina*	1,5				B,D,F,H,S	Y
Red knot	*Calidris canutus*	1,5				B,D,F,H	Y
Purple sandpiper	*Calidris maritima*					H	Y
Western sandpiper	*Calidris mauri*	1,5				B,D,H,S	Y
Least sandpiper	*Calidris minutilla*	1,5,6,7	MS			A,B,C,D,F,H,S	Y
Semipalmated sandpiper	*Calidris pusilla*	5,7	MS			C,S	Y
Chuck-will's widow	*Caprimulgus carolinensis*	1,5,6,7				A,B,D,F,H,M,S	Y
Whip-poor-will	*Caprimulgus vociferus*	6				A,B,H	Y
Crested caracara	*Caracara plancus*			T	T	H	N
American goldfinch	*Cardeulis tristis*	5				S	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Northern cardinal	*Cardinalis cardinalis*	1,5,6,7	DF,MV			A,B,C,D,F,H,M,S	Y
American goldfinch	*Carduelis tristis*	5,6				A,B,F,H,S	Y
Turkey vulture	*Cathartes aura*	1,5,6,7	DF,MV			A,B,C,D,F,H,M,S	Y
Veery	*Catharus fuscescens*	5,6				A,B,F,H	Y
Hermit thrush	*Catharus guttatus*	6				A	Y
Gray-cheeked thrush	*Catharus minimus*	6				A,B	Y
Swainson's thrush	*Catharus ustulatus*	6				A,B,H	Y
Willet	*Catoptrophorus semipalmatus*	1,5,6,7	MS			A,B,C,D,F,H,S	Y
Common loon	*Gavia immer*					B	Y
Belted kingfisher	*Ceryle alcyon*	1,5,6,7	DF,LP,MV,OW,TI			A,B,C,D,F,H,M,S	Y
Chimney swift	*Chaetura pelagica*	1,5,6				A,D,H,S	Y
Piping plover	*Charadrius melodus*	5		T	T	B,F,H	Y
Semipalmated plover	*Charadrius semipalmatus*	1,5,6				A,B,D,F,H	Y
Killdeer	*Charadrius vociferus*	1,5,6,7	DF,MV,TI			A,B,C,D,F,H,M,S	Y
Wilson's plover	*Charadrius wilsonia*	5,6				A,B,F,H,S	Y
Snow goose	*Chen caerulescens*	5				F	Y
Black tern	*Chlidonius niger*	5				S	Y
Antillean nighthawk	*Chordeiles gundlachii*					H	N
Common nighthawk	*Chordeiles minor*	1,5,6,7	DF			A,C,D,F,H,M,S	Y
Northern harrier	*Circus cyaneus*	1,5,6				A,B,D,F,H,S	Y
Marsh wren	*Cistothorus palustris*					H	Y
Sedge wren	*Cistothorus platensis*					H	Y
Yellow-billed cuckoo	*Coccyzus americanus*	1,5,6				A,B,D,F,H,S	Y
Mangrove cuckoo	*Coccyzus minor*	1,5,6,7	MV			A,B,C,D,F,H,S	Y
Northern flicker	*Colaptes auratus*	1,5,6,7				A,B,D,F,H,M,S	Y
Northern bobwhite	*Colinus virginianus*	5				B,F,H	Y
White-crowned pigeon	*Columba leucocephala*	1,5,6,7	MV		T	A,B,C,D,F,H,S	Y
Rock dove	*Columba livia*	1,5,6,7	DF			A,C,D,F,H,M	Y
Common ground dove	*Columbina passerina*	1,5,7	DF			B,C,D,F,H,M,S	Y
Eastern wood pewee	*Contopus virens*	6				A,H	Y
Black vulture	*Coragyps atratus*	1,5,6,7	MV			A,B,C,D,F,H,S	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
American crow	*Corvus brachyrhynchos*	5,7				B,H,M	Y
Fish crow	*Corvus ossifragus*	1,6,7	MV			A,B,C,D,H	Y
Smooth-billed ani	*Crotophaga ani*	5,6,7				A,F,M	Y
Blue jay	*Cyanocitta cristata*	1,5,6,7	MV			A,B,C,D,F,H,M,S	Y
Fulvous whistling duck	*Dendrocygna bicolor*					B,H	Y
Black-throated blue warbler	*Dendroica caerulescens*	1,5,6,7	MV			A,B,C,D,F,H,M,S	Y
Bay-breasted warbler	*Dendroica castanea*	6				A	Y
Yellow-rumped warbler	*Dendroica coronata*	1,5,6,7				A,B,C,D,F,H,M,S	Y
Prairie warbler	*Dendroica discolor*	1,5,6,7				A,B,D,F,M,S	Y
Florida prairie warbler	*Dendroica discolor paludicola*					H	Y
Yellow-throated warbler	*Dendroica dominica*	1,5,6				A,B,D,H,S	Y
Kirtland's warbler	*Dendroica kirtlandii*			E	E	B	Y
Magnolia warbler	*Dendroica magnolia*	1,6				A,B,D,H	Y
Black-throated gray warbler	*Dendroica nigrescens*					H	Y
Palm warbler	*Dendroica palmarum*	1,5,6,7	DF,TI			A,B,C,D,F,H,M,S	Y
Yellow warbler	*Dendroica petechia*	1,5				B,D,F,S	Y
Cuban yellow warbler	*Dendroica petechia gundlachi*					H	Y
Pine warbler	*Dendroica pinus*	6				A,B,H	Y
Blackpoll warbler	*Dendroica striata*	1,5,6				A,B,D,F,H	Y
Cape May warbler	*Dendroica tigrina*	1,5,6	CT,OW			A,B,D,F,H,S	Y
Black-throated green warbler	*Dendroica virens*	1,5				B,D,H,S	Y
Bobolink	*Dolichonyx oryzivorus*	5				B,F,H,S	Y
Pileated woodpecker	*Dryocopus pileatus*	1,5,6,7	MV			A,C,D,H,M,S	Y
Gray catbird	*Dumetella carolinensis*	1,5,6,7	DF,MV			A,B,C,D,F,H,M,S	Y
Little blue heron	*Egretta caerulea*	1,5,6,7	MV,OW,TI		SSC	A,B,D,F,H,M,S	Y
Reddish egret	*Egretta rufescens*	5,6,7	CT,MS,MV,OW,TI		SSC	A,B,C,F,H	Y
Snowy egret	*Egretta thula*	1,5,6,7	MV		SSC	A,B,C,D,F,H	Y
Tricolored heron	*Egretta tricolor*	1,5,6,7	CT,MV,OW,TI		SSC	A,B,C,D,F,H,M,S	Y
Swallow-tailed kite	*Elanoides forficatus*	5,6,7				A,B,F,H,M,S	Y
Black-shouldered kite	*Elanus caeruleus*					H	N

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Least flycatcher	*Empidonax minimus*	5				B,F,H	Y
Willow flycatcher	*Empidonax traillii*	1				D	Y
Acadian flycatcher	*Empidonax virescens*	1				D,H	Y
White ibis	*Eudocimus albus*	6	AG,CT,MV,TI		SSC	A,B,C,D,F,H,M,S	Y
Scarlet ibis	*Eudocimus ruber*	5				F	Y
Merlin	*Falco columbarius*	1,5,6				A,B,D,F,H,S	Y
Peregrine falcon	*Falco peregrinus*	1,5				B,D,F,S	Y
Arctic peregrine falcon	*Falco peregrinus tundrius*				E	H	N
American kestrel	*Falco sparverius*	1,5,6,7	DF,MV,TI			A,B,C,D,F,M,S	Y
Southeastern American kestrel	*Falco sparverius paulus*				T	B,H	Y
Eastern American kestrel	*Falco sparverius sparverius*					B	Y
Magnificent frigatebird	*Fregata magnificens*	1,6,7	OW			A,B,D,H,M	Y
American coot	*Fulica americana*	1,5,6,7	OW			A,B,D,F,H,M,S	Y
Common snipe	*Gallinago gallinago*	1,5,6				A,B,D,F,H,S	Y
Common moorhen	*Gallinula chloropus*	5,6,7	OW			A,B,F,H,M,S	Y
Common loon	*Gavia immer*	5				F,H	Y
Red-cheeked parrot	*Geoffroyus geoffroyi*	7			Exotic	M	Y
Common yellowthroat	*Geothlypis trichas*	1,5,7	TI			B,D,F,H,M,S	Y
Key West quail dove	*Geotrygon chrysia*					B	Y
Hill mynah	*Gracula religiosa*	1,6,7			Exotic	A,D,H,M	Y
Sandhill crane	*Grus canadensis*	5			T	H,S	Y
Blue grosbeak	*Guiraca caerulea*					B,H	Y
American oystercatcher	*Haematopus palliatus*				SSC	B,H	Y
Bald eagle	*Haliaeetus leucocephalus*	1,5,6,7	MV	T	T	A,B,C,D,F,H,S	Y
Worm-eating warbler	*Helmitheros vermivorus*	1,6				A,B,D,H	Y
Black-necked stilt	*Himantopus mexicanus*	1,5,6				A,B,D,H,S	Y
Barn swallow	*Hirundo rustica*	1,5,6,7				A,B,D,F,H,M,S	Y
Wood thrush	*Hylocichla mustelina*	6				A	Y
Yellow-breasted chat	*Icteria virens*	5,6				A,F,H	Y
Baltimore oriole	*Icterus galbula*	1,5				B,D,H,S	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Spotted oriole	*Icterus pectoralis*	6				A	Y
Mississippi kite	*Ictinia mississippiensis*	5				F,H	Y
Least bittern	*Ixobrychus exilis*	5				F,H,S	Y
Loggerhead shrike	*Lanius ludovicianus*	1,5				B,D,F,H,S	Y
Herring gull	*Larus argentatus*	7	MS			B,C,H	Y
Laughing gull	*Larus atricilla*	1,5,6,7	MS			A,B,C,D,H,M,S	Y
Ring-billed gull	*Larus delawarensis*	1,5,6,7	MV,MS			A,B,C,D,H,S	Y
Lesser black-backed gull	*Larus fuscus*					B,H	Y
Great black-backed gull	*Larus marinus*					H	Y
Bonaparte's gull	*Larus philadelphia*					B,H	Y
Franklin's gull	*Larus pipixcan*					H	Y
Black rail	*Laterallus jamaicensis*	5				F,H	Y
Short-billed dowitcher	*Limnodromus griseus*	5,6,7	MS			A,B,C,H,S	Y
Long-billed dowitcher	*Limnodromus scolopaceus*	5				S	Y
Swainson's warbler	*Limnothlypis swainsonii*					H	Y
Marbled godwit	*Limosa fedoa*	5				B,F	Y
Marbled godwit	*Limosa fedoa*	5				F	Y
Nutmeg mannikin	*Lonchura punctulata*	1				D	Y
Hooded merganser	*Lophodytes cucullatus*	5				F	Y
Red-bellied woodpecker	*Melanerpes carolinus*	1,5,6,7	DF,MV			A,B,C,D,F,H,M,S	Y
Red-headed woodpecked	*Melanerpes erythrocephalus*	6	DF			A	Y
Black scoter	*Melanitta nigra*					B,H	Y
Wild turkey	*Meleagris gallopavo*					H	N
Swamp sparrow	*Melospiza georgiana*	5				H,S	Y
Red-breasted merganser	*Mergus serrator*	1,5,6				A,B,D,F,H,S	Y
Northern mockingbird	*Mimus polyglottos*	1,5,6,7	DF,MV,TI			A,B,C,D,F,H,M,S	Y
Black-and-white warbler	*Mniotila varia*	1,5,7	MV			B,C,D,F,H,M,S	N
Brown-headed cowbird	*Molothus ater*	5				H,S	Y
Northern gannet	*Morus bassanus*					B,H	Y
Wood stork	*Mycteria americana*	1,5,6,7	LP,MV	E	E	A,B,C,D,F,H,S	Y
Great crested flycatcher	*Myiarchus crinitus*	1,5,6,7	DF			A,B,C,D,F,H,M,S	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Monk parakeet	*Myiopsitta monachus*	6,7			Exotic	A,H,M	Y
Long-billed curlew	*Numenius americanus*	5				F	Y
Whimbrel	*Numenius phaeopus*					B,H	Y
Yellow-crowned night heron	*Nyctanassa violacea*	1,5,6,7	LP,MV			A,B,C,D,F,H,M,S	Y
Black-crowned night heron	*Nycticorax nycticorax*	5,6,7	DF,MV			A,B,C,F,H,M,S	Y
Wilson's storm petrel	*Oceanites oceanicus*					B	Y
Connecticut warbler	*Oporornis agilis*	6				A,B,H	Y
Kentucky warbler	*Oporornis formosus*	6				A	Y
Eastern screech-owl	*Otus asio*	1,5,6,7				A,B,D,F,H,M,S	Y
Ruddy duck	*Oxyura jamaicensis*	7	LP			C	Y
Osprey	*Pandion haliaetus*	1,5,6,7	MV		SSC	A,B,C,D,F,H,M,S	Y
Northern parula	*Parula americana*	1,5,6,7				A,B,D,H,M,S	Y
Tufted titmouse	*Parus bicolor*	6				A	Y
House sparrow	*Passer domesticus*	1,6				A,B,D,H	Y
Savannah sparrow	*Passerculus sandwichensis*	5				B,F,H,S	Y
Painted bunting	*Passerina ciris*	1,5,6				A,B,D,F,H	Y
Indigo bunting	*Passerina cyanea*	5				B,F,H	Y
White pelican	*Pelecans erythrorhynchos*	5				B,H,S	Y
Brown pelican	*Pelecanus occidentalis*	1,6,7			SSC	A,B,C,D,H,M	Y
Cave swallow	*Petrochelidon fulva*	1				D	Y
Cliff swallow	*Petrochelidon pyrrhonota*	5,6				A,S	Y
Double-crested cormorant	*Phalacrocorax auritus*	1,5,6,7	LP,MV,MS,OW			A,B,C,D,F,H,M,S	Y
Red phalarope	*Phalaropus fulicaria*					B,H	Y
Rose-breasted grosbeak	*Pheucticus ludovicianus*	6				A,B,H	Y
Greater flamingo	*Phoenicopterus ruber*	6				A	Y
Downy woodpecker	*Picoides pubescens*	5,6				A,H,S	Y
Hairy woodpecker	*Picoides villosus*	5,6				A,F,H,S	Y
Eastern towhee	*Pipilo erythrophthalmus*	5,6,7				A,F,H,M,S	Y
Western tanager	*Piranga ludoviciana*	7				M	Y
Scarlet tanager	*Piranga olivacea*	1				B,D,H	Y
Summer tanager	*Piranga rubra*	5,6				A,B,F,H,S	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Glossy ibis	*Plegadis falcinellus*	5,6	OW			A,B,F,H,S	Y
Black-bellied plover	*Pluvialis squatarola*	7	MS			B,C	Y
Gray plover	*Pluvialis squatarola*					H	Y
Black-bellied plover	*Pluvialis squatarola*	5				S	Y
Horned grebe	*Podiceps auritus*					B,H	Y
Pied-billed grebe	*Podilymbus podiceps*	1,5,6,7				A,B,D,F,H,M,S	Y
Blue-gray gnatcatcher	*Polioptila caerulea*	1,5,6,7	DF,MV,TI			A,B,C,D,F,H,M,S	Y
Purple gallinule	*Porphyrula martinica*	5				F,H	Y
Sora	*Porzana carolina*	5,7	MV			C,F,H	Y
Purple martin	*Progne subis*	1,5,6				A,B,D,F,H,S	Y
Prothonotary warbler	*Protonotaria citrea*	1,6				A,B,D,H	Y
Rose-ringed parakeet	*Psittacula krameri*	6			Exotic	A	Y
Audubon's shearwater	*Puffinus iherrminieri*					H	Y
Red-whiskered bulbul	*Pycnonotus jocosus*	6			Exotic	A	Y
Boat-tailed grackle	*Quiscalus major*	1,5,6,7	DF,MV,TI			A,B,C,D,F,H,M,S	Y
Common grackle	*Quiscalus quiscula*	1,5,6,7	DF			A,C,D,F,H,M,S	Y
King rail	*Rallus elegans*	5,6,7	MV			A,C,F,S	Y
Clapper rail	*Rallus longirostris*	5,6,7	MV			A,B,C,F,H	Y
American avocet	*Recurvirostra americana*	5,7	MS			C,F	Y
Ruby-crowned kinglet	*Regulus calendula*	5				B,F,H	Y
Bank swallow	*Riparia riparia*	6				A,B,H	Y
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	5		E	E	B,F,H,S	Y
Black skimmer	*Rynchops niger*	5,7	MS		SSC	B,C,F,H	Y
Eastern phoebe	*Sayonris phoebe*	1,5,6,7	DF,EX,MV			A,B,C,D,F,H,M,S	Y
Woodcock	*Scolopax minor*					H	N
Ovenbird	*Seiurus aurocapillus*	1,5,6,7	DF			A,B,C,D,F,H,M,S	Y
Louisiana waterthrush	*Seiurus motacilla*	5,6,7				A,B,F,H,M	Y
Northern waterthrush	*Seiurus noveboracensis*	1,5,6				A,B,D,F,H,S	Y
Rufous hummingbird	*Selasphorus rufus*					H	Y
American redstart	*Septophaga ruticilla*	1,5,6,7				A,B,C,D,F,H,M,S	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Eastern bluebird	*Sialia sialis*	5				F,H	Y
Yellow-bellied sapsucker	*Sphyrapicus varius*	1,5,6				A,B,D,F,H	Y
Dickcissel	*Spiza americana*					H	Y
Chipping sparrow	*Spizella passerina*	5				H,S	Y
Field sparrow	*Spizella pusilla*	5				F	Y
Northern rough-winged swallow	*Stelgidopteryx serripennis*	5				B,H,S	Y
Pomarine jaeger	*Stercorarius pomarinus*					B,H	Y
Bridled tern	*Sterna anaethetus*					B	Y
Least tern	*Sterna antillarum*	1,5,6,7	MS		T	A,B,C,D,H,M,S	Y
Caspian tern	*Sterna caspia*	1,5,6				A,B,D,H,S	Y
Roseate tern	*Sterna dougallii*			T	T	H	N
Forster's tern	*Sterna forsteri*	1,6,7				A,B,D,H,M	Y
Sooty tern	*Sterna fuscata*					B	Y
Common tern	*Sterna hirundo*					B,H	Y
Royal tern	*Sterna maxima*	1,5,6,7	MS			A,B,C,D,F,H,S	Y
Sandwich tern	*Sterna sandvicensis*	6				A,B,H	Y
Eurasian-collored dove	*Streptopelia dacaocto*	1,5,7	DF		Exotic	B,C,D,H,M,S	Y
Ringed turtle dove	*Streptopelia risoria*					H	Y
Barred owl	*Strix varia*	6,7	DF			A,C,H,M	Y
Eastern meadowlark	*Sturnella magna*	5,7	TI			F,H,M,S	Y
European starling	*Sturnus vulgaris*	1,5,6,7			Exotic	A,B,D,F,H,M,S	Y
Masked booby	*Sula dactylatra*					B	Y
Brown booby	*Sula leucogaster*					B,H	Y
Blue-footed booby	*Sula nebouxii*					B	Y
Tree swallow	*Tachycineta bicolor*	1,5,6,7				A,B,D,F,H,M,S	Y
Carolina wren	*Thryothorus ludovicianus*	1,5,6,7	DF,MV			A,C,D,F,H,M,S	Y
Brown thrasher	*Toxostoma rufum*	5,6,7				A,B,F,M,S	Y
Lesser yellowlegs	*Tringa flavipes*	5,6,7	MS			A,B,C,F,S	Y
Spotted sandpiper	*Tringa macularia*	1,5				D,H,S	Y
Greater yellowlegs	*Tringa melanoleuca*	1,5				B,D,F,H,S	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Solitary sandpiper	*Tringa solitaria*	5				S	Y
House wren	*Troglodytes aedon*	1,5,6				A,B,D,F,H,S	Y
American robin	*Turdus migratorius*	5,7				B,F,H,M,S	Y
Gray kingbird	*Tyrannus dominicensis*	1,5,6,7	MV			A,B,C,D,F,H,S	Y
Scissor-tailed flycatcher	*Tyrannus forticata*					H	Y
Eastern kingbird	*Tyrannus tyrannus*	1,5,6				A,B,D,H,S	Y
Western kingbird	*Tyrannus verticalis*	5				B,H,S	Y
Barn owl	*Tyto alba*	6				A	Y
Orange-crowned warbler	*Vermivora celata*	1				B,D,H	Y
Golden-winged warbler	*Vermivora chrysoptera*	6				A	Y
Tennessee warbler	*Vermivora peregrina*	5				B,H,S	Y
Nashville warbler	*Vermivora ruficapilla*					H	Y
Black-whiskered vireo	*Vireo altiloquus*	1,5,6				A,B,D,F,H,S	Y
Bell's vireo	*Vireo bellii*	1				D,H	Y
Yellow-throated vireo	*Vireo flavifrons*	1,5,6				A,D,F,H,S	Y
Warbling vireo	*Vireo gilvus*	1				D	Y
White-eyed vireo	*Vireo griseus*	1,5,6,7	DF			A,B,C,D,F,H,M,S	Y
Red-eyed vireo	*Vireo olivaceus*	1,5,6				A,B,D,F,H,S	Y
Philadelphia vireo	*Vireo philadelphicus*	6				A	Y
Blue-headed vireo	*Vireo solitarius*	6				A	Y
Solitary vireo	*Vireo solitarius*					B	Y
Blue-headed vireo	*Vireo solitarius*	1,5				D,F,H	Y
Canada warbler	*Wilsonia canadensis*					H	Y
Hooded warbler	*Wilsonia citrina*	6				A,H	Y
White-winged dove	*Zenaida asiatica*	1,5,6				A,B,D,H,S	Y
Mourning dove	*Zenaida macroura*	1,5,6,7	DF,MV			A,B,C,D,F,H,M,S	Y
REPTILES							
Cottonmouth mocassin	*Agkistrodon piscivorus conanti*	5				F	Y
American alligator	*Alligator mississippiensis*	5,6,7	CT,HF,OW,SG	T (S/A)	SSC	A,B,F,H,M	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Green anole	*Anolis carolinensis*	1,5,6,7	DF,HF			A,B,C,D,F,H	Y
Bark anole	*Anolis distichus*	7			Exotic	M	Y
Cuban knight anole	*Anolis equestris*	7	DF		Exotic	C,M	Y
Brown anole	*Anolis sagrei*	1,5,6,7	DF,MV,OW		Exotic	A,C,D,F,H,M	Y
Florida softshell turtle	*Apalone ferox*	5,6,7	DF			A,F,H,M	Y
Basilisk lizard	*Basiliscus vittatus*					H	N
Spectacled caiman	*Caiman crocodilus*	5,6			Exotic	A,F,H	Y
Loggerhead sea turtle	*Caretta caretta*	6		T	T	A,B,H	Y
Green sea turtle	*Chelonia mydas*	5		E	E	B,F,H	Y
Snapping turtle	*Chelydra serpentina*	5,6,7				A,F,H,B	Y
Slider	*Chrysemys cocinna*	5				F	N
Cooter	*Chrysemys floridana*	5,6				A,F	Y
Black racer	*Coluber constrictor*	5,6,7	DF,MV,WL			A,C,F,M	Y
Everglades racer	*Coluber constrictor paludicola*	5				B,F	Y
Southern racer	*Coluber constrictor priapus*	5				F	N
American crocodile	*Crocodylus acutus*	5,7	LP,OW	E	E	A,B,C,F,H	Y
Eastern diamondback rattlesnake	*Crotalus adamanteus*	5				B,F	Y
Chicken turtle	*Deirochelys reticularia*	5,6				A,F	Y
Leatherback sea turtle	*Dermochelys coriacea*			E	E	B,H	Y
Ring-necked snake	*Diadophis punctatus*					B,H	Y
Southern ringneck snake	*Diadophis punctatus punctatus*	5,7	DF			B,C,F,M	Y
Eastern indigo snake	*Drymarchon corais couperi*	5,6	DF	T	T	A,B,F,H	Y
Red rat snake	*Elaphe guttata*	7	DF			C,M	Y
Corn snake	*Elaphe guttata guttata*	1,5				B,D,F,H	Y
Yellow rat snake	*Elaphe obsoleta quadrivittata*	5,7	DF			C,F,H,M	Y
Everglades rat snake	*Elaphe obsoleta rossalleni*					B	Y
Hawksbill sea turtle	*Eretmochelys imbricata*	5,6		E	E	A,B,F,H	Y
Mole skink	*Eumeces egregius*					B,H	Y
Southeastern 5-lined skink	*Eumeces inexpectatus*	1,5,7				B,C,D,F,H,M	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Skink	*Eumeces spp.*	6	MV			A	Y
Gopher tortoise	*Gopherus polyphemus*	1			SSC	D,H	Y
Indo-malaysian gecko	*Hemidactylus garnoti*	5,6,7	DF		Exotic	A,C,F,M	Y
Mediterranean gecko	*Hemidactylus turcicus*	5,6			Exotic	A,B,F	Y
Green iguana	*Iguana iguana*	7			Exotic	H,M	Y
Striped mud turtle	*Kinosternon bauri*	5,6				A,B,F	Y
Florida mud turtle	*Kinosternon subrubrum steindachneri*	5,6				A,F	Y
Common kingsnake	*Lampropeltis getulus*	5				F	Y
Kemp's ridley sea turtle	*Lepidochelys kempi*			E	E	B,H	N
Diamondback terrapin	*Malaclemys terrapin*	5,6				A,F,H	Y
Mangrove saltmarsh terrapin	*Malaclemys terrapin rhizophorarum*	1				B,D,H	Y
Eastern coral snake	*Micrurus fulvius*	7				B,M	Y
Mangrove salt marsh snake	*Nerodia clarkii compressicauda*	5,6,7	MV			A,C,F,M	Y
Green water snake	*Nerodia cyclopion*	5				F	N
Florida water snake	*Nerodia fasciata pictiventris*					B	Y
Rough green snake	*Opheodrys aestivus*	5				B,F,H	Y
Florida pine snake	*Pituophis melanoleucus mugitus*				SSC	H	N
Peninsula cooter	*Pseudemys floridana*	7				M	Y
Florida redbelly turtle	*Pseudemys nelsoni*	5,6,7				A,F,H,M	Y
Ground skink	*Scincella lateralis*					B	Y
Swamp snake	*Seminatrix pygaea*	5				B,F	Y
Pygmy rattlesnake	*Sistrurus miliarius*	5				F	Y
Dusky pigmy rattlesnake	*Sistrurus miliarius barbouri*					B,H	Y
Reef gecko	*Sphaerodactylus notatus*					B	Y
Florida brown snake	*Storeria dekayi victa*	5,6,7	EX			A,F,M	Y
Rim rock crowned snake	*Tantilla oolitica*				T	H	N
Central Florida crowned snake	*Tantilla relicta neilli*					B	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Florida box turtle	*Terrapene carolina bauri*	5,6,7	DF,MV			A,B,C,F,M	Y
Eastern box turtle	*Terrapene carolina carolina*	5,6				A,F	Y
Peninsula ribbon snake	*Thamnophis sauritus sackenii*	5,7	DF			C,F,M	Y
Blue-striped garter snake	*Thamnophis sirtalis similis*	5				F	Y
Eastern garter snake	*Thamnophis sirtalis sirtalis*	5,7	DF			C,F,M	Y
AMPHIBIANS							
Southern cricket frog	*Acris gryllus*	6,5				A,F	Y
Florida cricket frog	*Acris gryllus doroalis*	5				F	Y
Two-toed amphiuma	*Amphiuma means*	6,5				A,F	Y
Giant toad	*Bufo marinus*	5,7			Exotic	F,H,M	Y
Oak toad	*Bufo quercicus*	5,6				A,F	Y
Southern toad	*Bufo terrestris*	5,6,7	DF			A,B,C,F,M	Y
Greenhouse frog	*Eleutherodactylus planirostris*	5,6,7			Exotic	A,B,F,M	Y
Eastern narrowmouth toad	*Gastrophryne carolinensis*	5,6				A,B,F	Y
Green tree frog	*Hyla cinerea*	5,6	TI			A,B,F	Y
Squirrel tree frog	*Hyla squirella*	5,6				A,B,F	Y
Little grass frog	*Limnaoedus ocularis*	5,6				A,F	Y
Cuban tree frog	*Osteopilus septentrionalis*	5,6,7	DF		Exotic	A,B,F,H,M	Y
Southern chorus frog	*Pseudacris nigrita*	6				A	Y
Florida chorus frog	*Pseudacris nigrita verrucosa*	5				F,H	Y
Bullfrog	*Rana catesbeiana*					H	N
Pig frog	*Rana grylio*	5,6,7				A,F,M	Y
Southern leopard frog	*Rana utricularia*	5,6				A,F	Y
FISH							
Sergeant major	*Abudefduf saxatilis*	7	CL,LP,MS,TC			B,C	Y
Night sergeant	*Abudefduf taurus*					B	Y
Roughhead blenny	*Acanthemblemaria aspera*					B	Y
Papillose blenny	*Acanthemblemaria chaplini*					B	Y
Ocean surgeon	*Acanthurus bahianus*					B	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Doctorfish	*Acanthurus chirurgus*					B	Y
Blue tang	*Acanthurus coeruleus*					B	Y
Gulf surgeonfish	*Acanthurus randalli*					B	Y
Lined sole	*Achirus lineatus*					B	Y
Spotted eagle ray	*Aetobatus narinari*					B	Y
Key worm eel	*Ahlia egmontis*					B	Y
Bonefish	*Albula vulpes*					B,H	Y
African pompano	*Alectis ciliaris*					B	Y
Mutton hamlet	*Alphestes afer*					B	Y
Red-spotted hawkfish	*Amblycirrhitus pinos*					B	Y
Bowfin	*Amia calva*	5				F	Y
Pygmy moray	*Anarchias similis*					B	Y
Fringed pipefish	*Anarchopterus criniger*					B	Y
Bay anchovy	*Anchoa mitchilli*	7	MS,TC			C	Y
American eel	*Anguilla rostrata*	7	TC			B,C	Y
Black margate	*Anisotremus surinamensis*					B	Y
Porkfish	*Anisotremus virginiscus*					B	Y
Flamefish	*Apogon maculatus*					B	Y
Sea bream	*Archosargus rhomboidalis*					B	Y
Spotted driftfish	*Ariomma regulus*					B	Y
Bandtooth conger	*Ariosoma impressa*					B	Y
Hardhead catfish	*Arius felis*					B	Y
Conchfish	*Astrapogon stellatus*					B,H	Y
Oscar	*Astronotus ocellatus*	5			Exotic	F,H	Y
Southern stargazer	*Astroscopus y-graecum*					B	Y
Hardhead silverfish	*Atherinomorus stipes*					B	Y
Trumpetfish	*Aulostomus maculatus*					B	Y
Gafftopsail catfish	*Bagre marinus*	7	LP			B,C	Y
Blue croaker	*Bairdiella batabana*					B	Y
Silver perch	*Bairdiella chrysoura*					B,H	Y
Gray triggerfish	*Balistes capriscus*					B	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Queen triggerfish	*Balistes vetula*					B	Y
Bearded goby	*Barbulifer ceuthoecus*					B	Y
Sooty eel	*Bascanichthys teres*					B	Y
Pike killifish	*Belonesox belizanus*	5			Exotic	F	Y
Spotfin hogfish	*Bodianus pulchellus*					B	Y
Spanish hogfish	*Bodianus rufus*					B	Y
Eyed flounder	*Bothus ocellatus*					B	Y
Pugnose pipefish	*Bryx dunckeri*					B	Y
Ocean triggerfish	*Canthidermis sufflamen*					B	Y
Sharpnose puffer	*Canthigaster rostrata*					B	Y
Yellowjack	*Caranx bartholomaei*					B	Y
Bluerunner	*Caranx crysos*					B	Y
Crevalle jack	*Caranx hippos*					B	Y
Horse-eye jack	*Caranx latus*					B	Y
Bar jack	*Caranx ruber*					B	Y
Atlantic pearlfish	*Carapus bermudensis*					B,H	Y
Goldfish	*Carassius auratus*	7			Exotic	M	Y
Blacknose shark	*Carcharhinus acronotus*					B,H	Y
Bull shark	*Carcharhinus leucas*					B	Y
Black-tip shark	*Carcharhinus limbatus*					B	Y
Dusky shark	*Carcharhinus obscurus*					B	Y
Caribbean reef shark	*Carcharhinus perezii*					B	Y
Night shark	*Carcharhinus signatus*					B	Y
Common snook	*Centropomus undecimalis*	5,6,7	CL,LP,OW,TC		SSC	A,B,C,F,H	Y
Graysby	*Cephalopholis cruentata*					B	Y
Coney	*Cephalopholis fulva*					B	Y
Pugjaw wormfish	*Cerdale floridana*					B	Y
Bluethroat pikeblenny	*Chaenopsis ocellata*					B	Y
Atlantic spadefish	*Chaetodipterus faber*					B	Y
Foureye butterflyfish	*Chaetodon capistratus*					H	N
Florida blenny	*Chasmodes saburrae*					B	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Hardhead halfbeak	*Chriodorus atherinoides*					B	Y
Blue chromis	*Chromis cyanea*					B	Y
Yellowtail reeffish	*Chromis enchrysurus*					B	Y
Sunshinefish	*Chromis insolata*					B	Y
Brown chromis	*Chromis multilineata*					B	Y
Purple reeffish	*Chromis scotti*					B	Y
Peacock bass	*Cichla ocellatus*	5,6	OW		Exotic	A,F	Y
Black acara	*Cichlasoma bimaculatum*	5,7			Exotic	F,M	Y
Midas cichlid	*Cichlasoma citrinellum*	5,7			Exotic	F,H,M	Y
Mayan cichlid	*Cichlasoma urophthalmus*	5			Exotic	F	Y
Walking catfish	*Clarias batrachus*	5			Exotic	F,H	Y
Creole wrasse	*Clepticus parrae*					B	Y
Conger eel	*Conger oceanicus*					B	Y
Manytooth conger	*Conger triporiceps*					B	Y
Pompano dolphin	*Coryphaena equiselis*					B	Y
Dolphin	*Coryphaena hippurus*					B	Y
Bluelip parrotfish	*Cryptotomus roseus*					B	Y
Spotted seatrout	*Cynoscion nebulosus*					B,H	Y
Weakfish	*Cynoscion regalis*					B	Y
Sheepshead minnow	*Cyprinodon variegatus*	5,7	LP,MV,TC			B,C,F,M	Y
Flying gurnard	*Dactylopterus volitans*					B	Y
Southern stingray	*Dasyatis americana*					B	Y
Atlantic stingray	*Dasyatis sabina*					B	Y
Bluntnose stingray	*Dasyatis say*					B	Y
Marbled grouper	*Dermatolepis inermis*					B	Y
Irish pompano	*Diapterus auratus*					B	Y
Striped mojarra	*Diapterus plumieri*	5,7	LP			B,C,F	Y
Balloonfish	*Diodon holocanthus*					B	Y
Porcupinefish	*Diodon hystrix*					B	Y
Spotted dragonet	*Diplogrammus pauciradiatus*					B	Y
Dwarf wrasse	*Doratonotus megalepis*					B	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Fat sleeper	*Dormitator maculatus*					B	Y
Gizzard shad	*Dorosoma cepedianum*					H	N
Sharksucker	*Echeneis naucrates*					B	Y
Whitefin sharksucker	*Echeneis neucratoides*					B	Y
Chain moray	*Echidna catenata*					B	Y
Rainbow runner	*Elagatis bipinnulata*					B	Y
Spinycheek sleeper	*Eleotris pisonis*					B	Y
Ladyfish	*Elops saurus*	7	LP			B,C,H	Y
Midnight blenny	*Emblemaria bottomei*					B	Y
Bonnetmouth	*Emmelichthyops atlanticus*					B	Y
Viper moray	*Enchelycore nigricans*					B	Y
Bluespotted sunfish	*Enneacanthus gloriosus*	5				F	Y
Lofty triplefin	*Enneanectes altivelis*					B	Y
Pearl blenny	*Entomacrodus nigricans*					B	Y
Rock hind	*Epinephelus adscensionis*					B	Y
Speckled hind	*Epinephelus drummondhayi*					B	Y
Red hind	*Epinephelus guttatus*					B	Y
Goliath grouper	*Epinephelus itajara*					B	Y
Red grouper	*Epinephelus morio*					B,H	Y
Warsaw grouper	*Epinephelus nigritus*					B	Y
Snowy grouper	*Epinephelus niveatus*					B	Y
Nassau grouper	*Epinephelus striatus*					B,H	Y
High-hat	*Equetus acuminatus*					B	Y
Jackknife fish	*Equetus lanceolatus*					B	Y
Spotted drum	*Equetus punctatus*					B	Y
Cubbyu	*Equetus umbrosus*					B	Y
Emerald sleeper	*Erotelis smaragdus*					B	Y
False albacore	*Euthynnus alletteratus*					B	Y
Lyre goby	*Evorthodus lyricus*					B	Y
Oceanic two-wing	*Exocoetus obtusirostris*					B	Y
Cornetfish	*Fistularia tabacaria*					B	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Goldspotted killifish	*Floridichthys carpio*					B	Y
Golden topminnow	*Fundulus chrysotus*	5				F	Y
Marsh killifish	*Fundulus confluentus*	5				F	Y
Gulf killifish	*Fundulus grandis*	5,7	LP			C,F	Y
Mummichog	*Fundulus heteroclitus*	6	MV			A	Y
Southern longnose killifish	*Fundulus similis*	5				F	Y
Tiger shark	*Galeocerdo cuvier*					B	Y
Mosquitofish	*Gambusia holbrooki*	5,6,7	CL,LP,MV			A,B,C,F,H,M	Y
Mangrove gambusia	*Gambusia rhizophorae*	5,7	LP,MV,TC			B,C,F,M	Y
Yellowfin mojarra	*Gerres cinereus*	7	LP,TC			B,C	Y
Least killifish	*Geterandria formosa*	5				F	Y
Arrow stargazer	*Gillellus greyae*					B	Y
Nurse shark	*Ginglymostoma cirratum*	7	LP			C	Y
Freckled stargazer	*Gnathagnus egregius*					B	Y
Goldspot goby	*Gnatholepis thompsoni*					B	Y
Skilletfish	*Gobiesox strumosus*					B	Y
Spottail goby	*Gobionellus stigmaturus*	5				B,F	Y
Smooth butterfly ray	*Gymnura micrura*					B	Y
White margate	*Haemulon album*					B	Y
Bluestriped grunt	*Haemulon sciurus*	7	LP,TC			C	Y
Slippery dick	*Halichoeres bivittatus*					B	Y
Bluntnose jack	*Hemicaranx amblyrhynchus*					B	Y
Jewelfish	*Hemichromis letourneauxi*	5				F	Y
Wrasse blenny	*Hemiemblemaria simulus*					B	Y
Balao	*Hemiramphus balao*					B	Y
Ballyhoo	*Hemiramphus brasiliensis*					B	Y
Fourwing flyingfish	*Hirundichthys affinis*					B	Y
Sargassumfish	*Histrio histrio*					B	Y
Queen angelfish	*Holacanthus ciliaris*					B	Y
Rock beauty	*Holacanthus tricolor*					H	N
Reef silverside	*Hypoatherina harringtonensis*					B	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Butter hamlet	*Hypoplectrus unicolor*	7	LP,TC			C	Y
Halfbeak	*Hyporhamphus unifasciatus*					B	Y
Feather blenny	*Hypsoblennius hentz*					B	Y
Surf eel	*Ichthyapus ophioneus*					B	Y
Atlantic sailfish	*Istiophorus platypterus*					B	Y
Dwarf herring	*Jenkinsia lamprotaenia*					B	Y
Flagfish	*Jordanella floridae*	5				F	Y
False moray	*Kaupichthys hyoproroides*					B	Y
Hogfish	*Lachnolaimus maximus*					B,H	N
Scrawled cowfish	*Lactophrys quadricornis*					B	Y
Spot	*Leiostomus xanthurus*					B	Y
Florida gar	*Lepisosteus plathrhinchus*	5,7				F,H,M	Y
Warmouth	*Lepomis gulosus*	5				F,H,M	Y
Bluegill	*Lepomis macrochirus*	5				F,H	Y
Redear sunfish	*Lepomis microlophus*	5				F	Y
Blackedge cusk-eel	*Lepophidium brevibarbe*					B	Y
Sailfin eel	*Letharchus velifer*					B	Y
Tripletail	*Lobotes surinamensis*					B	Y
Blue goby	*Loglossus calliurus*					B	Y
Crested goby	*Lophogobius cyprinoides*	7	LP,MS			B,C	Y
Bluefin killifish	*Lucania goodei*	5				F	Y
Mangrove blenny	*Lupinoblennius dispar*	5				F	Y
Schoolmaster	*Lutjanus apodus*	7	LP,MS			C	Y
Red snapper	*Lutjanus campechanus*	7	TC			C	Y
Gray snapper	*Lutjanus griseus*	7	LP,TC			B,C	Y
Sand tilefish	*Malacanthus plumieri*					B	Y
Manta ray	*Manta birostris*					B	Y
Tarpon	*Megalops atlantica*	5,7	CL,LP,TC			B,C,F,H	Y
Inland silverside	*Menidia beryllina*	7	LP			C	Y
Tidewater silverside	*Menidia penninsulae*	5,7	LP,TC			C,F	Y
Southern kingfish	*Menticirrhus americanus*					B	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Pink wormfish	*Microdesmus longipinnis*					B	Y
Atlantic croaker	*Micropogonias undulatus*					B	Y
Large mouth bass	*Micropterus salmoides*	5,6,7	OW			A,F,H,M	Y
Yellowtail damselfish	*Microspathodon chrysurus*					B	Y
Spaghetti eel	*Moringua edwardsi*					B	Y
Striped mullet	*Mugil cephalus*	5,7	LP,TC			C,F,H	Y
Yellow goatfish	*Mulloidichthys martinicus*					B	Y
Smooth dogfish	*Mustelus canis*					B	Y
Black grouper	*Mycteroperca bonaci*					H	N
Blackbar soldierfish	*Myripristis jacobus*					B	Y
Speckled worm eel	*Myrophis punctatus*					B	Y
Lesser electric ray	*Narcine brasiliensis*					B	Y
Pilotfish	*Naucrates ductor*					B	Y
Lemon shark	*Negaprion brevirostris*					B,H	Y
Orangespotted goby	*Nes longus*					B	Y
Emerald parrotfish	*Nicholsina usta*					B	Y
Man-of-War fish	*Nomeus gronovii*					B	Y
Yellowtail snapper	*Ocyurus chrysurus*					B	Y
Reef croaker	*Odontoscion dentex*					B	Y
Key brotula	*Ogilbia cayorum*					B	Y
Leatherjack	*Oligoplites saurus*					B	Y
Opossum pipefish	*Oostethus brachyurus*	5				B,F	Y
Redlip blenny	*Ophioblennius atlanticus*					B	Y
Atlantic thread herring	*Opisthonema oglinum*					B	Y
Oyster toadfish	*Opsanus tau*					H	N
Pigfish	*Orthopristis chrysoptera*					B	Y
Margintail conger	*Paraconger caudilimbatus*					B	Y
Lancer dragonet	*Paradiplogrammus bairdi*					B	Y
Gulf flounder	*Paralichthys albigutta*					B	Y
Creole fish	*Paranthias furcifer*					B	Y
Sailfin flyingfish	*Parexocoetus brachypterus*					B	Y

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Dusky cusk-eel	*Parophidion schmiditi*					B	Y
Glassy sweeper	*Pempheris schomburgki*					B	Y
Redfin brotula	*Petrotyx sanguineus*					B	Y
Keeltail needlefish	*Platybelone argalus*					B	Y
Saddle stargazer	*Platygillellus rubrocinctus*					B	Y
Sailfin molly	*Poecilia latipinna*	5,7	CL,LP,MV,TC			B,C,F,H,M	Y
Gray angelfish	*Pomacanthus arcuatus*					B	Y
Burro grunt	*Pomadasys crocro*					B	Y
Bluefish	*Pomatomus saltatrix*					B	Y
Atlantic midshipman	*Porichthys plectrodon*					B	Y
Glasseye snapper	*Priacanthus cruentatus*					B	Y
Rusty goby	*Priolepis hipoliti*					B	Y
Short bigeye	*Pristigenys alta*					B	Y
Smalltooth sawfish	*Pristis pectinata*					B	Y
Bluntnose flyingfish	*Prognichthys gibbifrons*					B	Y
Freckled driftfish	*Psenes cyanophrys*					B	Y
Reef bass	*Pseudogramma gregoryi*					B	Y
Spotted goatfish	*Pseudupeneus maculatus*					B	Y
Sailfin catfish	*Pterygoplichthys multiradiatus*					H	N
Cobia	*Rachycentron canadum*					B	Y
Roundel skate	*Raja texana*	7	MS			B,C	Y
Atlantic Guitarfish	*Rhinobatos lentiginosus*					B	Y
Cownose ray	*Rhinoptera bonasus*					B	Y
Atlantic sharpnose shark	*Rhizoprionodon terraenovae*					B,H	Y
Vermillion snapper	*Rhomboplites aurorubens*					B	Y
Mangrove rivulus	*Rivulus marmoratus*	5			SSC	B,H	Y
Bonito	*Sarda sarda*					B	Y
Round sardinella	*Sardinella aurita*					B	Y
Molly miller	*Scartella cristata*					B	Y
Red drum	*Sciaenops ocellata*					H	N
Spanish mackerel	*Scomberomorus maculatus*					H	N

Common Name	*Genus species*	Location	Habitat Type	Federal	State	Source	Observed
Deepreef scorpionfish	*Scorpaenodes tredecimspinosus*					B	Y
Bigeye scad	*Selar crumenophthalmus*					B	Y
Atlantic moonfish	*Selene setapinnis*					B	Y
Lookdown	*Selene vomer*					B	Y
Greater amberjack	*Seriola dumerili*					B	Y
Banded rudderfish	*Seriola zonata*					B	Y
Great barracuda	*Sphyraena barracuda*	7	TC			C	Y
Southern sennet	*Sphyraena picudilla*					B	Y
Bonnethead shark	*Sphyrna tiburo*	7	MS			C,H	Y
Hammerhead shark	*Sphyrna zygaena*					B	Y
Checkerd blenny	*Starksia ocellata*					B	Y
Key blenny	*Starksia starcki*	5			SSC	F	N
Atlantic needlefish	*Strongylura marina*					B	Y
Chain pipefish	*Sygnathus louisianae*	7	CL,MS,TC			C	Y
Blackcheek tonguefish	*Symphurus plagiusa*					B	Y
Red lizardfish	*Synodus synodus*					B	Y
Blueheaded wrasse	*Thalassoma bifasciatum*					B	Y
Blue tilapia	*Tilapia aurea*	7			Exotic	M	Y
Spotted tilapia	*Tilapia mariae*	5,7			Exotic	F,H,M	Y
Atlantic torpedo ray	*Torpedo nobiliana*					B	Y
Snakefish	*Trachinocephalus myops*					B	Y
Florida pompano	*Trachinotus carolinus*					B	Y
Permit	*Trachinotus falcatus*	7	LP			B,C,H	Y
Palometa	*Trachinotus goodei*					B	Y

Location (names correspond to project's geographic sub-components as described in the BBCW Project Management Plan; moving north to south):

1. Deering Estate
2. Cutler Wetlands (C-100 to C-1)
3. L-31E Flowway (C-1 to C-103)
4. North Canal Flowway (C-103 to Florida City Canal
5. Barnes Sound Wetlands (Florida City Canal south and east to U.S. Highway 1)
6. Within project boundary
7. Outside project boundary

Habitat Type (available primarily from Dalrymple reports):

AG = Agriculture	HF = Herbaceous flats	SG = Sawgrass
CL = Canals	LP = Lakes and ponds	TC = Tidal creek
CT = Cattails	MS = Marine/shoreline	TI = Tree island
DF = Disturbed/filled	MV = Mangrove	WL = Willow
EX = Exotics dominated wetlands	OW = Open water	

Data Source:

A = ADID Technical Document (EPA 1994)
B = Biscayne National Park species list (Goldman 2002)
C = Chapman Field Report (Dalrymple 1998)
D = Deering Estate (Metro-Dade County Parks and Recreation Department;unpublished data)
F = Florida Power and Light Everglades Mitigation Bank Reports (Cotleur Hearing 1997, 1998)
H = Homestead Air Force Base Environmental Impact Statement (U.S. Air Force and Federal Aviation Administration 2000)
M = Matheson Hammock Report (Dalrymple and O;Hare 1998)
S = South Dade Wetlands (Hofstetter 2003)

United States Department of the Interior

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

June 21, 2004

James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Duck:

The Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) for the U.S. Army Corps of Engineers (Corps) regarding the Biscayne Bay Coastal Wetlands Restoration Project (BBCW), a component of the Comprehensive Everglades Restoration Plan (CERP). This PAL is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*), and section 7 of the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This PAL does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA. This PAL provides guidance and transmits some of our concerns with this project. Additional natural resource protection legislation relevant to this project includes the National Environmental Policy Act, as amended (42 U.S.C. 4321 *et seq.*), the Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 703-712), the Estuary Protection Act (16 U.S.C. 1221-1226), and the Coastal Zone Management Act (16 U.S.C. 1451-1464).

Introduction

The primary purpose of this PAL is to recommend that the Interagency Modeling Center (IMC) review the hydrodynamic and hydrologic models being developed by the Corps in support of the BBCW Project as soon as possible. The two models have not been completed, but they have been developed to the point that a review by the IMC is warranted. This letter describes the advantages of having the models reviewed by the IMC at this time. A secondary purpose of the PAL addresses a component of data collection in support of the modeling efforts. Specifically, the collection of geotechnical and hydrogeologic data in the coastal wetlands has been delayed for various reasons over the past two years. The Corps has recently reported further delays due to rights of entry problems on both public and private lands that have been targeted for establishing study sites for the data collection effort. The Service encourages the Corps to resolve these rights of entry problems as soon as possible to expedite the collection of these data, which are critical to the development, calibration, and validation of the hydrodynamic and

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hydrologic models. The concerns and recommendations appearing in this PAL were forwarded to the Corps' and South Florida Water Management District's (District) BBCW Project Managers in an e-mail sent on June 14, 2004.

Background on Modeling Efforts for the BBCW Project

Because the project area includes freshwater wetlands, coastal mangrove wetlands, and nearshore areas of western Biscayne Bay, both a hydrodynamic model for simulating bay circulation and salinity, and a groundwater/surface water model for wetland applications have been deemed necessary to fulfill the modeling requirements for the project. The TABS-MDS hydrodynamic model was chosen by the Corps to fulfill hydrodynamic modeling needs for the nearshore waters of the bay, and a modified version of the WASH123D model will be used to fulfill modeling requirements in the coastal wetlands of central and southern Biscayne Bay. Both models are being developed by the Corps' Engineer Research and Development Center at the Waterways Experiment Station in Vicksburg, Mississippi.

Over the past two years, the BBCW Project Delivery Team (PDT) has expressed a number of issues and concerns regarding the selection and development of models for use in the project area. In a PAL dated December 24, 2002, the Service addressed many of these issues and concerns, and provided a number of recommendations for selecting and developing hydrologic and hydrodynamic models to be used in the BBCW project. These recommendations included, but were not limited to the following: (1) a supplemental review and evaluation of all models applicable to the project area; (2) proper initiation, calibration, and verification of models; (3) filling the data gaps required to appropriately calibrate and validate models, such as, nearshore salinity measurements, high-resolution bathymetric and topographic data, and groundwater data; (4) minimize effects of boundary conditions by extending the model domain beyond the immediate project study area; (5) appropriate water level resolution and accuracy (±0.5 foot); and (6) flexibility to link with or have the capability to be compared with other sub-regional models that will be utilized in adjacent CERP projects.

Review of the models by the IMC

On May 25, 2002, Service staff participated in the BBCW PDT meeting during which the Corps provided an update of the development of these models. As part of the update, the Corps presenters noted that the WASH123D modeling efforts had resulted in the completion of a number of milestones, including the development of the conceptual model, evaluation of field data and development of calibration data sets, development of the numerical model, and validation of model code. Following the update, a representative of the District recommended that the models be reviewed by the IMC. The Service supports this recommendation for the reasons provided below.

Successful utilization of the model output will depend on the model's ability to simulate hydrologic processes of ecological concern (*e.g.*, stage, depth, flow) over ranges of values and along temporal scales that are likely to have an ecological effect. Performance measures, habitat

suitability indices, and quantitative measures of the sort are typically generated by computer programs or other data post-processors. Such programs typically seek out and transform various trends or patterns in the hydrologic model output into various other measures or surrogates for ecological performance. This process simplifies review of the output by non-modelers; however, the same processes can introduce error into the interpretation of the model output if the model is not capable of adequately simulating the events (magnitude and duration) that would elicit an ecological response.

The modeling and associated evaluation efforts could benefit from a model conceptualization and design effort that strives to yield a model that is well calibrated to those data trends and/or ranges of values necessary to compute selected performance measures. Therefore, IMC review of model conceptualization, calibration, accuracy and precision is warranted at this stage of TABS-MDS and WASH123D development.

If it is found that satisfaction of model accuracy and precision requirements of existing performance measure programs will likely not be achieved, early identification of the model limitations by IMC will maximize the potential for the project team to reconsider and/or reconceptualize the performance measures of concern, or maximize the potential to improve model accuracy and precision. Insofar as the model design and development effort achieves the desired model accuracy and precision at the temporal scales targeted by applicable performance measures, it would be beneficial to consider the intended use of the model results during review of the proposed modeling efforts. We offer that the reviewers of this modeling effort consider the tolerances and sensitivities of each project-related performance measure during the review to maximize the potential for the model to serve the full range of intended purposes.

Recognizing the scope of the task at hand, it might help reviewers if calibration statistics are generated for the ranges/classes of values (*e.g.* stage, depth, and flow) sought by the performance measure programs. An understanding of how accurately the model predicts the desired values at various time scales (*e.g.*, daily mean versus 7-day mean) could help frame the application of various performance measures or assist in their refinement for use during project evaluation, documentation, and benefit quantification.

Problems with data collection in support of models

The need for additional geotechnical and hydrogeologic data for the project was identified in the early stages of project development. The data will play an important role in the development, calibration, and validation of the WASH123D hydrologic model, as well as provide baseline conditions for the project area. These data will better quantify the geology of the area, groundwater elevation and movement, seepage of groundwater into Biscayne Bay, and other aquifer characteristics such as porosity of overlying soils. Collection of these data requires the drilling and installation of groundwater/surface water wells at sites identified by the geotechnical team. These sites occur on both public and private lands.

Over the past two years there have been numerous delays in initiating the collection of the geotechnical and hydrogeologic data, including problems with the Scope of Work, Corps funding issues, and problems with unacceptably high bids from contractors who will be installing the wells. The most recent delay in the data collection effort was disclosed at the May 24, 2004, PDT meeting, when the Corps reported problems regarding rights of entry on the public and private lands previously identified for well installation. These rights of entry and access agreements are required for installing the geotechnical wells and establishing data collection stations. It is the Service's understanding that a standard access agreement was signed by the required parties several months ago, but then the Corps' legal representation deemed the agreement was unsuitable for CERP projects. The reason for the delay in having an appropriate access agreement signed is unclear.

The Service recommends that the Corps seek the appropriate levels of local and state governments, as well as the private sector, in securing the required rights of entry to the properties slated for well installation as soon as possible. We believe that geotechnical and hydrogeologic data collection should be a high priority to ensure that data required for proper development, calibration, and validation of the WASH123D and TABS-MDS models are available as soon as possible to bring these models online for the alternative evaluation process.

Closing comments

Developing hydrodynamic and hydrologic models most suitable to the project area is critical to the alternative evaluation and selection process. Alternatives are currently being developed and documented for the project, so the best available models may soon be required for evaluating alternatives. We do not anticipate that the IMC review of the TABS-MDS and WASH123D models will prohibitively delay the project beyond the current Project Management Plan schedule. The Service believes that a favorable review of the models at this time would give scientific credibility to the modeling program and contribute significantly to "buy in" from those agencies that have expressed skepticism and concerns regarding the models chosen by the Corps for use in the project area. If the review reveals significant modeling problems, errors, or shortcomings, there will likely be delays in meeting the project schedule until the models can be appropriately revised. However, postponing the IMC review until the models are more completely developed could potentially increase delays if additional model components must be fixed or revised.

In closing, we are committed to providing timely assistance to the Corps and the PDT to ensure that appropriate hydrologic and hydrodynamic models will be available to aid in the evaluation of the project alternatives that are currently being developed for the BBCW project. Through effective communication, consultation, and coordination, the Service, the Corps, and the remainder of the PDT will successfully implement this project and succeed in conserving our valuable fish and wildlife resources along the shores of central and southern Biscayne Bay. We fully support and appreciate the beneficial actions the Corps is taking to restore wetland habitat

in the BBCW project area, and to conserve and recover south Florida's threatened and endangered species. Please feel free to contact Patrick Pitts at 772-562-3909, extension 250, if you have any questions regarding this letter.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
Biscayne National Park, Homestead, Florida (Sarah Bellmund)
Corps, Jacksonville, Florida (Bob Dunne)
Corps, Jacksonville, Florida (Brad Tarr)
Corps, Jacksonville, Florida (Shelley Trulock)
Everglades National Park, Homestead, Florida (John Klochak)
FDEP, West Palm Beach, Florida
FWC, Vero Beach, Florida (Joseph Walsh)
Miami-Dade County DERM, Miami, Florida (Susan Markley)
NOAA Fisheries, Miami, Florida (Joan Browder)
Service, Jacksonville, Florida (Miles Meyer)
SFWMD, West Palm Beach (Cynthia Gefvert)
SFWMD, West Palm Beach, Florida (Jorge Marban)

United States Department of the Interior

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

July 14, 2004

Robert Kukleski
Senior Environmental Engineer
South Florida Water Management District
c/o Center for Environmental Studies
3932 RCA Boulevard, Suite 3210
Palm Beach Gardens, Florida 33410

Dear Mr. Kukleski:

The Fish and Wildlife Service (Service) has reviewed the document entitled "Report of Phase I/II Environmental Site Assessment Biscayne Bay Coastal Wetlands South Florida Water Management District Tract 500-003" submitted by MACTEC Engineering and Consulting, Incorporated. This 15-acre property is located in southeast Miami-Dade County, Florida. While a 1953 aerial photograph indicated agriculture occurred on the northern portion of the property, it is currently overgrown by vegetation with no current activities taking place. Agriculture apparently had ceased at some point between 1953 and 1963.

The tract was divided into three 5-acre parcels. A single discrete sample was collected 0-6 inches below land surface from each parcel and analyzed for organochlorine pesticides and metals. Only chromium (Cr) and barium (Ba) were found in samples at concentrations exceeding sediment quality assessment guidelines ecological criteria values. Ba (21, 32, 21 mg/kg) and Cr (50 mg/kg) concentrations both exceeded threshold effects concentrations (TECs) for possible effects to benthic organisms. The property average for Ba (24.5 mg/kg) exceeded its TEC (20 mg/kg) while the average for Cr (35 mg/kg) did not exceed its TEC (43 mg/kg). The 95 percent upper confidence levels (UCL) for both chemicals exceeded the TEC since the sample number was small (n = 3). The Cr and Ba data were combined with data for the same metals from tracts 500-001 and 500-002, since they are contiguous with tract 500-003, for recalculation of the 95 percent UCL. The recalculated 95 percent UCLs for both (Cr = 17 mg/kg, Ba = 18 mg/kg) were less than their respective TECs. Arsenic concentrations (1.5, 3.6, 2.2 mg/kg) exceeded residential soil clean-up target levels (0.8 mg/kg), but residential use is not expected for the property.

The Service believes the ecological risks from contamination on tract 500-003 are minimal and will not exceed the benefits of inclusion of this property within the proposed project.

The Service is grateful for the opportunity to review this assessment for the Biscayne Coastal Wetlands Tract 500-003. If you have any questions regarding these comments, please contact Dr. Tim Bargar at 772-562-3909, extension 315.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
Biscayne National Park, Homestead, Florida (Sarah Bellmund)
Corps, Jacksonville, Florida (Peter Besrutschko)
Corps, Jacksonville, Florida (Shelley Trulock)
Corps, Jacksonville, Flroida (Bob Dunne)
DEP, West Palm Beach, Florida (Leslie Smith)
District, West Palm Beach, Florida (Jorge Marban)
FWC, Vero Beach, Florida (Dr. Joseph Walsh)
Miami-Dade County DERM, Miami, Florida (Dr. Susan Markley)
NOAA Fisheries, Miami, Florida (Dr. Joan Browder)
Service, Vero Beach, Florida (Barry Rosen)

United States Department of the Interior

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

August 9, 2004

Robert Taylor
South Florida Water Management District
c/o Center for Environmental Studies
3932 RCA Boulevard, Suite 3210
Palm Beach Gardens, Florida 33410

Dear Mr. Taylor:

The Fish and Wildlife Service (Service) has reviewed the document entitled, "Report of Phase I/II Environmental Assessment Biscayne Bay Coastal Wetlands SFWMD Tract 100-003," submitted by MACTEC Engineering and Consulting, Incorporated (MACTEC) to the South Florida Water Management District. Slated to be incorporated within the Biscayne Coastal Wetlands Project, Tract 100-003 is an undeveloped, heavily vegetated, 39-acre parcel located in southeast Miami-Dade County.

Historically, agriculture had taken place on the property from the early 1940's to the 1950's. No other activities were visibly evident on the property since the 1950's. A landfill was located 1,500 feet north of the property until 1978. Groundwater monitoring north of Tract 100-003 in 2002 indicated exceedences of groundwater criteria values for ammonia and lead, but groundwater sampling on Tract 100-003 indicated criteria exceedence of only total dissolved solids. However, MACTEC stated flooding Tract 100-003 would likely require approval by the Dade County Department of Environmental Monitoring due to the effects of flooding on the contaminated groundwater. No structures associated with any agricultural or non-agricultural activity were noted on the property.

MACTEC divided the property into four, approximately 10-acre parcels. One discrete sample was collected from each parcel. No organochlorines were detected in any sample, while one metal (barium) was found in one sample at a concentration (22 mg/kg) exceeding its threshold effects concentration (20 mg/kg). MACTEC predicted no ecological concerns from contamination on this property. The Service concurs that this property, in its current condition, is suitable for the intended purpose of wetland restoration.

The Service is grateful for the opportunity to review this site assessment for Tract 100-003. If you have any questions regarding these comments, please contact Dr. Tim Bargar at 772-562-3909, extension 315.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
Biscayne National Park, Homestead, Florida (Sarah Bellmund)
Corps, Jacksonville, Florida (Shelley Trulock, Project Manager)
Corps, Jacksonville, Florida (Bob Dunne, Project Technical Lead)
Corps, Jacksonville, Florida (Peter Besrutschko, PD-ES)
FDEP, West Palm Beach, Florida (Leslie Smith)
FWC, Vero Beach, Florida (Dr. Joseph Walsh)
Miami-Dade County DERM, Miami, Florida (Dr. Susan Markley)
NOAA Fisheries, Miami, Florida (Dr. Joan Browder)
Service, Vero Beach, Florida (Barry Rosen)
SFWMD, West Palm Beach, Florida (Jorge Marban, Project Manager)

Planning Division
Environmental Branch

14 DEC 2004

Mr. James Slack
Field Supervisor
U. S. Fish and Wildlife Service
1339 20th Street
Vero Beach, Florida 32960-3559

Dear Mr. Slack:

The U.S. Army Corps of Engineers, Jacksonville District (Corps), is preparing an integrated Project Implementation Report/Environmental Impact Statement for the Biscayne Bay Coastal Wetlands (BBCW) Project for the primary purpose of redistributing freshwater runoff from the watershed into Biscayne Bay by providing a more natural and historic overland flow through existing and or improved coastal wetlands, as part of the Comprehensive Everglades Restoration Plan. The BBCW study area lies in southeast Miami-Dade County.

Pursuant to the Endangered Species Act, as amended, the Corps is requesting confirmation of species or their critical habitat, either listed or proposed for listing, that may be present in the referenced study area (see enclosed map of BBCW area).

The following list of Threatened and Endangered species was provided by your agency and contained in the Planning Aid letter dated June 21, 2002: Those Federally listed species include the American crocodile (*Crocodylus acutus*), West Indian manatee (*Trichechus manatus*), wood stork (*Mycteria americana*), eastern indigo snake (*Drymarchon corais couperi*), and the Schaus swallowtail butterfly (*Heraclides areistodemus ponceanus*). Other threatened and endangered species that may be of concern as a result of this project include the Florida panther (*Puma concolor coryi*), Everglade snail kite (*Rostrhamus sociablis plumbeus*), Cape Sable seaside sparrow (*Ammodramus maritimus*), bald eagle (*Haliaeetus leucocephalus*), roseate tern (*Sterna dougallii dougalii*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Dermochelys coriacea*), Kemp's ridley sea turtle (*Lepidochelys kempii*), and the loggerhead sea turtle (*Caretta caretta*). Federally listed plant species that may occur in the project area include the crenulated lead-plant (*Amorpha herbacea* var. *crenulata*), Garber's spurge (*Chamaesyce garberii*), and tiny polygala (*Polygala smallii*).

We would appreciate concurrence on whether or not these species are still applicable to the BBCW site and that the information is accurate and up to date.

For further information please contact Ms. Carrie Bond at 904-232-1061 or Mr. Brad Tarr at 904-232-3582.

Sincerely,

James C. Duck
Chief, Planning Division

Enclosure

Tarr/CESAJ-PD-ES/3582
Cintron/CESAJ-PD-ES
Mason/CESAJ-PD-E
Trulock/CESAJ-DR-S
Duck/CESAJ-PD

For further information please contact Ms. Carrie Bond at 904-232-1061 or Mr. Brad Tarr at 904-232-3582.

Sincerely,

James C. Duck
Chief, Planning Division

Enclosure

United States Department of the Interior

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

January 24, 2005

RECEIVED
28 Jan 05

James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Duck:

This letter is in response to the U.S. Army Corps of Engineers' (Corps) request dated December 14, 2004, for confirmation of a list of federally threatened or endangered species potentially affected by the Biscayne Bay Coastal Wetlands (BBCW) Project, one of the Comprehensive Everglades Restoration Plan (CERP) project components located in Miami-Dade County. In a Planning Aid Letter dated June 21, 2002, the Fish and Wildlife Service (Service) provided the Corps with a preliminary list of threatened and endangered species that exist or potentially exist in the project area. An update to that original list is provided here, as well as technical assistance on the protection and conservation of fish and wildlife resources in accordance with section 7 of the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*), and the provisions of the Fish and Wildlife Coordination Act of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*). The letter does not constitute a biological opinion as described under section 7 of the ESA.

The goal of the BBCW restoration project is to restore or enhance freshwater and saltwater wetlands, and nearshore bay habitats. Specific objectives include minimizing harmful point source discharges, preserving and restoring the spatial extent of natural coastal glades habitat, reestablishing productive nursery habitat along the shoreline, and reestablishing connectivity between watershed basins. These objectives will be achieved by redistributing water from major conveyance canals to provide a more natural and historic overland flow through existing coastal wetlands.

The Service has reviewed our current data, the South Florida Multi-Species Recovery Plan, Florida Natural Areas Inventory, and other sources to identify the following federally listed threatened and endangered species in or near the project area. This list is consistent with the species identified in the Service's Planning Aid Report dated February 27, 2004, which provided the Corps with an updated biological opinion on CERP projects and included a section that quantified impacts to listed species in the BBCW Project area.

Federally listed endangered animal species known to exist or potentially exist within the project area include the Florida panther (*Puma concolor coryi*), West Indian manatee (*Trichechus manatus*), American crocodile (*Crocodylus acutus*), wood stork (*Mycteria americana*), and the

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Schaus swallowtail butterfly (*Heraclides aristodemus ponceanus*). Threatened species include the bald eagle (*Haliaeetus leucocephalus*) and eastern indigo snake (*Drymarchon corais couperi*). Other federally threatened or endangered animal species that are known to exist or potentially exist in Miami-Dade County, but which will not likely be of concern in this study due to the lack of suitable habitat in and within close proximity of the project area, include the Everglade snail kite (*Rostrhamus sociablis plumbeus*), roseate tern (*Sterna dougallii dougallii*), and Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*).

Four federally listed endangered sea turtles species exist or potentially exist in the project area including the green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempii*), and leatherback sea turtle (*Dermochelys coriacea*). The loggerhead sea turtle (*Caretta caretta*), a threatened species, is also known to exist or potentially exist in the project area. The Service's jurisdiction over listed sea turtles is limited to beach and shoreline habitat above Mean High Water. Since it is highly unlikely that suitable nesting habitat exists for sea turtles in, or in close proximity to, the project area, these animals will not likely be of concern to the Service with regards to this project. However, these animals should be considered in project design and implementation as they occur or potentially can occur in waters within the project area. The National Marine Fisheries Service (NOAA Fisheries) should be consulted as it has jurisdiction over sea turtles below Mean Low Water.

The federally listed plant species most likely to be impacted by the BBCW Project is the endangered Johnson's seagrass (*Halophila johnsonii*). NOAA Fisheries has jurisdiction over this plant and, thus, should be consulted. Another endangered plant likely to exist in the project area is the tiny polygala (*Polygala smallii*), which can be found on open coastal spoil piles. Five additional federally listed plant species are known to exist or potentially exist in Miami-Dade County. However, all but one of these species are primarily pine rockland or marl prairie inhabitants, and are, consequently, unlikely to exist in the project area. They include the endangered crenulate lead-plant (*Amorpha herbacea* var. *crenulata*), endangered deltoid spurge (*Chamaesyce* (=*Euphorbia*) *deltoidea* ssp. *deltoidea*), endangered Small's milkpea (*Galactia smallii*), and threatened Garber's spurge (*Chamaesyce garberi*). The fifth species, the endangered beach jacquemontia (*Jacquemontia reclinata*), occurs on vegetated dunes, open areas of maritime hammock, coastal strands, and coastal scrub. Candidate plant species that are known to exist or potentially exist in the project area include Blodgett's silverbush (*Argythamnia blodgettii*), Florida brickell-bush (*Brickellia mosieri*), Pineland sandmat (*Chamaesyce deltoidea* ssp. *pinetorum*), Florida prairie clover (*Dalea carthagenensis* var. *floridana*), Florida pineland crabgrass (*Digitaria pauciflora*), and Carter's small-flowered flax (*Linum carteri* var. *carteri*). These candidate species are primarily affiliated with pine rockland or marl prairie habitat, and are therefore unlikely to occur in the project area.

Critical habitat for two federally endangered species, as defined by the Code of Federal Regulations (CFR) 50 Parts 1 to 199, lie within close proximity of the project area. The easternmost tip of Turkey Point defines the northern boundary of critical habitat for the American crocodile. Turkey Point is 2.5 miles south-southeast of C-103. The project area lies within critical habitat for the West Indian manatee. According to CFR 50, one component of

critical habitat is defined as "all waters of Card, Barnes, Blackwater, Little Blackwater, Manatee, and Buttonwood Sounds between Key Largo, Monroe County, and the mainland of Miami-Dade County." The other component is defined as "Biscayne Bay, and all adjoining and connected lakes, rivers, canals, and waterways from the southern tip of Key Biscayne northward to and including Maule Lake, Miami-Dade County."

In addition to the federally listed species, the BBCW Project area also provides habitat for species listed by the State of Florida. We recommend that the Corps contact the Florida Fish and Wildlife Conservation Commission to solicit input for species under their jurisdiction that may occur in the BBCW study area or be affected by the project.

If you have any questions regarding this letter, if modifications are made to the project, or if additional information involving potential impacts on listed species becomes available, please notify Patrick Pitts at 772-562-3909, extension 250.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
Corps, Jacksonville, Florida (Martin Gonzalez, Brad Tarr, and Shelley Trulock)
Service, Jacksonville, Florida (Miles Meyer)
District, West Palm Beach, Florida (Jorge Marban)
National Park Service, Homestead, Florida (John Klochak)
FWC, Vero Beach, Florida (Joe Walsh)
NOAA Fisheries, Miami, Florida

United States Department of the Interior

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

January 27, 2005

James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Duck:

The Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) for the U.S. Army Corps of Engineers (Corps) regarding the Biscayne Bay Coastal Wetlands Restoration Project (BBCW), a component of the Comprehensive Everglades Restoration Plan (CERP). This PAL is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and section 7 of the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This PAL does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA. This PAL provides guidance and transmits some of our concerns with this project. Additional natural resource protection legislation relevant to this project includes the National Environmental Policy Act, as amended (42 U.S.C. 4321 *et seq.*), the Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 701 *et seq.*), the Estuary Protection Act (16 U.S.C. 1221-1226), and the Coastal Zone Management Act (16 U.S.C. 1451-1464).

Throughout the entire multi-year planning process for the BBCW project, the Corps and South Florida Water Management District (SFWMD) have promised accurate, functional hydrodynamic and hydrologic models to quantify impacts and benefits of the project. Output from these models has become the basis for most of the project performance measures. During a meeting of the BBCW technical support team on December 16, 2004, Corps modelers from the Engineer Research and Development Center informed the team that model results for baseline conditions (existing and future without project) and the Yellow Book alternative will not be available in time to aid the team in developing a set of reasonable alternatives, which will themselves be modeled. Technical support team members, including Corps and SFWMD Project Managers, were anticipating using baseline and Yellow Book model results to help guide development of alternatives. All team members agree that attaining the best Tentatively Selected Plan (TSP) requires initial model output to help develop alternatives. Developing viable alternatives without this information is like "shooting in the dark" (as expressed by one Corps team member). One option for addressing this problem is to allow at least one additional model run after all model results (i.e., baseline, Yellow Book, and three alternatives) have been obtained and post-processed. Even though this slight modification of the project planning

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process would likely delay the TSP date by a few weeks, the Service believes a significantly better TSP would result and fully recommends this slight change.

Granting the requested TSP date extension would also allow additional time to refine project performance measures. Presently, some of the performance measures have unclear or vague targets. The team needs time to determine exactly which model cells or nodes should be used to quantify each performance measure. The extension would also allow more time to correct and refine an existing vegetation map in lieu of the Corps and SFWMD decision to not support the creation of a new vegetation map that could be more easily tied to project area hydrology (see PAL dated October 23, 2003). The Service has recently taken the lead role of revising one of three existing vegetation maps to serve as the primary map for quantifying upland and wetland habitat benefits and impacts. Various potential problems exist with each of these maps, which has necessitated a ground-truthing effort to choose which map will be used as a starter map, and then to correct as many errors in the starter map as possible within a reasonable time period. For example, one of the potential starter maps was created in 2003 by the Florida Fish and Wildlife Conservation Commission (FWC). Creators of the FWC map performed little to no ground-truthing in the BBCW area and the Service has found numerous inconsistencies between this map and other older, perhaps less reliable vegetation maps. The Service will use all available maps and field data to correct and refine the FWC map. Once ground-truthed and integrated with hydrology, this map will play an important role in selecting the TSP by quantifying project impacts and benefits to wetlands and uplands occurring in the project area. Extending the TSP date by 6 to 8 weeks would provide invaluable time to accomplish this task.

In closing, we are committed to providing timely and effective communication, consultation, and coordination with the Corps and the remainder of the BBCW support team to successfully implement this project and succeed in conserving our valuable fish and wildlife resources along the shores of central and southern Biscayne Bay. We fully support and appreciate the beneficial actions the Corps is taking to restore wetland habitat in the BBCW project area, and to conserve and recover south Florida's threatened and endangered species. Please feel free to contact Patrick Pitts at 772-562-3909, extension 250 if you have any questions regarding this letter.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
Corps, Jacksonville, Florida (Shelley Trulock)
SFWMD, West Palm Beach, Florida (Jorge Marban)
Corps, Jacksonville, Florida (Martin Gonzales)
Corps, Jacksonville, Florida (Brad Tarr)
Everglades National Park, Homestead, Florida (John Klochak)
FWC, Vero Beach, Florida (Dr. Joseph Walsh)
Miami-Dade County DERM, Miami, Florida (Dr. Susan Markley)
National Marine Fisheries Service, Miami, Florida (Dr. Joan Browder)
Florida Department of Environmental Protection, Pt. St. Lucie, Florida (Greg Graves)
Service, Jacksonville, Florida (Miles Meyer)

United States Department of the Interior

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

June 9, 2005

Stuart J. Appelbaum
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Appelbaum:

The Fish and Wildlife Service (Service) has prepared this Planning Aid Report (PAR) for the U.S. Army Corps of Engineers (Corps) regarding the Biscayne Bay Coastal Wetlands Restoration Project (BBCW), a component of the Comprehensive Everglades Restoration Plan. This PAR is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and section 7 of the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This PAR does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA. Additional natural resource protection legislation relevant to this project includes the National Environmental Policy Act, as amended (42 U.S.C. 4321 *et seq.*), the Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 703-712), the Estuary Protection Act (16 U.S.C. 1221-1226), and the Coastal Zone Management Act (16 U.S.C. 1451-1464). The report is submitted in fulfillment of tasks described in section 7.4.4.1.1 in the BBCW Project Management Plan (PMP). Although the Service was not assigned these tasks, we recognized the value of this information and volunteered to complete the tasks in lieu of Corps' and South Florida Water Management District's decision to not fund their completion by outside contractors, as indicated in the PMP.

The primary purpose of this PAR is to document current vegetation patterns in the project area. The report, together with the accompanying Geographic Information System (GIS) vegetation map and available GIS data layers, should assist the BBCW Project Team in accomplishing the following tasks required for successfully planning and implementing the restoration of the central and southern Biscayne Bay coastal wetlands: (1) describing and defining existing conditions in the project area; (2) evaluating all freshwater wetlands, saltwater wetlands, and upland habitats; (3) evaluating and differentiating project alternatives by attempting to predict vegetation changes in response to hydrologic changes anticipated to occur through restoration efforts; and (4) quantifying project benefits resulting from various alternatives. Critical to this process is accurate information pertaining to the location and spatial extent of all major vegetation types.

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In closing, we appreciate the opportunity to coordinate and cooperate with the Corps and their project sponsors to conserve, protect, and enhance fish, wildlife, and plants and their habitats. We are committed to contributing scientific and technical guidance in the areas of ecological and biological assessment throughout the life of the BBCW. Also, we fully support and appreciate the beneficial actions the Corps is taking to restore wetland and nearshore habitat in central and southern Biscayne Bay. If you have any questions regarding this letter, please feel free to contact Patrick Pitts at 772-562-3909, extension 250.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

Enclosure

cc: w\enclosure
BNP, Homestead, Florida (Sarah Bellmund)
Corps, Jacksonville, Florida (Shelley Trulock and Brad Tarr)
District, West Palm Beach, Florida (Matt Morrison)
Everglades National Park, Homestead, Florida (John Klochak)
DEP, Port St. Lucie, Florida (Greg Graves)
Miami-Dade DERM, Miami, Florida (Steve Blair)
FWC, Vero Beach, Florida (Joseph Walsh)

PLANNING AID REPORT

ON THE

BISCAYNE BAY COASTAL WETLANDS PROJECT:

VEGETATION MAPPING OF THE PROJECT AREA

Submitted to:
U.S. Army Corps of Engineers
Jacksonville District
Jacksonville, Florida

Prepared by: Patrick Pitts and Les Vilchek
Approved by: James J. Slack, Field Supervisor

Fish and Wildlife Service
South Florida Ecological Services Office
Vero Beach, Florida

June 9, 2005

INTRODUCTION

In order to plan for hydrologic restoration and to assess the success of the Comprehensive Everglades Restoration Plan's (CERP) Biscayne Bay Coastal Wetlands Restoration Project (BBCW), an accurate inventory of the vegetation of the area is necessary prior to project initiation. The general zonation of coastal vegetation in southeastern Miami-Dade County is well understood (Egler 1952; EPA 1994; DERM 2003), particularly in the Model Lands Basin. Existing spatial data layers portraying land cover and/or vegetation coverage of all or part of the project area that were considered for this effort include a map produced by the South Florida Water Management District (District) in 1999 (District 1999), a map produced by the Florida Fish and Wildlife Conservation Commission in 2003 (FWC 2004), another compiled by Florida International University in 2002 (Gaiser and Ross 2003), and a map produced cooperatively by the Miami-Dade County Department of Environmental Resource Management (DERM), the U.S. Environmental Protection Agency (EPA), and the U.S. Army Corps of Engineers (Corps) (DERM 2003). However, due to a number of factors such as spatial coverage, spatial resolution and accuracy, levels of classification, and suitability of the classification system, none of these maps were deemed suitable for the overall project purpose. In addition, vegetation in the area has changed significantly in recent years due to storms and encroaching urban and agricultural development. A current map of the project area was deemed necessary to establish baseline conditions, inform planning, and quantify restoration benefits.

This report describes the methods used in creating a current vegetation map and provides total acreages of each of 28 vegetation classes used to produce the map. The new map was produced by a small team of biologists at the Fish and Wildlife Service (Service) South Florida Ecological Services Field Office. Representatives from DERM and the District aided in the ground-truthing effort. The new map covers 17,875 acres of the anticipated project area between the Deering Estate (Shoal Point) at the northern extreme of the project area and SW 360th Street in the Model Lands (Turkey Point) (Figure 1). The resulting map should be considered a final draft subject to review and revision wherever necessary to best portray the vegetation coverage of the project area.

It is anticipated that this new map will provide a valuable resource to aid the BBCW Project Team (PT) in accomplishing the following tasks:

(1) Describing and defining existing conditions in the project area. This is an important section in the Project Implementation Report and it requires accurate assessments of vegetation types in the project area;

(2) Evaluating all freshwater wetlands, saltwater wetlands, and upland habitats. The entire project area will likely be evaluated using some form of habitat assessment method. Because of the size of the project area and inaccessibility of certain areas within the project extent, much of the assessment will be a desktop exercise where the team will rely heavily on the best available vegetation data to delineate habitat types of similar value;

(3) Evaluating and differentiating project alternatives by attempting to predict vegetation changes in response to hydrologic changes. Theoretically, the BBCW PT should be able to tie existing vegetation to existing hydrology as modeled by the WASH123 hydrologic model and the TABS-MDS hydrodynamic model, both developed by the Corps' Engineering Research and Development Center. Changes in hydroperiod, water levels, and salinity produced by various alternatives will affect plant communities in different ways, depending on the species' hydrologic requirements or preferences. The identification of vegetation type and location will help determine how hydrologic changes provided by given alternatives will affect ecology of the area; and

(4) Quantifying project benefits as part of the Corps' Cost Effectiveness/Incremental Cost Analysis process. Predicted ecological lift resulting from various alternatives must be quantified. Critical to this process is accurate information pertaining to the location and spatial extent of all major vegetation types. Presently, no map of the project area provides this information at the level of detail required for the benefits assessment. It has been suggested that conversion of areas presently dominated by invasive non-native vegetation to native species may provide one of the most important benefits to the freshwater wetlands through implementation of the project. To that end, accurate delineation of non-native vegetation coverage will be critical to quantifying the number of acres of non-native vegetation that can or will be converted to native habitat.

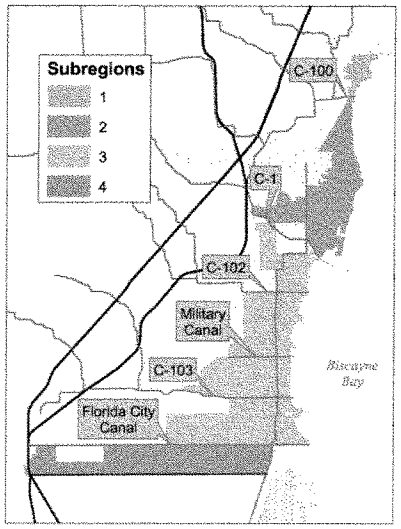

Figure 1. Map showing the portion of the BBCW area included in the mapping effort. Note that for Sub-region 4, only the northern 4,060 acres lying between Florida City Canal and SW 360th Street were mapped. The C-111 Spreader Canal PT is mapping the Model Lands south of SW 360th Street.

MAPPING METHODS AND SPECIFICATIONS

The new map was compiled using a monoscopic "on-screen" digitizing technique and ArcGis 8.3® (Registered trademark of Environmental Systems Research Institute, Incorporated, Redlands, California) geographic information system (GIS) software. Distinct vegetation types and/or communities were delineated from a digital 2004 natural color air photo mosaic provided to the Service by the DERM. The imagery was geo-referenced to the State Plane coordinate system, Zone 3601, NAD 83, units feet. Stereoscopic color infrared imagery is typically used for vegetation mapping, but current photography of this type was not available for the project area. Because of the high resolution of the true color imagery (2 feet x 2 feet picture elements), the extensive local knowledge provided by the DERM, the use of supporting collateral data sources, and the availability of helicopter transportation for ground-truthing, the natural color mosaic was deemed acceptable for the mapping effort.

Ground-truthing via District helicopter was conducted on January 21, 2005, and March 10, 2005, during which a total of 108 individual check sites were visited. Differential global positioning system equipment was utilized to find the check sites when necessary, but most sites were easily identified by sight using available landmarks. Additional characterization of the project vegetation communities was performed while traveling between the 108 formal check sites. Observations were recorded directly on hard copy printouts of the digital imagery. Two Service photo interpreters were present on each of the reconnaissance flights. A follow-up ground-truthing effort was conducted by automobile on April 26, 2005, during which an additional six sites were checked. Two Service biologists and one DERM biologist participated in this effort. Fieldwork was designed to clearly correlate the signatures on the aerial photography with the vegetative community types occurring in the field.

To expedite the creation of the map, the team delineated all new vegetation polygons instead of identifying and correcting the polygons from pre-existing data, as was the original plan. Due to an uneven spatial offset inherent in some of the pre-existing data, as well as new disturbance in the project area, it was determined that creating a new map would be more accurate and the process more time efficient. The final vegetation map is stored digitally in GIS shape file format. The data is geo-referenced to the State Plane coordinate system, Zone 3601, NAD83, units feet.

Two existing vegetation maps were used as guides to aid in delineations and determination of vegetation classifications. One of these existing vegetation maps was produced cooperatively by the DERM, the EPA, and the Corps as part of the southwest Biscayne Bay Advanced Identification (ADID) study (EPA 1994). This project was initiated to determine which, if any, of the wetlands remaining along the southwest shore of Biscayne Bay might be potential future disposal sites for fill material, pursuant to authority in the Clean Water Act of 1977 and regulations outlined in 40 CFR Part 230 (EPA 1994). When completed, the ADID project provided an excellent and relatively detailed vegetation map for the Biscayne Bay coastal wetlands north of Turkey Point. However, for a number of reasons the map is now inadequate for use in the BBCW. First, the ADID map is approximately 15 years old and was created prior to the passage of Hurricane Andrew. The center of this major hurricane made landfall at the

project site in August of 1992 and affected the entire ADID project area, resulting in extensive damage to natural areas (EPA 1994). Hardest hit were tall, forested areas, including mature mangrove forest and upland forest. Nearly 3,000 acres of coastal band mangroves were severely affected, as the vast majority of the mature trees were snapped off near the base of the trunk. Furthermore, some freshwater graminoid marshes were significantly damaged from saltwater inundation caused by storm surge. Thus, the remaining natural vegetation coverage differs somewhat from what appears on the ADID map as a result of the storm. Secondly, land use in the ADID project area has changed significantly over the past 15 years. Residential development and tree nurseries have encroached from the west and north into former natural areas. Finally, the ADID map covers only the project area north of Palm Drive (approximately 12,000 acres), and there is virtually no coverage of the Model Lands Basin (approximately 43,000 acres). Nevertheless, the ADID map has been found to be more accurate and with more practical vegetation classifications than two more recent vegetation maps of the project (District 1999; FWC 2004).

The second map that was used as a collateral guide to identify vegetation signatures was created by researchers at Florida International University in 2002 to document water flow through coastal wetlands (Gaiser and Ross 2003). This map is considered highly accurate, but it covers only a relatively small portion of the project area. The coverage includes approximately 1,440 acres of saltwater wetlands located mostly east of L-31E between C-102 and C-103.

A minimum mapping unit was not established prior to the initiation of this mapping effort. Because the classification system was developed as mapping progressed and because the number of individual classes and mixed classes was unknown before mapping began, it was difficult to determine a reasonable minimum size. Also, the mapping effort was under a relatively unknown time constraint resulting in some initial linework generalizations. Further refinement of the delineations was accomplished as time permitted with the size threshold defaulting to what could accurately be identified on the photography. Most of the smallest polygons (less than 0.1 acre) belong to the Coastal Band Mangrove category, as the taller stature of the trees made them stand out well against the mostly low-growing surrounding vegetation.

A formal accuracy assessment was not conducted on the final draft map due to time and resource constraints. Because of the extensive involvement and review by personnel from DERM, who have extensive local knowledge of the area's land cover and land use, confidence in the accuracy of the map is relatively high, especially when compared to other existing vegetation data sets. If deemed necessary and if resources become available, an accuracy assessment can be conducted in the future.

VEGETATION CLASSIFICATIONS

The new map uses 13 primary vegetation classes (Table 1). Two additional primary categories include open water and any area that has been filled, developed, or mechanically disturbed (*i.e.*, agriculture, urban, or commercial land use). An additional 13 mixed vegetation classes were required due to the complexity of the vegetation in the project area. Undisturbed natural areas usually reach relative equilibrium over time and typically have well defined boundaries or

transition areas between the various vegetation communities. Plant community shifts due to natural forces such as fire are more predictable and less severe than changes caused by human interference. These habitats are much easier to interpret from aerial photography. When anthropogenic forces come into play the number of possible vegetation classes is higher because there is so much mixing of vegetation types (*e.g.*, Australian pine [*Casaurina equisetifolia*] with sawgrass [*Cladium jamaicenses*]). Other mixed classes occur naturally such as the sawgrass/ mangrove class. These areas are very complex, resulting in a relatively large number of community types especially when invasive non-native species are present. Some of these classes can be combined later if desired. The primary vegetation classes utilized in this mapping effort are listed below with a brief description.

Table 1. List and description of the 13 primary vegetation classes utilized to construct the BBCW vegetation map. Also included in the list are classifications for open water and filled-developed-disturbed areas.

Vegetation Class	Description
1. Coastal band mangrove	Any mangrove forest that is not dwarf mangrove; includes red mangrove (*Rhizophora mangle*), black mangrove (*Avicenia germinans*), or white mangrove (*Laguncularia racemosa*). Note that this class lumps the Gaiser and Ross (2002) classifications of coastal band, interior and transitional mangrove forests.
2. Dwarf dense mangrove	Dwarf mangrove with little or no open space between trees. Dominated by red mangrove, but can include black and white mangrove, as well as buttonwood (*Conocarpus erectus*).
3. Dwarf sparse mangrove	Same as dwarf dense mangrove but with significant space between trees.
4. Salt marsh	Any combination or monospecific stands of saltwater graminoids dominated or co-dominated by black needlerush (*Juncus roemerianus*) or spikegrass (*Distichlis spicata*). Scattered dwarf red mangroves are usually present.
5. White mangrove/ buttonwood	Areas dominated by white mangrove and/or buttonwood.
6. Native forested or shrub wetland	Include any combination of white mangrove, buttonwood, coastal plain willow (*Salix caroliniana*), wax myrtle (*Myrica cerifera*), cocoplum (*Chrysobalanus icaco*), elderberry (*Sambucus Canadensis*), and dahoon holly (*Ilex cassine*).
7. Brazilian pepper	Areas that are deemed to be greater than 80 percent Brazilian pepper (*Schinus terebinthifolius*).
8. Australian pine	Dense Australian pine with little or no understory.
9. Other exotics	Can include various combinations of shoebutton ardesia (*Ardisia elliptica*), Bishopwood (*Bischofia javanica*), Napier grass (*Pennisetum purpureum*), seaside mahoe (*Thespesia populnea*), paperbark tree (*Melaleuca leucadendron*), wild taro (*Colocasia esculenta*), and primrose willow (*Ludwigia peruviana*).

Table 1 continued.

Vegetation Class	Description
10. Sawgrass	Freshwater marsh dominated by sawgrass.
11. Cattail	Freshwater marsh dominated by cattail (*Typha domingensis*).
12. Pine rockland	Uplands characterized by South Florida slash pine (*Pinus elliottii* var. *densa*) as the dominant canopy tree, usually with an understory palm component such as saw palmetto (*Serenoa repens*).
13. Tropical hardwood hammock	Closed canopy forest consisting of diverse assemblage of evergreen and semi-deciduous tree and shrub species. Typical canopy species include gumbo-limbo (*Bursera simaruba*), paradise tree (*Simarouba glauca*), pigeon-plum (*Coccoloba diversifolia*), strangler fig (*Ficus aurea*), and wild mastic (*Sideroxylon foetidissimum*).*
14. Filled-developed-disturbed	Any area that has been filled, developed, or mechanically disturbed. Agriculture is the dominant land use form that defines this category.
15. Open water	Includes canals, ponds, rockmine pits and shallow standing water

*See Service (1999) for a more complete description of canopy, sub-canopy, shrub, and herb layer species.

A total of 13 mixed classes were used for the map, as follows:

Mixed Class	Description
2/4	Dwarf dense mangrove / salt marsh
2/10	Dwarf dense mangrove / sawgrass
3/4	Dwarf sparse mangrove / salt marsh
3/10	Dwarf sparse mangrove / sawgrass
5/7	White mangrove / Brazilian pepper
6/7	Native forested or shrub wetland / Brazilian pepper
6/8	Native forested or shrub wetland / Australian pine (may rarely include Brazilian pepper)
6/9	Native forested or shrub wetland / other exotics
6/10	Native forested or shrub wetland / sawgrass
6/11	Native forested or shrub wetland / cattail
7/8	Brazilian pepper / Australian pine
8/10	Australian pine / sawgrass
10/11	Sawgrass / cattail

RESULTS

Figure 2 shows the vegetation coverage in the project area between Shoal Point and Turkey Point. Table 2 provides the number of acres, number of polygons, average sizes of polygons, and percent of total acreage for each vegetation class delineated in the study area. The following description provides some very generalized characteristics of the vegetation coverage and patterns in the project area. Not surprisingly, mangroves are the dominant vegetation type east of L-31E, but they do occasionally occur just west of the levee. Coastal band mangroves cover 2,737 acres and dwarf dense mangroves cover 1,258 acres; these coverages represent approximately 15 and 7 percent of the total project area, respectively. Dwarf sparse mangroves are much less common, covering only 336 acres of the project area. Land coverage west of L-31E is dominated by the filled-developed-disturbed category, which comprises 4,251 acres or about 24 percent of the total project area. As noted above, agriculture is the primary land use that defines this category. Three vegetation classes have roughly equal representation west of L-31E. These three include native forested or shrub wetland/Brazilian pepper mix (1,901 acres), sawgrass (1,471 acres), and native forested wetland or shrub/Australian pine mix (1,315 acres), which account for 10.6, 8.2, and 7.3 percent of the total project area, respectively. It is important to note that 9 of the 28 vegetation classes include non-native species, with the non-native species usually dominating the native species in these areas. Combined, these non-native classes cover 5,177 acres, or 29 percent, of the total project area. Note that cattail is not included as a non-native species, even though it is usually present in South Florida only when water quality has been unnaturally altered.

It should be noted that the high degree of complexity and mixing of vegetation classes in the project area cannot be overemphasized. An example of the complexity is provided by the fact that a total of 1,050 vegetation polygons were delineated within the 17,875 acres included in this mapping effort, resulting in an average polygon size of 17 acres. Significant mixing of vegetation types occurs throughout the project area. Of particular note is the mixing of native forested or shrub wetland and Brazilian pepper (1,901 acres), native forested or shrub wetland and Australian pine (1,315 acres), native forested or shrub wetland and other exotics (528 acres), and Australian pine and sawgrass (521 acres). The mapping team strived to characterize vegetation as coverage by a single species, where possible. Also, in the interest of time, narrow strips of vegetation associated with ditch berms were often combined with adjacent vegetation classes. Vegetation comprising these strips was usually Australian pine, Brazilian pepper, or one of the mangrove classes.

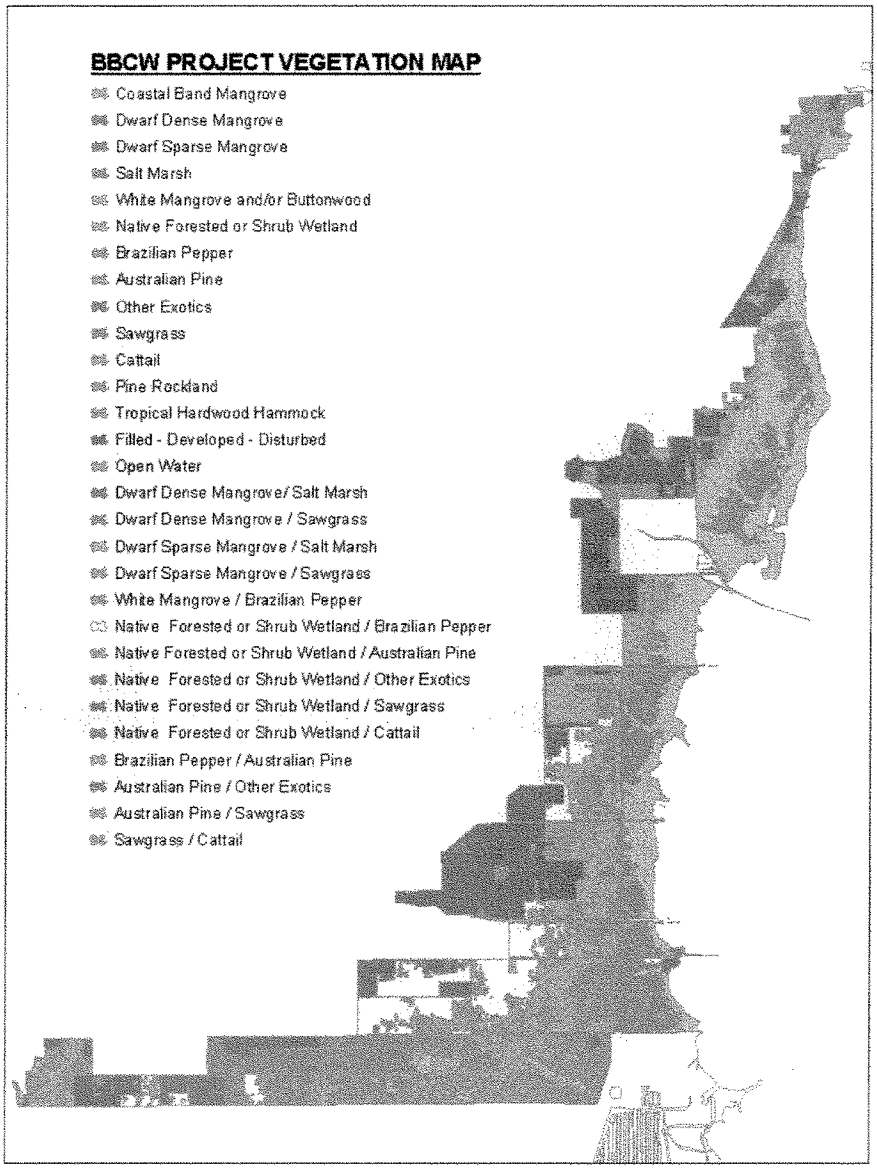

Figure 2. Vegetation coverage of the BBCW area between Shoal and Turkey Points.

Table 2. Acres, number of polygons, mean polygon size, and percent of total acres for each of 28 vegetation/land use categories used to describe the BBCW area north of SW 360th Street.

Vegetation Class		Acres	Number of Polygons	Mean Polygon Size (acres)	Percent of Total Acres
1.	Coastal band mangrove	2737.0	82	33.4	15.3
2.	Dwarf dense mangrove	1257.5	115	10.9	7.0
3.	Dwarf sparse mangrove	336.2	53	6.3	1.8
4.	Salt marsh	118.5	24	4.9	0.7
5.	White mangrove and/or buttonwood	507.2	30	16.9	2.8
6.	Native forested-shrub wetland	196.4	66	3.0	1.1
7.	Brazilian pepper	467.7	31	15.1	2.6
8.	Australian pine	158.9	28	5.7	0.9
9.	Other exotics	105.6	19	5.6	0.6
10.	Sawgrass	1470.6	114	12.9	8.2
11.	Cattail	363.3	109	3.3	2.0
12.	Pine rockland	87.4	3	29.1	0.5
13.	Tropical hardwood hammock	184.0	5	36.8	1.0
14.	Filled-developed-disturbed	4250.7	63	67.5	23.8
15.	Open water	574.2	60	9.6	3.2
2/4.	Dwarf dense mangrove / salt marsh	33.2	4	8.3	0.2
2/10.	Dwarf dense mangrove / sawgrass	126.6	11	11.5	0.7
3/4.	Dwarf sparse mangrove / salt marsh	23.9	6	4.0	0.1
3/10.	Dwarf sparse mangrove / sawgrass	99.0	18	5.5	0.6
5/7.	White mangrove / Brazilian pepper	128.7	5	25.7	0.7
6/7.	Native F-S wetland / Brazilian pepper	1901.3	33	57.6	10.6
6/8.	Native F-S wetland / Australian pine	1314.9	59	22.3	7.3
6/9.	Native F-S wetland / other exotics	528.1	28	18.9	3.0
6/10.	Native F-S wetland / sawgrass	152.6	17	9.0	0.9
6/11.	Native F-S wetland / cattail	104.8	7	15.0	0.6
7/8.	Brazilian pepper / Australian pine	49.7	6	8.3	0.3
8/10.	Australian pine / sawgrass	521.8	32	16.3	2.9
10/11.	Sawgrass / cattail	71.7	21	3.4	0.4

COVERAGE BY REGION

To facilitate alternative plan formulation and evaluation, the BBCW area was divided into four geographic sub-regions. This section of the report characterizes vegetation patterns for each of these sub-regions. Sub-region 1 is 480 acres in size and includes the project area north of C-100. It is occupied by the Deering Estate. Sub-region 2 is 3,873 acres in size and includes the project area between C-100 and C-1, which is comprised of the Cutler and Black Creek wetlands. Sub-region 3 lies between C-1 and the Florida City Canal and occupies

9,460 acres. Sub-region 4 includes all of the Model Lands south of Florida City Canal and east of U.S. Highway 1. However, only a relatively narrow strip (4,060 acres) of Sub-region 4 was mapped through this effort, including all areas between Florida City Canal and SW 360th Street. The C-111 Spreader Canal PT mapped the areas of Sub-region 4 south of SW 360th Street.

A. Sub-region 1 (Deering Estate)

This sub-region represents only a small fraction of the study area, but it contains perhaps some of the most unique habitat types. It is the only sub-region that contains pine rocklands (87 acres) and most of the project area's tropical hardwood hammock (162 acres) is found here. These two classes comprise 18 percent and 34 percent of the total area of the sub-region, respectively. The pine rocklands occupy the northwest section of the sub-region, whereas the hardwood hammock occupies the central western portion. Coastal band mangrove accounts for 23 percent of the total coverage (110 acres), whereas salt marsh accounts for 5 percent (23 acres). These two vegetation types lie west of the hammock and pine rocklands habitat. The filled-developed-disturbed class occupies 75 acres or 16 percent of the sub-region.

B. Sub-region 2 (Cutler and Black Creek Wetlands)

This sub-region is 3,873 acres in size and lies east of the saltwater intrusion barrier, and thus is characterized primarily by halophylic flora. The patterns and types of vegetation are very similar to that described by Gaiser and Ross (2003) for areas east of L-31E in Sub-region 3. It is noted here that the mapping team combined three of Gaiser and Ross' (2003) mangrove vegetation classes into one class. Specifically, Gaiser and Ross' (2003) fringe mangrove forest, transitional mangrove forest, and interior mangrove forest classes were combined into one class named "coastal band mangrove." Also, Gaiser and Ross' (2003) dwarf mangrove forest class was subdivided into dwarf dense mangrove and dwarf sparse mangrove categories. These modifications to their system were made because the mapping team felt that hydrologic changes associated with the BBCW will likely have little, if any, effect on the coastal band mangrove community, but they should affect dwarf dense and dwarf sparse mangrove types.

The dominant vegetation type in this sub-region is coastal band mangrove, which comprises 35 percent (1,358 acres) of the total area of the sub-region. The next most abundant class is the filled-develop-disturbed category that accounts for 924 acres or 24 percent of the area within this sub-region. White mangrove/buttonwood and dwarf dense mangrove classes cover nearly equal amounts of this sub-region at 434 and 411 acres, respectively, or about 11 percent of the total sub-region. Dwarf sparse mangrove accounts for 169 acres or about 4 percent of the total. The western margin of the sub-region is dominated by non-natives, including Australian pine and Brazilian pepper, which is likely a reflection of greater anthropogenic impacts. Brazilian pepper, Australian pine, and non-native mixes cover 371 acres (about 10 percent of the total) in the western area.

C. Sub-region 3 (Homestead Wetlands)

Vegetation in this sub-region is generally comprised of freshwater wetlands west of L-31E and saltwater wetlands east of the levee. A notable exception is the preponderance of mangrove mixed with sawgrass or Australian pine in some areas just west of L-31E. An important class in this sub-region is the filled-developed-disturbed class, which occupies much of the terrain along the western side of the sub-region. This class accounts for 27 percent (2,595 acres) of the total land area in the sub-region, most of it being utilized as landscape nurseries.

As noted above, vegetation pattern and structure for much of this sub-region east of L-31E was well described by Gaiser and Ross (2003). Coastal band mangrove is the dominant vegetation class and comprises 1,264 acres or 13 percent of the sub-region. Dwarf dense mangrove occupies 828 acres, whereas dwarf sparse mangrove covers 168 acres. Salt marsh covers 96 acres and is only found in the northern part of the sub-region, generally along either side of C-102. A relatively large grove of Australian pine exists along the eastern edge of the levee just south of C-102. Very little dwarf mangrove exists near Military Canal, that area being dominated by coastal band mangrove. See Gaiser and Ross (2003) for a more detailed description of vegetation pattern and structure of this area, as well as an analysis of historical changes in these wetlands.

Vegetation community types lying west of L-31E and east of the extensive agricultural development are dominated primarily by two classes, both of which include non-native vegetation as a principal component. Brazilian pepper forests and native forested or shrub wetlands mixed with Brazilian pepper occupy 1,485 acres (16 percent of the sub-region); whereas Australian pine forests and native forested or shrub wetlands and Australian pine mix covers 1,267 acres (13 percent of the sub-region). It should be noted that those areas indicated as Brazilian pepper are rarely monospecific, they almost always have native or non-native shrubs, such as willow, shoebutton ardesia, or white mangrove intermixed at low concentrations. Also, the native forested or shrub wetlands and Australian pine mix is often dominated by the pines. The shrubs in the mix include white mangrove, willow, and/or other natives, and may occasionally include Brazilian pepper. In the area between C-102 and Military Canal is a patchwork of dwarf dense mangrove embedded in the primarily Australian pine/shrub mix. North of North Canal sawgrass or sawgrass mixed with other vegetation is limited mainly to the areas just west of L-31E near Florida Power and Light's main transmission lines. However, south of North Canal sawgrass patches extend westward almost to the project boundary. Sawgrass covers 365 acres or 4 percent of the sub-region. Patches of cattail first become apparent south of C-103 and become larger and more prevalent southward. Cattail and cattail mixes occupy 294 acres or 3 percent of this sub-region.

D. Sub-region 4 (Model Lands; limited to the area between Florida City Canal and SW 360th Street)

Vegetation in the northern segment of the Model Lands Basin differs from the more northern sub-regions by having relatively large expanses of sawgrass marshes. A total of 1,105 acres of sawgrass is found in this part of Sub-region 4 or 27 percent of the area. The filled-develop-

disturbed class is the second most common single class, accounting for 656 acres (16 percent of the sub-region), followed by the mixed class of native forested or shrub wetlands and Brazilian pepper, which accounts for 599 acres or 15 percent of the total. Combined, the non-native classes and non-native/native mixes cover 1,692 acres or about 42 percent of the total area within the sub-region. The non-natives species most common in these mixes are Brazilian pepper followed by shoe button ardisia. Cattails are also of note in the sub-region, covering 230 acres or 6 percent of the sub-region.

SUMMARY OF FINDINGS AND IMPLICATIONS

From the description above it is apparent that the BBCW area contains a broad and diverse representation of wetland habitat types common in the south Florida ecosystem. It is also apparent that the project area contains a very complex mix of vegetation types, especially west of the L-31E. As discussed above, a significant degree of this complexity is likely unnatural and has resulted from anthropogenic actions, primarily drainage to facilitate agricultural and urban development. The prevalence of dense stands of non-native forests, particularly Brazilian pepper and various mixes of non-native and native vegetation in the project area, underscores this point. The BBCW objectives of re-establishing a more natural overland flow pattern by diverting water from conveyance canals into the coastal wetlands should serve to restore and enhance freshwater and estuarine wetlands in the project area, thus increasing the function of these habitats for fish and wildlife. Re-establishing connectivity between adjacent sub-basins, which is another project objective, should aid in restoring a more natural broad overland flow across these wetlands.

Of particular importance for restoring the wetlands will be to re-establish hydroperiods and water levels that are suitable for native freshwater marshes. Hydroperiods and water levels appropriate for native marshes are not conducive to the survival and proliferation of the seedlings of many nuisance non-native species, such as Brazilian pepper and Australian pine. However, it should be noted that restoration of more natural hydrology alone will likely not suffice to eradicate established stands of Brazilian pepper. It may be necessary to physically remove this vegetation. It is also anticipated that a return of a more natural fire regime will be required to maintain the desired vegetation communities, which will likely require the implementation of a fire management program.

Restoring natural vegetation communities in the project area will result in the restoration and enhancement of the area's fish and wildlife resources. Wetland habitat types found in the project area, particularly freshwater graminoid marsh and mangrove wetlands, are extremely important in terms of supplying plant biomass to the food web of Biscayne Bay. Both also serve as vital refuge and nursery grounds for a wide variety of freshwater and estuarine fish and invertebrate species, as well as foraging grounds for a variety of wading birds and reptiles, including the federally endangered American crocodile (*Crocodylus acutus*). Specifically, freshwater and oligohaline graminoid marshes foster the production of large numbers of mosquito fish (*Gambusia affinis*), sailfin mollies (*Poecilia latipinna*), and other small fishes that serve as the prey base for many of the region's wading birds and higher trophic level predators. Current water management practices have resulted in altered hydroperiod and water levels in these marshes, which has reduced prey fish production and impacts breeding capabilities of wading

birds. Restoring more natural salinities, hydroperiods, and water levels to these marshes, as planned in the BBCW, should serve to increase prey fish production and further enhance these habitats for wading birds and other fish and wildlife resources. The Service provided documentation of the project area's fish and wildlife resources, and a more thorough description of the food web interactions, in an earlier Planning Aid Report (Service 2004).

The BBCW represents an opportunity to restore, enhance, and preserve the various habitats that comprise the project area. This report documents the tremendous diversity and complexity of vegetation that comprise these habitats. In the broader picture, the BBCW is an important component of CERP because it encompasses such a large area and includes diverse habitat types in a region that is otherwise heavily urbanized. Furthermore, the project is an appropriate representative of the fundamental purpose of CERP, the restoration, protection, and preservation of the south Florida ecosystems.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
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November 21, 2005

Stuart Applebaum
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Attention: Brad Tarr

Dear Mr. Applebaum:

The Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) for the U.S. Army Corps of Engineers (Corps) regarding the Biscayne Bay Coastal Wetlands (BBCW) Project, a component of the Comprehensive Everglades Restoration Plan (CERP). This PAL is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This letter does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA. This PAL provides guidance and transmits some of our concerns with this project.

Introduction

Planning for the BBCW Project has progressed to the point where an array of alternatives has been formulated and will be evaluated. Some of these alternatives include stormwater treatment areas (STA) as management measures for providing improvement in water quality from a variety of nutrients and pollutants. Some of alternatives also include reservoirs for storage of water during peak periods of runoff to be released when the flows are needed or to prevent excess discharge of stormwater to the estuarine and marine environment. The Service has conducted an in depth literature review of STA and reservoir construction and management, evaluated existing STAs and reservoirs in southern Florida, and formulated recommendations for optimal siting, configuration, and operation (Service 2004). Our goal is to maximize the value of these components for fish and wildlife as well as water quality enhancement, while maintaining the primary function for which the facility was intended. These facilities provide a unique opportunity to enhance habitat for a multitude of fish and wildlife when properly constructed and operated. The Service advises consideration for implementation, where applicable, of the following recommendations during the planning, construction, and operations phases of any BBCW Project STA or reservoir facility.

TAKE PRIDE IN AMERICA

General Recommendations

The recommendations appearing in this section have been drawn from recommendations resulting from an interagency workshop whose purpose was to determine how best to incorporate measures to enhance fish and wildlife into STA and reservoir design and operation. This workshop was hosted by the Service at the South Florida Ecological Services Office in Vero Beach, Florida, on June 15, 2004. Agency participants included the Service, Corps, South Florida Water Management District (SFWMD), National Park Service, Environmental Protection Agency, Florida Fish and Wildlife Conservation Commission, and Florida Department of Environmental Protection. Details of the methods, discussion, and recommendations resulting from this workshop appear in Service (2004), including supporting references.

Contaminants

Evaluate and Remediate Contaminants. Evaluate potential STA sites prior to acquisition in accordance with the SFWMD Standard Operating Procedures (Appendix A), and Service protocols. Site remediation must occur prior to construction in areas where contaminant concentrations could compromise fish and wildlife health, as well as public health. Adherence to this process will eliminate or reduce contaminant remobilization, eliminate or reduce exposure risks to fish and wildlife, reduce long-term treatment and remediation costs, optimize STA and reservoir function by eliminating potential contaminant remobilization, and improve public health.

Clean Construction Materials. Evaluate construction materials for contaminants prior to use for levees, berms, islands, etc. Do not use materials from contaminated areas. Assuring the use of clean construction materials prevents mobilization of contaminants and reduces exposure risk to fish and wildlife and the public.

Contaminant Monitoring. Implement a post-construction monitoring and contingency plan for mercury, pesticides, and other toxicants as described in the draft Contaminants of Concern CERP Guidance Memorandum (Appendix B). Contaminant monitoring and contingency plan implementation will alert managers to potential exposure risks to fish and wildlife, and prevent contaminant remobilization.

Design and Location

Facilities Location. Locate potential STA and reservoir facilities in the project area where water is available to optimize water treatment (by placing them adjacent to reservoirs or canals), and minimize "dry-outs" (water below bed surface). Avoid ecologically sensitive areas, which is a CERP goal. Locate facilities to maximize water supply, storage, treatment, and management to benefit fish and wildlife resources and habitats. Locate facilities to reduce direct (footprint) and indirect (*e.g.*, undesirable hydrological modifications, fragmentation) impacts to fish and wildlife resources and habitats. When practicable, locate facilities to minimize potential remobilization of pollutants, including contaminants and nutrients.

Heterogeneous Topography. Preserve or create features that reduce the potential for hydrologic short-circuiting. Short-circuiting is a direct hydrological pathway for water to move rapidly through an STA thereby reducing water retention (treatment) time. Preserving heterogeneous topography, such as berms, ditches, farms roads and emergent vegetated rows (Figures 1 and 2) will reduce short-circuiting and maximize residence time in the STA. This practice also supports habitat diversity, enhances biochemical processes over a wide range of water elevations, and provides refugia for aquatic/forage species during critical periods (*e.g.*, winter or drawdown). Heterogeneous topography has the potential to increase hydraulic residence time and treatment efficiency, reduce design, construction, and maintenance costs, and reduce the potential for hydrologic short-circuiting when perpendicular to flow direction.

Shallow Pools/Interior Perimeter Canal. Preserve or create shallow pools (*e.g.*, distribution and collection canals, interior perimeter canal), some at least three feet deep, to provide aquatic plant and fish habitat, and refugia for other aquatic resources during critical periods (*e.g.*, low water events). The size and extent of these features should be proportional to the facility size. Shallow pools can improve hydrologic mixing, increase hydraulic residence time, and reduce resuspension of sediment-bound pollutants.

Sloping Vegetated Zones. Include gradually sloping and/or stepped vegetated littoral zones along shorelines in STAs, reservoirs, and seepage canals (Figure 3). Sloping/stepped vegetated zones provide habitat for plant diversity, fish spawning, and wading bird foraging during water level manipulation. Sloping/stepped vegetated zones can further function to maintain bank stability, resist erosion, and contribute to turbidity reduction. Provide organic soil over hard substrates where soil is lacking, and manage for native vegetation. Organic soil provides for aquatic vegetation which promotes viable aquatic ecosystems.

Irregular Shorelines. Preserve irregular shoreline features such as peninsulas and submerged bars. Irregular shorelines provide visual cover, increase habitat edge, and support biologically rich and diverse zones (Figure 4). Irregular shorelines may provide for design and construction cost savings (*e.g.*, maintenance access for existing utilities, Figure 5).

Low-profile Vegetated Areas. Preserve low-profile vegetated areas in appropriate locations upon which native plants are established and maintained (Figure 6). Low-profile vegetated areas increase habitat diversity and support fish and wildlife activities such as loafing, feeding, and sheltering (Figure 7). Low-profile vegetated areas may prevent hydrologic short-circuiting, enhance retention time, and improve hydrologic mixing.

Multi-cell Flow ways. Design cell sequence to minimize wildlife use in downstream portions of polishing cells to avoid unwanted localized increases in nutrient levels at STA outflows. Design STAs with multi-cell flow ways to increase maintenance flexibility, treatment efficiency, and reduce short-circuiting (Figure 8). In addition, multi-cell flow ways can function to increase habitat diversity, structure, and composition (*e.g.*, more edge, vertical structure).

Vegetated Buffers. Create or maintain vegetated buffers (*e.g.*, 100 to 500 meters wide) adjacent to STA and reservoir levees, and seepage collection canals (Figure 9). These buffers provide habitat for amphibians, reptiles, neotropical migrant birds, and other wildlife. Vegetated buffers create natural aesthetic and safety barriers between constructed facilities and developed areas, provide wildlife travel corridors, and reduce seepage impacts to neighboring property. Manage buffers to control invasive non-native vegetation.

Wading Bird Foraging Conditions. Maintain water depths in STAs between 6 and 14 inches (15 to 35 cm) for a minimum 90-day period from January through May. This may be partially accomplished by heterogeneous topography and/or water management. Maintaining shallow water conditions provides wading bird foraging opportunities during the nesting season (January through May). Maintaining wetted cells enhances phosphate removal, reduces pollutant remobilization, and reduces mercury methylation. Methylmercury is toxic to wildlife, and high nutrient pulses can negatively impact downstream plant and animal communities.

Biological Diversity

Long-hydroperiod Marsh. Maintain long-hydroperiod marsh cells that are inundated three to five years between dry-outs, to the maximum extent practicable. Long-hydroperiod marsh ecosystems support natural communities, resulting in a stable food web. Long-hydroperiod marsh ecosystems improve water treatment and can minimize maintenance.

Delayed Cell Dry-outs. In reservoir-assisted STAs, delay scheduled dry-outs until after May 15, or as late as possible, by holding water in reservoirs. Delayed dry-outs in cells containing water during the latter part of the dry season (January through May) increases survival of offspring (*e.g.*, apple snails and other aquatic organisms) during the following wet season. Delayed dry-outs can reduce maintenance costs associated with rehydration.

Recession Rates and Reversals. Manage reservoir and STA water levels to gradually recede, and minimize rapid reversals during the dry season (October through April), when possible. Slowing recession rates and minimizing reversals will concentrate wading bird prey in a manner similar to natural water recessions, protect low-lying nests from flooding, increase retention time, and increase water treatment efficiency. Optimally managing recession rates can be complicated by weather and competing water demands.

Water Quality

Passive Flow Technology. Use best available passive flow technology (baffles, distribution and collection canals, etc.), to evenly distribute inflows and aerate water at inflow and outflow points. Passive flow technologies that distribute and aerate inflows/outflows can benefit wildlife by increasing dissolved oxygen concentrations and reducing pockets of stagnation (Figure 10). They can also increase water treatment efficacy by reducing short-circuiting, distributing water evenly, improving hydrologic mixing, and increasing dissolved oxygen levels.

Avoid Reservoir/STA Dry-outs. Avoid dry-outs to increase treatment efficiency, impede mercury methylation, and prevent release of sequestered nutrients. Avoiding dry-outs also benefits wildlife by sustaining aquatic communities in STAs and reservoirs, protects aquatic resources from contaminant exposure, and protects and enhances downstream ecosystems.

Water Retention after Dry-outs. At facility start-up and after dry-outs, raise water levels in the reservoir and/or STA quickly to a depth greater than 14 inches (35 cm). Retain water levels until water quality is acceptable for discharge to the receiving water body pursuant to applicable federal and state regulations and legally binding documents. Water retention after dry-outs will reduce the release of methylmercury and high nutrient pulses, and improve water quality treatment efficiency.

Chemical Treatment. Avoid applying chemical treatments in STAs and reservoirs to achieve phosphorus and nitrogen reduction targets. Chemical treatments for pollutant reduction expose wildlife and their habitat to unknown risks. Chemical treatments for pollutants incur continuous operation costs which are avoided with natural treatment methods.

Iterative Process

Hydrologic Operating Plans. Develop and implement hydrologic operating plans to maintain water levels for desired plant communities. Hydrologic operating plans sustain vegetation for fish and wildlife survival and reproduction by planning for beneficial water management. Hydrologic operating plans enhance water treatment and storage functions. These plans should include iterative monitoring and adaptive assessment.

Coordinate STA operating issues with the SFWMD's STA Communication Team. Coordinated monitoring and communication between state and federal agencies can improve management for fish and wildlife benefits, and decrease time between operational adjustments.

Monitoring Plan. Design and implement a monitoring plan for water and sediment quality to trigger the adaptive management process. Include standards for operation contained in the project Hydrologic Operating Plan. Monitoring provides knowledge of fish and wildlife habitat, water and sediment quality, response to STA and reservoir operations, and early detection and resolution of potential problematic wildlife issues. Monitoring also allows assessment of water treatment and storage efficiency. Environmental permits issued to the SFWMD include compliance criteria which necessitate routine monitoring, reporting, and adaptive management responses.

Adaptive Assessment and Management. Develop and implement a facility monitoring plan with adaptive management. Include annual evaluation of compliance with targets for adaptive assessment. Adaptive assessment and management improves facility operations that benefit fish and wildlife, and improves facility operation for water treatment and storage functions. Environmental permits issued to SFWMD include compliance criteria which necessitate routine monitoring, reporting, and adaptive management responses.

Avian Protection Plan. Develop and implement an avian protection plan based, in part, on lessons learned from the management of existing projects. An avian protection plan supports avian diversity and listed species recovery, can assist in maintaining and enhancing avian populations, and improves operational flexibility by defining operation and management options concerning wildlife issues.

Public Use

Recreational Use. Provide compatible public recreational opportunities as identified in the CERP Master Recreation Plan. Compatible recreational use promotes public awareness of fish and wildlife conservation and provides multi-purpose facilities for public benefit. Recreational uses generate public support for STA and reservoir projects. Recreational uses must be compatible and not conflict with the primary function of the STA or reservoir.

Project Specific Recommendations

Planning for the BBCW Project has produced a current array of alternatives, some of which include STAs and/or reservoirs at a variety of possible locations. Alternatives that include STAs or reservoirs presently have these features sited primarily on existing or historic agricultural lands. However, the locations of these facilities may be adjusted due to real estate costs and availability. In addition to the general recommendations described above, the Service has the following specific recommendations for STAs and reservoirs in the BBCW Project area:

1. Strive to retain positioning of STAs and reservoirs on lands that are currently being used for agriculture or on lands that are heavily infested with non-native vegetation. The western half of the project area has large tracts of land that are dominated by invasive non-native vegetation—primarily Brazilian pepper (*Schinus terebinthifolius*). Positioning STAs on lands infested with non-natives would have the dual benefit of replacing non-natives with native vegetation and providing water quality benefits to improve downstream habitats.

2. If proposed locations for STAs and reservoirs currently support invasive species such as Brazilian pepper, Australian pine (*Casaurina equisetifolia*), shoebutton ardesia (*Ardisia elliptica*), Bishopwood (*Bischofia javanica*), Napier grass (*Pennisetum purpureum*), cattail (*Typha domingensis*), and paperbark tree (*Melaleuca leucadendron*), eradicate existing stands prior to construction of the feature. This will minimize the potential for survival of non-natives despite changes in hydrology resulting from operation of the STA or reservoir, and it will minimize reinvasion following construction. However, it may be necessary to provide periodic post project control to maintain the native composition of the vegetative community and prevent reestablishment of non-natives.

3. Because it is desirable to position STAs and reservoirs on existing or former agricultural lands, special attention should be paid to thoroughly evaluate these lands for contaminants (see procedures described above).

4. Use of fertilizers in the extensive agricultural lands upstream of the central and southern parts of the project area results in relatively high concentrations of nutrients in the water of major conveyance canals (particularly C-102 and C-103) from which water will be redirected into wetlands in the project area, hence the need for STAs. Data collected from the SFWMD monthly monitoring program (http://glades.sfwmd.gov/pls/dbhydro_pro_plsql/show_dbkey_info.main_page) indicates that phosphate loads are generally insignificant in comparison to nitrate nitrogen loads delivered to the bay in the project area, ostensibly from agricultural use of nitrogen-laden fertilizers and the propensity of the calcareous soils in the area to scavenge phosphate. A recent study has demonstrated a significant lowering of macroinvertebrate diversity indices, taxonomic densities, and sensitive species scores near the mouth of C-103 that has been attributed to elevated nitrate nitrogen levels (Graves et al., 2004). Accordingly, STAs should be sized and managed for appropriate removal of nitrate nitrogen according to methods developed by Kadlec (2003, 2005a, 2005b).

5. Avoid positioning project features on ecologically sensitive areas, such as in the Florida panther primary zone and higher quality wetland habitat. Figure 11 shows that the Florida panther primary zone occurs in the northwestern half of the Model Lands area. Presently, two alternatives (Yellow Book and Alternative E) position STAs within the Florida panther primary zone.

6. Consider installing screening or other preventative structures to stop movement into, and establishment of undesirable aquatic non-native fish species in, the reservoirs and/or STAs that could become refugia for their further spread. If management for certain non-native species is determined to be compatible with the operation of the facility (*i.e.*, recreational fishing) these species can be introduced and appropriate measures taken to prevent their escape.

Closing Comments

The above recommendations provide a number of fish and wildlife enhancement features and opportunities in the design and operation of STAs and reservoirs, should these management measures be incorporated in the BBCW project. Features that mimic natural ecological processes, functions, and habitat diversity would promote sustainable wetland communities, and may be compatible with primary design functions. The Service does not suggest all recommendations presented are applicable or practicable for all possible STA and reservoirs in the project area. However, during plan formulation, these recommendations should be considered in STA and reservoir design and operation when and if they are compatible with the primary design functions of the project. It is important that all operational plans be developed with the participation and review of all appropriate state and federal agencies and disciplines, including biologists.

In closing, we are committed to providing timely assistance to the Corps and the Project team to ensure the best possible outcome of the BBCW Project. This project has the potential to have wide-ranging effects on fish and wildlife resources, which includes direct and indirect effects of project features, such as STAs and reservoirs. We appreciate this opportunity to provide planning guidance to the Corps on the BBCW Project and look forward to continuing to provide technical support to the Corps during all phases of this important project. If you have any questions regarding this letter, please feel free to contact Patrick Pitts at 772-562-3909, extension 250.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

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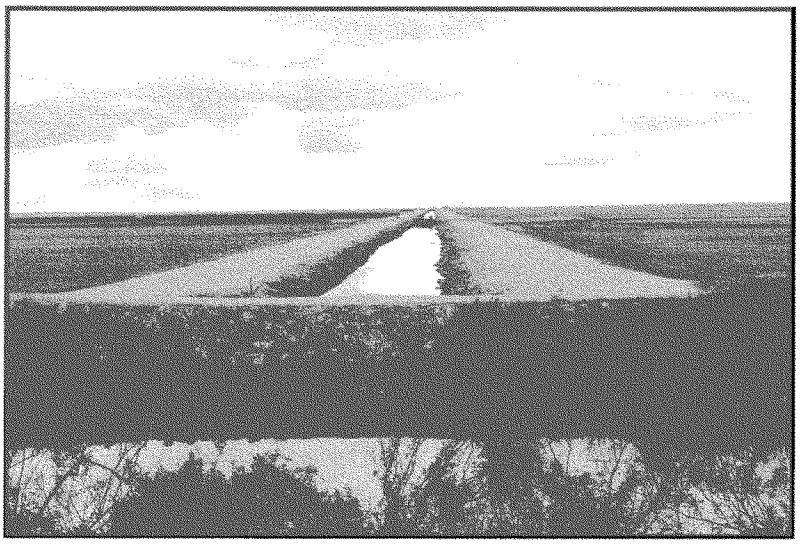

Figure 1. Pre-existing agricultural canal.

Figure 2. Heterogeneous topography preserved from pre-existing agricultural canal.

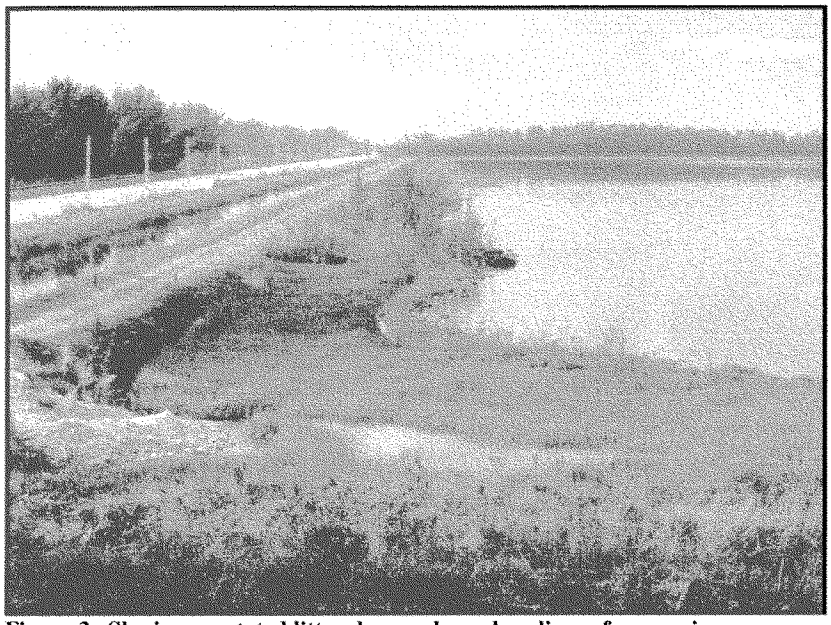

Figure 3. Sloping vegetated littoral zone along shorelines of reservoir.

Figure 4. Irregular shoreline that provides visual cover, increased habitat, and supports a variety of wildlife species.

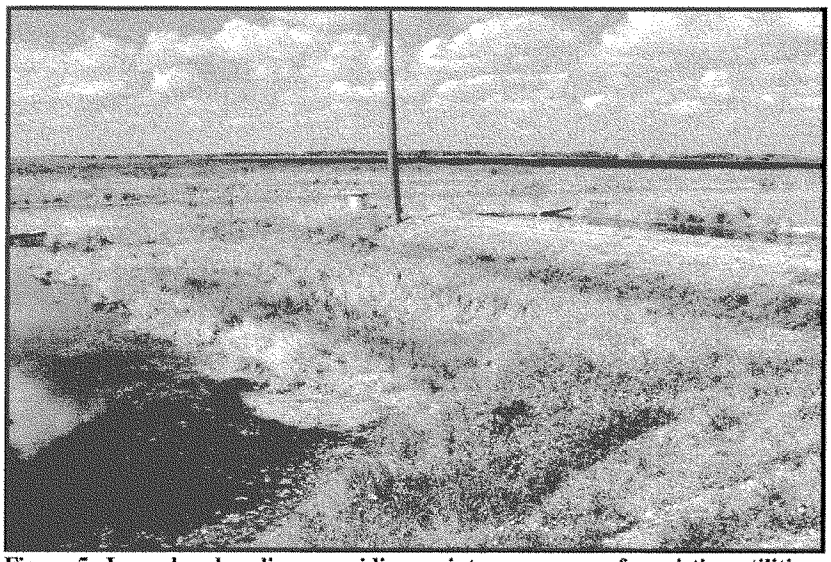

Figure 5. Irregular shorelines providing maintenance access for existing utilities.

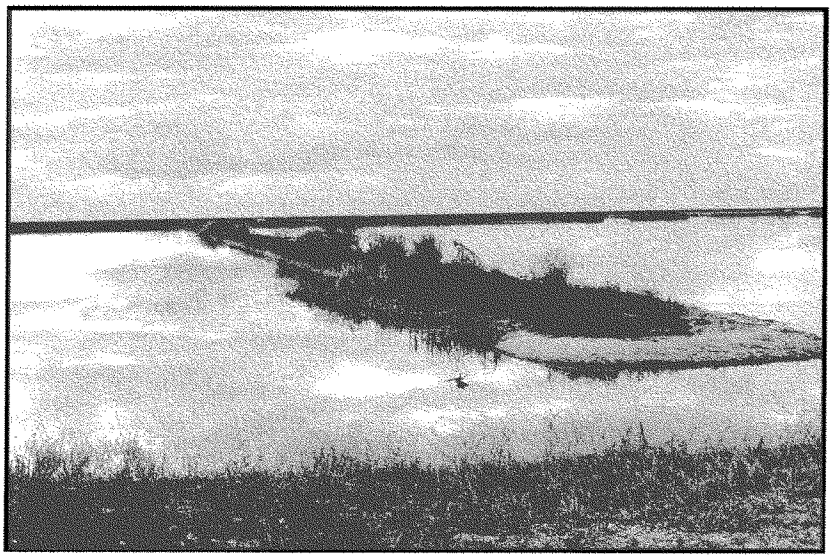

Figure 6. Low profile vegetated island created from existing levee feature.

Figure 7. Low profile vegetated island with native plants established and supporting wildlife activities such as loafing, feeding, and sheltering.

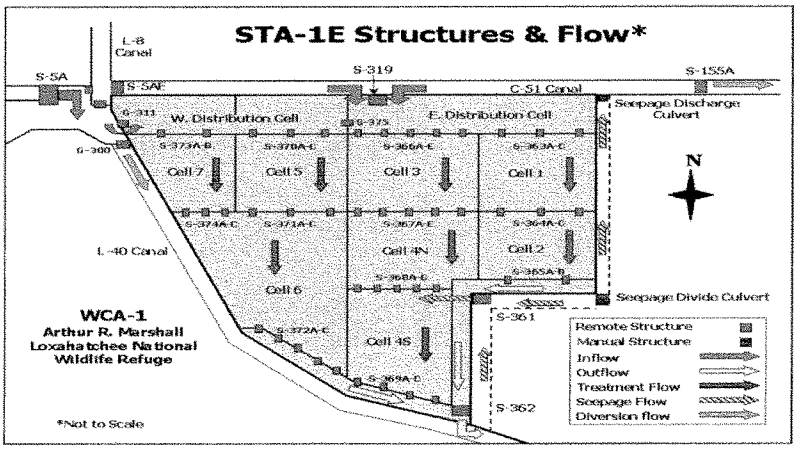

Figure 8. STA with multi-cell flowway.

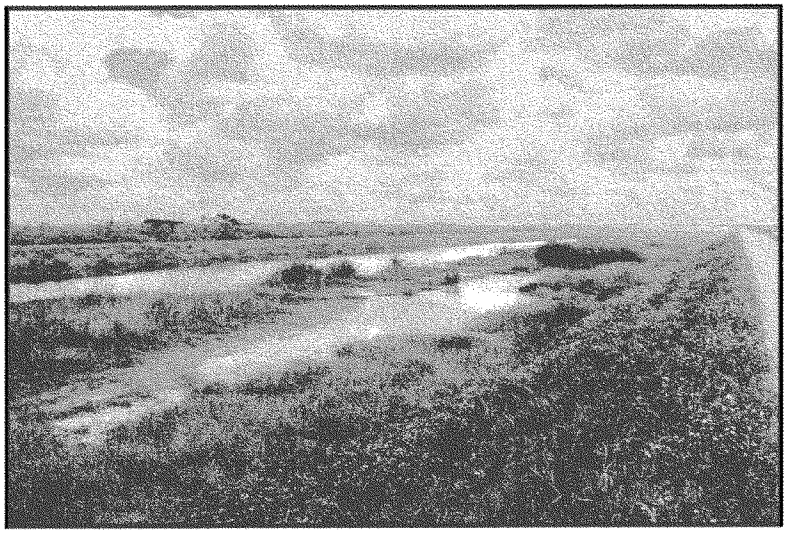

Figure 9. Vegetated buffer along canal and separating access road.

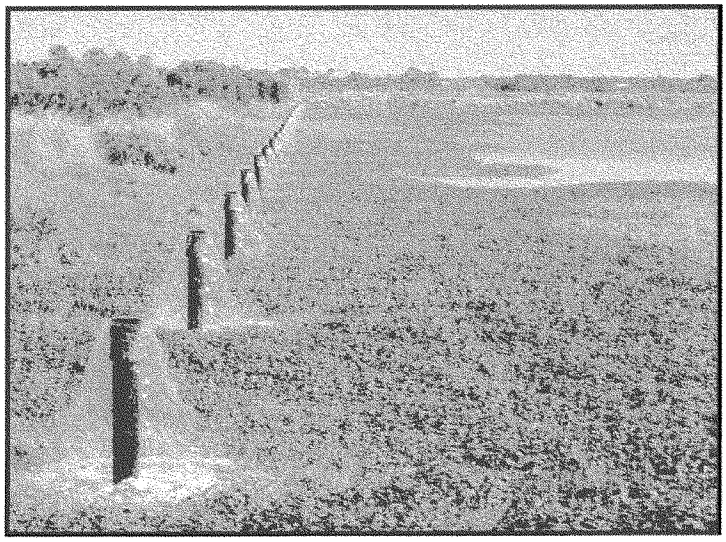

Figure 10. Even distribution of STA inflow with aeration.

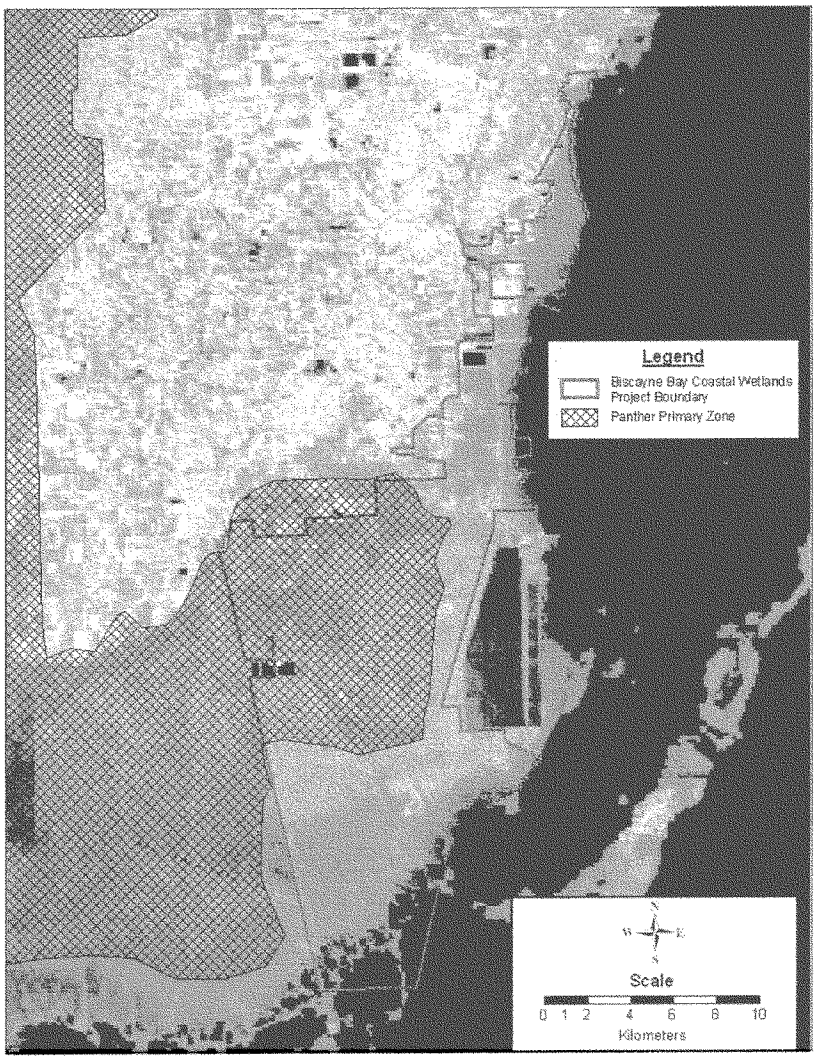

Figure 11. Florida panther primary zone in the Biscayne Bay Coastal Wetlands study area.

Appendix A

District Guidance in the Design of a Project-level Monitoring and Assessment Plan for Mercury, Pesticides and Other Toxicants

Guidance in the Design of a Project-level Monitoring and Assessment District Plan for Mercury, Pesticides and Other Toxicants

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INTRODUCTION

This document is intended to guide in the design of monitoring and assessment plans for mercury (Hg), pesticides, and other toxicants for South Florida Water Management District (District or SFWMD) projects. Because Hg is a regional problem in South Florida, it should be a consideration in all plans. As discussed below, although pesticides or other toxicants are often found dispersed in various media throughout South Florida (e.g., water, sediment, biota), concentrations do not frequently exceed critical levels that are thought to result in toxicity. Therefore, risk from exposure to pesticides or other toxicants tends to be a more localized concern than for mercury. More importantly in this context, the risk from changes related to the Comprehensive Everglades Restoration Plan (CERP) increasing the likelihood that wildlife will be exposed to these constituents, to a level that is toxic, also tends to be a localized concern. Accordingly, monitoring pesticides or other toxicants should be considered on a case-by-case basis.

It is not the intent of this plan to substitute for environmental site assessments (ESA) that are conducted on acquisition tracts. The District has an excellent record in conducting ESAs, site-specific environmental risk assessments (ERA), and implementation of corrective actions, where appropriate. This guidance has been prepared in consultation with and, where possible, will be implemented in coordination with the District's program for assessing the environmental liabilities associated with land transfer. However, the potential for anomalous methylmercury (MeHg) production is not considered during the ESA and thus must be assessed separately. With regard to other toxicants, the guidance provided here should prove useful in cases where either:

- an ESA identified dispersed low-level contamination of toxicants and there is a need to reduce uncertainties, i.e., better define spatial or vertical distribution,
- where lands were purchased by other public / private entities, but may not have been subjected to the same level of ESA as current transfers,
- there has been a lengthy interval between the time of assessment and start of construction (with interim usage by a lessee), or
- where pesticides or other toxicants have previously been identified as a concern on public lands (i.e., possibly as a result of stormwater runoff).

Results from the monitoring and assessment plan, in combination with information generated during land transfers, is intended to provide state and federal regulatory and trust oversight agencies with reasonable assurance that the project will not cause or contribute to an unacceptable increase in the risk of toxic effects to aquatic or terrestrial resources. As discussed below, the current numerical water quality standard (WQS) for total mercury (THg) is not protective of human or wildlife health. Consequently, assessments will need to place greater weight on protecting designated beneficial uses, i.e., recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. This will also be true for other toxicants that can be released suddenly from flooded soils and/or that have the potential to biomagnify. In

addition to numerical water quality standards, assessments will need to consider Line 62 of 62-302.530, Florida Administrative Code (F.A.C.), which states that substances in concentrations which injure, are chronically toxic to, or produce adverse physiological or behavioral response in humans, plants, or animals shall not be present. In addition to state requirements, federal legislation that may be pertinent include the Comprehensive Environmental Response, Compensation and Liability Act, the Endangered Species Act, and/or, the Migratory Bird Treaty Act.

This guidance uses a phased, multi-tiered approach that is intended to commit information gathering, assessment, and remedial resources in proportion to the likelihood of harm by following a logical and cost-effective procedure. The plan covers three phases of a project: (1) Baseline Collection and Assessment, (2) Monitoring during the Three-Year Stabilization Period, and (3) Routine Operational Monitoring (Post-Stabilization). The plan includes decision points and adaptive management recommendations if preconstruction or operational monitoring reveals conditions of immediate concern. If an identified threshold of concern (i.e., action level) is crossed, then Tier 2 expanded monitoring and risk assessment would be triggered to determine the cause and guide appropriate adaptive management decision making regarding short-term corrective actions and long-term operational optimization. The intent of this approach is to allow monitoring efforts to smoothly ramp down or up, as appropriate.

This general plan is intended to accommodate diverse projects by providing a framework that can be tailored to a project's specific design. For example, a monitoring and assessment plan for a wetland restoration project would likely differ substantially from a plan for a Stormwater Treatment Area (STA) or reservoir. While it is anticipated that this guidance will serve as a frame of reference for future permit-mandated monitoring, incorporation of all, some, or none of its elements into a permit is at the discretion of the responsible authorities.

Mercury

Although atmospheric loading is often the dominant proximate source of inorganic mercury to many water bodies, the complication lies in the relationship between influx of inorganic mercury and the amount that is methylated by sulfate-reducing bacteria (SRB) following deposition. The latter process is of fundamental concern because MeHg is the more toxic and bioaccumulative form that can build up in the food chain to levels harmful to humans and other fish-eating animals, particularly in ecosystems with complex, lengthy food chains. Accordingly, a monitoring and assessment plan must be able to detect increased amounts of MeHg in the project area or downstream waters, either through sedimentary release of THg or MeHg, or through increased net Hg methylation. Although there are some constraints in predicting outcomes, the following factors are thought to be associated with increased MeHg production, particularly when in combination with certain site conditions (i.e., sediment biogeochemistry that is, as yet, less well-defined):

Increased proportion of source water from direct rainfall relative to surface water runoff (explanatory note: rain contains elevated levels of bioavailable inorganic Hg, particularly during summer; whereas, surface water runoff has already lost Hg through evasion back to atmosphere, sorption and deposition, and biological uptake);

- Elevated levels of oxidized sulfur compounds (e.g., sulfate, etc.) in inflows or sediments (explanatory note: used as electron acceptor by SRBs);
- Drawdown – drying followed by rewetting (explanatory note: allows constituents in the sediments/soils to oxidize); or
- Large bioavailable carbon source (explanatory note: feeds SRBs).

The goal is to prevent these factors from combining to produce a mercury methylation hot spot both in the short term (known as the "first-flush effect") and the long term (known as the "reservoir effect"). For additional details, see evolving conceptual model presented in the Fink et al., 1999; Stober et al., 2001; Harris et al., 2003; Atkeson and Axelrad, 2004.

The Florida Department of Environmental Protection (FDEP) has recognized that the current Florida numerical water quality criterion of 12 nanograms of total mercury (THg) per liter (ng/L) in water is of limited use, because fish consumption advisories have proven necessary for waters meeting the state criterion (Atkeson and Parks, 2002). Likewise, the U.S. Environmental Protection Agency (USEPA), also recognizing the limited utility of its recommended water quality criterion for the protection of human health, recently published guidance on a new criterion expressed not as a water-column concentration of mercury, but as a concentration of mercury in fish tissue (0.3 milligrams per kilogram, or mg/kg in fish tissue; USEPA, 2001). Biomonitoring mercury provides several advantages. First, MeHg occurs at much greater concentrations in fish tissues relative to surrounding water, making chemical analysis more accurate, precise, and cost-effective. Second, organisms integrate exposure to MeHg over space and time, while corresponding water concentrations may vary by a factor of two or more over a period of hours. Finally, the tissue Hg concentration in fish is a true measure of its bioavailability and provides a much better indicator of possible exposure to fish-eating wildlife and humans than the concentration in water.

In anticipation of the state adopting a new WQS based on tissue concentration and because it is cost-effective, this generic plan has a biomonitoring program as a key component. The long-term goal is to reduce tissue Hg concentrations in predatory fish to levels that do not exceed USEPA guidance values for the protection of both human health and wildlife (for guidance values to protect wildlife, see USEPA, 1997). However, it should be recognized that the Everglades has a preexisting, widespread mercury problem (i.e., fish from most areas currently exceed one or more predatory protection criteria) and that many of the influential factors controlling MeHg production are beyond the scope of individual projects. Accordingly, use of USEPA's guidance criterion as a "risk-based" action levels is not appropriate in the short term. Instead, monitoring and assessment plans will track the status and trends of mercury bioaccumulation to ensure that it

does not significantly increase over baseline levels. This monitoring and assessment plan incorporates action levels or triggers for decision points based on existing reference or baseline conditions (i.e., annual basin-wide arithmetic average or percentile concentration for all basins pooled). For purposes of pooling related data, the basin will be operationally defined based on the physiography and land uses of the watershed, category of water body (e.g., wetland, slough, open lake, etc.), and the data set available at that time. Ideally, the data set would allow for comparisons between similar habitat or sediment types. However, near-term projects may not have this option and may need to collect reference samples (especially where data on similar sediment types are unavailable) or use surrogate data collected at Stormwater Treatment Areas or Water Conservation Areas under the Everglades Forever Act Permits for comparative purposes.

Pesticides and Other Toxicants

Potential impacts to wildlife from exposure to toxicants other than mercury (e.g., organic pesticides or trace metals) continues to be a problem. This is of particular concern in Florida because of its complex stormwater management system from both urban (e.g., lawns, golf courses, "street dust") and agriculture, high groundwater table, and significant usage of a wide variety of pesticides and fertilizers. Fertilizers (including organic and biosolids) are a concern because several studies have measured heavy metals (e.g., cadmium, lead, nickel, and copper) in mineral ores and the resulting fertilizers (USEPA, 1999). Like mercury, many other toxicants, including relic (e.g., DDT, DDE, toxaphene, etc.) and new (e.g., atrazine, alachlor) pesticides, have been found to be atmospherically deposited from both local and global sources (for details, see Eisenreich et al., 1981; Goolsby et al., 1993). Consequently, source identification can be challenging.

Owing to their absorptive capacity, soils and sediments typically act as a sink for these contaminants. As long as these soils/sediments maintain the capacity to store and thus immobilize the potential toxicant, the effects are significantly reduced. However, any alteration in the environment (e.g., flooding, anoxia and redox, microbial processes, pH changes) can suddenly reduce the sediment's storage capacity, which in turn can result in serious environmental damage (see "Chemical Time Bomb" concept in Stigliani et al., 1991).

Pesticides have been detected in sediments and surface water at District structures at various times (Miles and Pfeuffer, 1997; Pfeuffer and Matson, 2003; Pfeuffer and Rand, 2004). Likewise, pesticide residues have been found in fish and wildlife from certain locations in the central and southern Everglades (USGS National Water Quality Assessment Program at http://fl.water.usgs.gov/Abstracts/fs110_97_haag.html; Rumbold et al. 1996, Spalding et al. 1997, Rodgers 1997, Fernandez et al. 2003). Recently, a bird kill in excess of 800 birds occurred on Lake Apopka, possibly as a result of pesticide poisoning, after former farmlands were flooded (see Memorandum of Understanding between U.S. Department of Justice and

St. John's River Water Management District, available at http://sjr.state.fl.us/programs/acq_restoration/s_water/lapopka/MOU.html).

The monitoring and assessment plan for other toxicants often takes advantage of the mercury monitoring program, as in many cases, additional work simply involves splitting samples.

MONITORING AND ASSESSMENT FRAMEWORK

1. Phase 1 - Baseline Collection and Assessment

This section describes activities conducted during the initial stages of a project. In some cases, a Project Manager may opt to carry out these activities prior to site selection (i.e., on short-listed sites) to provide additional information to guide in the selection process. If site selection has already occurred, then a Project Manager may elect to carry out these tests to assist in selecting the final design (e.g., footprint or operational features). As previously stated, it is not the intent of this plan to substitute for ESAs that are conducted on acquisition tracts. Results of those assessments are routinely reviewed and receive necessary approvals from the FDEP and the U.S. Fish and Wildlife Service. Accordingly, where an ESA has recently been completed, baseline collection and assessment of toxicants other than Hg is not a general recommendation beyond the Phase 1 - Tier 1 task of compiling and reviewing existing data. Although these tests are a general recommendation for mercury, it should be understood that due to current limitations in predicting methylation potential, results of these tests should not be the sole factor in making site or design selection. Nonetheless, information gathered during this phase of the project will be crucial in developing the final monitoring plan and as baseline for future, post-construction cause-and-effect assessments.

1. 1 Phase 1 - Tier 1: Compilation and Review of Available Data

The first step in any project is to compile and review all available data (e.g., ESA, DBHYDRO, Battelle Monitoring Data Inventory) collected from the project footprint and surrounding area. With regard to other toxicants, data should be reviewed to answer the following questions:

- If land transfer, responsible agency and level of ESA preformed (i.e., Phase 1 or 2)?
- Did the ESA identify contaminants of concern?
- Were any corrective actions taken and was there follow-up sampling?
- Was there dispersed low-level contamination of toxicants (i.e., that did not exceed the requirements for corrective action)?

- Has there been a lengthy interval between the time of assessment and start of construction (with interim usage by a lessee) and, if so, what chemicals may have been used in the interim?
- If public lands, have toxicants been previously identified based on surface water, sediment or fish monitoring?

Answers to these questions will guide in developing an abbreviated analyte list for subsequent monitoring.

In areas that have been extensively studied, projects may have adequate baseline datasets and thus may not be required to collect any additional data before developing the Phase 2 monitoring and assessment plan. Alternatively, where datagaps exist or where the preponderance of the baseline data demonstrate a potential problem, additional sampling (i.e., under Phase 1 - Tier 2 or Tier 3) may be necessary.

1. 2. Phase 1 - Tier 2: Field Sampling

1. 2.a Soil/Sediment

To describe conditions within each project, it is recommended that soil/sediment cores be collected from five locations within each operable unit (i.e., OU - each independently operated treatment train of an STA or reservoir) or each 1,000-acre parcel, whichever is smaller. At each location or site, three cores from the 0-to-4 cm horizon are to be collected and composited as a single soil sample. To conserve resources at large projects, sub-samples or aliquots from each of the soil samples from the five different locations can be pooled to form a single supercomposite sample for each OU or 1,000 acres. In this two-staged sampling approach, the analyses of the supercomposite representing the entire OU or 1,000 acres can be used as a screening mechanism to identify if additional, individual analysis are need to be performed (on each of the individual soil/sediment samples). Accordingly, remaining material from each soil sample will be archived separately for up to one year to allow for possible future analysis.

If the site was flooded and sediments had been saturated for some period of time (i.e., in excess of a month) with water comparable to future source water, then sediments may be immediately analyzed for THg, MeHg, moisture content, total organic carbon (TOC), total sulfur (TS), and total iron (TFe). Alternatively, if soils were collected from a dry site (i.e., orange grove, range land, etc.), then baseline concentrations will not reflect future flooded conditions (i.e., potential for MeHg production or first flush). Accordingly, soil/sediment must first be incubated with source water (i.e., surface water containing ambient concentrations of sulfate and dissolved organic carbon mixed with rainwater containing bioavailable inorganic Hg) for a period to evaluate this potential for first flush and future MeHg production. This test (i.e., beaker-scale

microcosm test) will use fresh soils (i.e., the supercomposite from above) and ambient water from the anticipated inflows (i.e., appropriate mixture of surface water and rainfall, which have been subsampled for analysis for THg and MeHg), and will be run under static conditions, with frequent renewal. Upon completion of the test, sediments will be collected and analyzed for THg, MeHg, moisture content, TOC, TS, and TFe.

If deemed necessary, based on the discussion above, soil/sediment samples (wet or dry) could also be split and analyzed for toxicants of concern identified either through an ESA, available water quality (WQ) database or, if these were unavailable, previous land uses (both upstream and within the footprint). Although this course sampling would likely miss possible "hot spots" (e.g., fuel loading or pesticide mixing zones), which should have been detected during the ESA (when cores were collected from 5-acre subparcels and composited for randomly selected 50-acre parcels), this level of detail should be sufficient to characterize dispersed contaminants.

The objective of screening for toxicants is (1) to prevent direct toxicity, either acute or chronic, and (2) to prevent the biomagnification of toxicants from reaching unacceptable levels that would pose a threat to upper trophic level wildlife. To achieve the first objective, toxicants would be evaluated against effects-based, numerical sediment quality assessment guidelines (SQAGs for sediment dwelling organisms, MacDonald Environmental Sciences Ltd.; USGS, 2003). In cases where the effects-based SQAG did not assess the potential for adverse effects on aquatic organisms due to the resuspension of sediments or partitioning of contaminants into water (i.e., using elutriates or pore water), soils may be subjected to a synthetic precipitate leaching procedure (SPLP; USEPA Method 1312, also see Brannon et al., 1994) using ambient source water to elute the column and the resulting elutriate assessed based on Chapter 62-302, F.A.C. (and other references contained in Pfeuffer and Matson, 2003); exceedances would trigger
Tier 3 assessments. To achieve the second objective, bioaccumulative toxicants would also be evaluated against established bioaccumulative-based SQAGs, if available (MacDonald Environmental Sciences Ltd.; USGS, 2003).

A project would stop and reevaluate the ESA (if completed) and/or proceed to Phase 1 - Tier 3 bioaccumulation tests and dynamic modeling if:

- concentrations in sediments exceeded the appropriate SQAG,
- concentrations in sediments exceeded a value reported in the ESA or a level that was determined to be critical in a site-specific risk assessment, or
- the concentration in the elutriate exceeded a WQS in Chapter 62-302, F.A.C.

Although bioaccumulation-based SQAGs have been developed for a limited number of toxicants, there is no chemical-specific SQAG for mercury. Consequently, there is no screening-level benchmark sediment THg or MeHg concentration that can be used to confidently predict whether a site will become a "MeHg" hotspot. However, data collected over the last nine years by various

agencies working in the Everglades offer some limited capability as a reference (or baseline) to predict the potential for excessive MeHg production. Accordingly, as one of several potential tools for alternatives analysis, it is recommended that soil/sediment conditions of the site be assessed for MeHg production potential through comparisons with this reference database. If absolute concentrations of MeHg, or percent MeHg (i.e., percentage of THg that is in the MeHg form) in soils/sediment from an OU exceeds the 90% upper confidence interval for within basin sediments or, if not available, the 90th percentile concentration (or %MeHg) for all basins, then the potential exists for excessive MeHg production and, accordingly, it is recommended that the project proceed to Phase 1 - Tier 3.

As previously discussed, a great deal of uncertainty remains surrounding the use of soil/sediment concentrations as a predictive tool to forecast future MeHg potential. Accordingly, as discussed in the following section, it is recommended that resident fish also be collected to assess current MeHg production and bioaccumulation.

1. 2.b Fish Tissues

At a minimum, fish samples from multiple trophic levels should be collected upstream and downstream of each project. Specifically, a sample of at least 100 mosquitofish (*Gambusia spp.*) should be collected from each location and composited into a single sample for THg analysis. Additionally, individual sunfish [sample size (n) should be greater than or equal to 5; whole-body] should be collected from each location and analyzed for THg. Where habitat will support largemouth bass (*Micropterus salmiodes*) and there is a possibility of future recreational harvesting, bass should also be collected and individually analyzed for THg (n should be greater than or equal to 5; fillets). Becasue virtually all (> 85 percent) of the mercury in fish muscle tissues is in the methylated form (Grieb et al., 1990; Bloom, 1992; SFWMD, unpublished data), the analysis of fish tissue for THg, which is a more straightforward and less-costly procedure than for MeHg, can be interpreted as being equivalent to the analysis of MeHg.

To reduce variance (i.e., due to species related differences in diet, ontological shifts in diet, exposure duration) and improve spatial and temporal comparisons of tissue levels within trophic levels, collections should target bluegill (*Lepomis macrochirus*) ranging in size from 102 to 178 mm (i.e., 4-7 inches) and largemouth bass ranging in size from 280 to 330 mm (i.e., 11 to 13 inches); however, other lepomids (first priority being given to spotted sunfish, *L. punctatus*, due to similar trophic status) or sizes are to be collected if efforts fail to locate targeted fish. If neither sunfish nor bass are present, then consideration should be given to sampling other species.

In addition, if possible (i.e., if flooded), mosquitofish should also be collected randomly from multiple locations from each OU or 1,000 acres (total should exceed 100 mosquitofish) and physically composited to form a single mosquitofish sample representative of the entire OU.

Body burdens in upstream and downstream fish do not provide predictive capabilities for alternatives analysis; however, this data set will be a crucial baseline for trend analyses following initiation of flow-through operation. Alternatively, ambient fish from the interior or footprint do provide some predictive capabilities for alternatives analysis. If these mosquitofish demonstrate excessive levels of MeHg bioaccumulation that exceed the 90% upper confidence level of the basin-wide annual average (reference basin will be defined for each specific project) or the 90th percentile concentration for the period of record for all basins, then it is recommended that the project proceed to Phase 1 - Tier 3: Bioaccumulation Tests and Dynamic Modeling.

If deemed necessary, based on the discussion above, fish samples could also be split and analyzed for bioaccumulative toxicants identified either through an ESA, available WQ database or, if these were unavailable, previous land uses (both upstream and within the footprint). Although, it is recognized that under certain circumstances a taxa other than fish may be more appropriate biological sentinels depending on toxicant and risk assessment endpoint, this will require a thorough justification.

If levels of other toxicants in tissues exceed recognized background tissue concentrations (USGS National Water Quality Assessment Program, etc.) or benchmarks established in ecological risk assessments completed as part of the ESA, then the project would stop and reevaluate the ESA or proceed to Tier 3 Bioaccumulation Tests and Dynamic Modeling.

1. 3. Phase 1 - Tier 3: Bioaccumulation Tests and Dynamic Modeling

Tier 3 assessments during Phase 1 Baseline Collection and Assessment are triggered if one of the following action levels are exceeded:

- If absolute concentrations of MeHg, or average percent MeHg (i.e., percentage of THg that is in the MeHg form) in soils/sediments from an OU exceeds the 90% upper confidence level of within the basin average, or if not available, the 90th percentile concentration (or %MeHg) for all basins;
- If concentrations of other toxicants in soils/sediments exceeded benchmarks established in ecological risk assessments completed as part of the ESA, or exceeded an appropriate SQAG, or the concentrations in the elutriate exceeds Chapter 62-302, F.A.C.; or
- If ambient fish collected within the project boundary demonstrate excessive bioaccumulation that exceeds the critical tissue benchmark used to establish SQAGs or in site-specific risk assessments exceeds the 90% confidence level of within the basin average, or if not available, the 90th percentile concentration for all basins.

Before proceeding to full Tier 3 sampling or modeling, the following steps are recommended to better define spatial extent of problem (i.e., to focus future efforts and thus conserve resources).

Step 1. Run analytical chemistry on the five individual soil samples that comprise the supercomposite that exceeded the trigger.

Step 2. Resample mosquitofish at a finer scale (i.e., 1 sample per 200 acres) within the OU or 1,000 acres for which the Tier 1 composite sample exceeded the trigger.

1.3.a Bioaccumulation Tests

As previously discussed, uncertainties remain surrounding the use of soil/sediment concentrations as a predictive tool to forecast future MeHg potential. Depending on soil conditions (e.g., concentration of TOC, TS, or TFe) bulk concentrations could substantially overestimate the fraction of MeHg actually bioavailable to aquatic animals living on or in surficial soils and thus the short-term MeHg bioaccumulation potential.

To reduce this uncertainty, a standardized laboratory determination of MeHg bioaccumulation (ASTM 1688-00a, E1706-00e1, or equivalent; also see Ingersoll et al., 1998; Nuutinen and Kukkonen, 1998) may be carried out using soils collected from multiple locations within the footprint of the proposed component; supercomposite from above or individual composites (if area has been defined by sediment concentrations). Because most of the cost of this test is associated with the collection of soil/sediments, a Project Manager may opt to collect sufficient soil/sediments for this test during Tier 1 sampling.

The bioaccumulation test will use soils/sediments, ambient water from the anticipated inflows (i.e., appropriate mixture of surface water and rainfall, which have been subsampled for analysis for THg and MeHg) and will be run under static conditions with frequent renewal. Current standard protocols utilize infaunal invertebrates (e.g., *Lumbriculus variegatus*, a freshwater benthic worm) and are non-feeding exposures. Therefore, assessment of food chain transfers (biomagnification) require modeling (i.e., in this case to mosquitofish or sunfish) using biomagnification factors (BMFs) from the peer-reviewed literature, if basin-specific data are unavailable. A probabilistic bioenergetics-based food chain model may be used if a valid, applicable BMF cannot be obtained (e.g., Norstrom et al., 1976; Rodgers, 1994; Korhonen et al., 1995; Schultz et al., 1995).

If Tier 3 Bioaccumulation Tests and Modeling is triggered by toxicants other than Hg on a site that has recently undergone an ESA or ERA, then the Project Manager should reevaluate early model runs and rerun with additional data. Where an SQAG (either effects-based or bioaccumulation-based) has not been identified, or in cases where an exceeded SQAG is thought to be overly conservative, it is recommended that a standardized laboratory bioaccumulation test (ASTM 1688-00a, E1706-00e1, or equivalent; also see Ingersoll et al., 1998) be performed.

1.3.b Modeling

If Phase 1 - Tier 2 evaluations or Tier 3 bioaccumulation tests demonstrate the potential for excessive MeHg production and bioaccumulation over a substantial portion of the project footprint (hence, the need to define spatial extent, as discussed above), then it is recommended that the Everglades Mercury Cycling Model (E-MCM) or comparable model be used during alternatives analysis. Preferably, model output should be considered both in terms of site selection and operational design. However, due to the current limitations in the predictive strength of the E-MCM, results of the management scenarios simulated must be considered as possible, rather than probable outcomes (Harris et al., 2004), and should not be the sole factor in site selection.

Consultants under contract to the District's Land Acquisition Department have developed and routinely use several different models for evaluating biomagnification and ecological risk from exposure to other toxicants. If resulting risk estimates (either based on uptake or critical tissue concentrations) are deemed acceptable, the project would proceed and initiate Phase 2 - Tier 1 monitoring. On the other hand, if risk is deemed to be unacceptable, then the Project Manager would proceed to determine potential remedial actions/alternatives to reduce exposure and risk.

2. Phase 2 - Monitoring During Three-Year Stabilization Period

This section describes a general monitoring and assessment plan to be conducted on projects after initial flooding and through the first three years of operation.

2.1 Phase 2 - Tier 1: Routine Monitoring During Stabilization Period

2.1.a Water

At a minimum, an unfiltered surface water sample (n = 1) should be collected in accordance with Chapter 62-160, F.A.C., at the inflows and immediately upstream of the outflows of each project on a quarterly basis and analyzed for THg, MeHg, and if not included under routine WQ monitoring, sulfate. In addition, flow will be monitored at the inflow and outflow to allow for load estimation to and from the project (it should be recognized that quarterly sampling would allow for only rough estimation of loads).

This data set will provide crucial information regarding assessment measures, i.e., annual outflow loads of THg and MeHg should not be significantly greater than inflow loads, including atmospheric loading; load estimates should include confidence intervals that describe uncertainty in measures of flow and concentration (e.g., field and analytical precision) and resulting from

interpolation (note: assessment protocol to be negotiated with permitting authority). Failure to satisfy this assessment measure would trigger Tier 2 Expanded Monitoring and Risk Assessment.

Until a new criterion based on tissue concentrations is promulgated, monitoring THg in surface water will likely also be necessary to demonstrate compliance with Chapter 62-302, F.A.C. (i.e., WQS of 12 ng THg/L); however, this would trigger Tier 2 Expanded Monitoring and Risk Assessment only if the loading assessment measure was also exceeded.

It is recommended that other toxicants identified during Phase 1 - Tier 1 data review (i.e., based on ESA, DBHYDRO, Battelle Monitoring Data Inventory) be included on the analyte list for quarterly water-column sampling. Because of the concern for potential acute toxicity, the initial sample collection should occur prior to flow-through operation. Subsequent sampling would occur at the same frequency as mercury monitoring and be assessed using a similar performance measure, i.e., outflow load should not be significantly > inflow load (including atmospheric load). Because of differences in the anticipated time frames under which sedimentary release are thought to occur (i.e., relative to MeHg that may have time lag associated with changes in biogeochemistry and microbial methylation driven by water quality), monitoring for other toxicants would cease after one year, if action levels are not exceeded within that time. Exceedance of WQS in Ch.62-302 would trigger Tier 2 Expanded Monitoring and Risk Assessment.

2.1.b Soil / Sediment

Soil / sediments will not be collected under Phase 2 - Tier 1 monitoring.

2.1.c Fish Tissues

At a minimum, samples of fish from multiple trophic levels should be collected from each OU and from a single downstream site for each project. Specifically, within one month following initial flooding and quarterly thereafter, mosquitofish should be collected from multiple locations within each OU (to total at least 100 fish) and physically composited into one (spatially-averaged) sample and analyzed for THg (note, a single aliquot should be analyzed per composite). Mosquitofish were selected as a primary sentinel species because of their widespread occurrence in the Everglades, ability to invade newly flooded areas, and because of their relatively small home range and short life span. Mosquitofish are known to bioaccumulate MeHg as well as, other metals, such as lead, zinc, selenium and cadmium and organochlorine pesticides including but not limited to DDT, endosulfan, and toxaphene. These characteristics make the mosquitofish an excellent indicator of short-term, localized changes in a toxicant's bioavailablity.

On an annual basis, sunfish (n should be greater than or equal to 5) should be collected and individually analyzed (whole-fish) for THg. Sunfish were selected because of their widespread occurrence (especially bluegill) and because they are a preferred prey for a number of fish-eating species. Where habitat supports largemouth bass and there is a possibility of future recreational harvesting, bass should also be collected (n should be greater than or equal to 5) and individually analyzed (fillets) for THg. Largemouth bass can be used as an indicator of potential human exposure to mercury. To reduce variance (i.e., due to species differences in diet, ontological shifts in diet, exposure duration) and improve spatial and temporal comparisons of tissue levels within trophic levels, collections should target bluegill ranging in size from 102 to 178 mm (i.e., 4 to 7 inches) and largemouth bass ranging in size from 280 to 330 mm (i.e., 11 to 13 inches); however, other lepomids (due to similar trophic status, first priority being given to spotted sunfish) or sizes are to be collected if efforts fail to locate targeted fish.

Due to their relatively longer life spans and larger home ranges, sunfish and largemouth bass integrate their exposure over a larger spatial area and longer time frame. Accordingly, caution should be exercised when assessing levels in these fish in recently flooded (or intermittingly flooded) marshes. Under those circumstances, more weight should be placed on levels in mosquitofish which, as stated previously, integrate exposure over a shorter period of time.

If after one year of monitoring, sufficient data are collected to demonstrate that conditions within the different OUs are equivalent, collection of large-bodied fish can be reduced to one OU and one downstream site. Alternatively, if OUs are shown to differ in terms of average concentration in mosquitofish, project managers may elect to sample large-bodied fish from the OU with the highest observed concentration and assess results as "worst case". However, in either case, mosquitofish collections would continue from all OUs.

This data will then be used to evaluate the following assessment measure: annual average THg levels in fishes should not increase progressively over time or become elevated to the point of exceeding the 90% upper confidence level of the annual basin-wide average, or if basin-specific data are lacking, exceeding the 90th percentile concentration for the period of record for all basins. Exceedance of any of these action levels would trigger Phase 2 - Tier 2 Expanded Monitoring and Risk Assessment.

It is recommended that bioaccumulative toxicants identified during the Phase 1 - Tier 1 data review (i.e., based on information contained in the ESA, available WQ database, or previous land uses) be included on the analyte list for fish tissues collected during the first year of the stabilization period, if analytical procedures exist. For toxicants other than mercury, more weight may need to be placed on whole-body residues in mosquitofish and sunfish (that will include organs that may preferentially accumulate other toxicants) to assess ecological risk than levels in fillets of largemouth bass. Furthermore, it should also be recognized that under certain circumstances taxa other than fish may be more appropriate biological sentinels depending on the toxicant and the risk assessment endpoint. For example, preliminary discussions have taken place regarding the possible use of the apple snail (*Pomacea paludosa*) to biomonitor potential

copper exposure to the endangered snail kite (*Rostrhamus sociabilis plumbeus*). However, a thorough justification will be required in any plan that targets species other than mosquitofish, sunfish, or bass.

Tissue levels of other toxicants should not increase significantly over time or become elevated to the point of exceeding the critical tissue benchmark used to establish SQAGs or in risk assessments, exceeding the 90% upper confidence level of the annual basin-wide average, or if not available, exceeding the 90th percentile concentration for all basins. Exceedance of these action levels would trigger Phase 2 - Tier 2 Expanded Monitoring and Risk Assessment.

2.2 Phase 2 - Tier 2: Expanded Monitoring and Risk Assessment

Phase 2 - Tier 2 is triggered if one of the following action levels is exceeded:

- If annual outflow loads of THg or MeHg are significantly greater than inflow loads (i.e., based on an uncertainty analysis of loading estimates);
- If a WQS (in Chapter 62-302, F.A.C.) for a toxicant other than mercury is exceeded;
- If annual average levels of a residue in a given fish species increases progressively over time (i.e., two or more years) ($p < 0.1$);
- If annual average Hg levels in a given fish species become elevated to the point of exceeding the 90% upper confidence level of the basin-wide average, or if basin-specific data are lacking, exceeding the 90th percentile concentration for the period of record for all basins; or
- If residue levels of other toxicants in fish become elevated to the point of exceeding the critical tissue benchmark used to establish SQAGs or developed in risk assessments.

The following steps will be taken if any action level in Phase 2 - Tier 2 is triggered:

Step 1: Resample media (e.g., water or fish) that triggered Tier 2.

If results of Step 1 (i.e., re-sampling of media that triggered Tier 2) demonstrate that the anomalous condition was an isolated event, the project will revert back and continue with Phase 2 - Tier 1 monitoring. Alternatively, if results of Step 1 reveal anomalous condition was not an isolated event, proceed to Step 2.

Step 2 involves expanding the monitoring program as follows:

- Increase frequency of mosquitofish collection from quarterly to monthly.
- If Tier 2 was triggered by excessive loading or exceedance of a WQS at common outflow, then begin sampling discharges at outflows of each OU or independent

treatment train to better define spatial extent of problem. If necessary (i.e., if loading uncertainty is high), increase frequency of surface water collection to monthly (reducing temporal interpolation), or as appropriate for hydraulic retention time (HRT).

- To further define spatial extent of problem, collect multiple mosquitofish composites from within the OU or treatment train exhibiting anomalous conditions.
- If Tier 2 was triggered by tissue levels in large-bodied fish, increase sample size of large-bodied fish to n = 20, i.e., 20 each of sunfish (collect various species and sizes) and/or bass (collect various sizes and extract otolith from bass for age determination).
- To evaluate possible trends in methylation rates in sediments (i.e., to determine if problem is improving or worsening), replicate sediment cores (0-4 cm) can be collected from the suspected methylation "hot spot" and reference locations within the component (for THg, MeHg, moisture content, TOC, TS, and TFe) over a given period of time (i.e., 2 to 4 months). At these same locations and times, collect pore water samples and analyze for THg, MeHg, and sulfides, or if no acceptable pore water protocol has been developed, acid-volatile sulfide (AVS) on solids.

Projects shown to have (spatially) large or multiple MeHg "hotspots" should consider use of the E-MCM or comparable model as an assessment tool (i.e., to synthesize results of expanded monitoring).

Step 2 will also include the notification of the permitting authority that anomalous conditions are continuing. The permitting authority and the permittee may then develop an adaptive management plan using the data generated from the expanded monitoring program. This plan will evaluate the potential risks from continued operation under existing conditions (i.e., through a risk assessment for appropriate ecological receptors). If risk under existing operational conditions is deemed acceptable, then project monitoring would continue under a modified Tier 2 scheme to monitor exposure. On the other hand, if risk under existing operational conditions is deemed unacceptable, then the adaptive management plan would then proceed to determine potential remedial actions
to (1) reduce exposure and risk (e.g., signage for human health concerns, reduce fish populations, reduce forage habitat suitability); if risk of acute toxicity - immediate drawdown of OU and reevaluation of ESA [Note that assessment of potential human health impacts and corrective actions (i.e., signage) will require the involvement of the Florida Department of Health]; and (2) affect mercury biogeochemistry to reduce net methylation (e.g., modify hydroperiod or stage, water quality).

In developing this adaptive management plan, the permitting authority may conduct a publicly noticed workshop to solicit comments from the permittee, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the National Park Service, the Florida Fish and Wildlife Conservation Commission, and other interested persons.

The next step would then be to carry out such remedial or corrective action. If the remedial or corrective action is demonstrated to be successful, then the project would revert back to Phase 2 - Tier 1 monitoring. Alternatively, if monitoring data indicate that the remedial action was unsuccessful in reducing fish tissue concentrations or downstream loading, the permitting authority and the permittee would then initiate a peer-reviewed, scientific assessment of the benefits and risks of the project.

3. Phase 3 - Routine Operational Monitoring (Post-Stabilization)

This section describes assessment measures, action levels and monitoring efforts for the project following the period of stabilization, i.e., during operation in years 4 through 9. Because of differences in the anticipated time frames under which sedimentary release and bioaccumulation are thought to occur, monitoring toxicants other than mercury in water or biological tissues is not a general recommendation past the first year of stabilization.

3.1 Phase 3 - Tier 1: Routine Operational Monitoring

If after the first three years of monitoring neither downstream loading nor residue levels in fishes exceed action levels, then (1) surface water sampling would be discontinued, (2) frequency of mosquitofish collection would be reduced to semiannually, and (3) frequency of large-bodied fish collection reduced to one collection event every three years.

Phase 2 - Tier 2 Monitoring and Risk Assessment during operation is triggered if one of the following action levels is exceeded:

- If annual average THg levels in mosquitofish progressively increased over time (i.e., two or more years) or become elevated to the point of exceeding the 90% upper confidence level of the basin-wide annual average or, if basin-specific data are lacking, exceed the 90th percentile concentration for the period of record for all basins; or
- If triennial monitoring of large-bodied fish (i.e., in years 6 and 9) reveals tissue Hg levels in fishes has statistically increased, progressively over time (i.e., two or more years) or has become elevated to the point of exceeding the 90% upper confidence level of the basin-wide annual average or, if basin-specific data are lacking, exceeded the 90th percentile concentration for the period of record for all basins.

On the other hand, if fishes collected under Phase 3 Operational Monitoring have not exceeded action levels by year 9, project-specific monitoring would be discontinued; future assessments would be based on regional monitoring under RECOVER. However, Project Managers are cautioned that action levels may be revised at a future date, owing to the likelihood that a tissue-based WQS will be adopted by the state within in next 9 to 10 years.

CONTRACTOR SELECTION CRITERIA

Given the inherent difficulties of ultra-trace monitoring, it is crucial that any contractor selected to carry out field collection has demonstrated prior performance or be trained by District staff and has a stringent quality assurance/quality control (QA/QC) program in place. Likewise, the analytical lab must also demonstrate prior performance in ultra-trace analysis, have a stringent QA/QC program (including inter-laboratory comparisons) and be capable of achieving desired method detection limits.

REPORTING REQUIREMENTS

The District shall submit an annual report to the permitting authority that summarizes the most recent data and compares them with the cumulative results from previous years. This report shall also evaluate assessment performance measures (i.e., action levels) outlined above.

CONTACTS

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Appendix B

Ecological Risk Assessment Guidance

Draft

Ecological Risk Assessment Guidance for Wetland Restoration on Agricultural Lands in South Florida

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

November 2001
(Revised 8/30/04)

I. Contaminant Issues

Construction and implementation of the Comprehensive Everglades Restoration Plan (CERP) will require thousands of acres of publicly owned land (State and Federal) for the purpose of maintaining hydrologic buffer areas and the operation of regional water storage and conveyance systems. Lands determined to be feasible for incorporation into CERP projects in south Florida are limited and expensive, as increasing demands for commercial and residential development compete with the need for viable and functioning Everglades wetlands and adjacent scrub and forested uplands. A large portion of these lands are presently, or were at some time, in active agricultural production. Historical management practices, especially those associated with row crop farming, typically involved the frequent application of organochlorine (OC) pesticides for insect control. Most of these pesticides are no longer registered for use in the U.S. due to environmental concerns. However, from the 1940s to the mid 1980s, frequent applications of DDT, chlordane, toxaphene, and other OCs were common in agricultural areas of south Florida, leaving significant residual concentrations of these toxic substances and their degradation by-products bound to and sequestered in the top soil. Conversion of these soils from a dry and frequently disturbed aerobic environment to inundated (perennially or intermittent) relatively undisturbed anaerobic sediments, supporting native submergent and emergent vegetation and periphyton, will likely promote the release of these residual pesticides (along with other common contaminants such as mercury, selenium, and copper) into surface waters. More recent agricultural practices employ a different suite of pesticides, including organophosphates, carbamates, and a variety of herbicides and fungicides. Although generally not as persistent as OCs, many of these modern pesticides are highly toxic to wildlife.

Many of these lands proposed for acquisition will support functioning water reservoirs (storm water treatment areas, Aquifer Storage and Recovery detention reservoirs, and storage reservoirs) designed to impound a wide range of water capacities and depths over long periods of time. Additionally, many of these reservoirs will cover large expanses of several thousand acres, establishing local and regional aquatic ecosystems as well as providing foraging habitat for waterfowl and other aquatic wildlife. Without appropriate risk management and attention to design alternatives, the subsequent release of these pesticides and trace metals into CERP wetlands, reservoirs, and conveyances will provide exposure pathways to the regional fish and wildlife communities in south Florida.

Although the need for this guidance was prompted by the CERP land acquisition program, its use is encouraged for wetland restoration projects under other programs such as the Service's Partners for Fish and Wildlife Program, the Natural Resources Conservation Service's Wetland Reserve Program, or other water management districts in Florida.

II. Phase I Environmental Site Assessment

The Phase I Environmental Site Assessment (Phase I) is performed in accordance with the American Society of Testing and Materials (ASTM) Standard Practice E1527-00, "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process." The purpose of the Phase I is to identify the presence or likely presence of any hazardous substance or petroleum product on the property. This includes conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substance or petroleum product into structures on the property or into the ground, groundwater, or surface water of the property. The Phase I should provide all available information on current and past land use, and consists of the following elements:

A. Site inspection

The site inspection usually consists of walking, driving and/or flying over the property to visually ascertain the presence of features or indicators of past land uses and possible environmental contaminants. A checklist of such indicators includes, but is not limited to, dumps, drums, construction debris, fills, unusual chemical odors, above ground and underground storage tanks, chemical storage buildings, asbestos evidence, "stressed" vegetation or bare ground, "sterile" water bodies, oiled roads, stained or discolored ground or stream banks, oil slicks, air strips, maintenance areas, pipelines, transformers or other electrical equipment, oil and gas drilling, and mining activities.

B. Historical considerations

The historical review should include interviews with owners, previous owners, and neighbors to obtain an accurate picture of past land uses, farming practices, pesticide usage, etc. Aerial photographs should be reviewed for evidence of row crops and other agricultural, commercial or industrial activities. At a minimum, the historical review should include reliable information on (1) farming practices (e.g., row crops, sugarcane, citrus, sod farm, ornamentals, grazing), (2) exact location of these practices on the property, and (3) farming chronology. For example, row cropping on a portion of the property during the period from the 1940s to the mid-1980s is strong suggestive evidence for the presence of OC pesticides at that location.

C. Review of environmental databases

An extensive review of environmental databases (Comprehensive Environmental Response, Compensation, and Liability Information System; Resource Conservation and Recovery Information System; National Priorities List; Emergency Response Notification System; state Above Ground and Underground Storage Tank records; Solid Waste Facility and Landfill Report; Florida State Hazardous Waste Site list; Facility Index System/Identification Initiative Program Summary Report; Formerly Used Defense Sites; and local mosquito control districts) should be conducted.

Information gleaned from the Phase I assessment is used to determine the necessity of a Phase II assessment.

III. Phase II Environmental Site Assessment

Should information gleaned from the Phase I or other credible sources (i.e., previous investigations) indicate the presence of contamination or that the potential for contamination exists, a Phase II Environmental Site Assessment (Phase II) should be initiated. Coordination between the Service and the agency performing the assessment is important starting at this point and throughout the rest of the process. Coordination will be facilitated by providing the Service with a Phase II Scope of Work (SOW) or proposal for review. The proposal should describe in detail the sampling plan (number, media, and location of samples), sample collection methods, analytical parameters, quality control/quality assurance (QA/QC) plan, standards and/or ecological screening criteria to be used for comparison, contingency for expanded sampling, and screening level risk assessment procedures, if applicable. The environmental laboratory to perform chemical analyses should be EPA certified, maintain a rigorous QA/QC program, and achieve laboratory detection limits consistent with state and federally approved ecological screening values and water/soil quality standards. More detail on sampling procedures and analytical requirements is provided in the following section. The selection of a credible laboratory is one of the highest priorities in the site assessment process.

The purpose of the Phase II is to identify sources and locations of contamination, specify contaminants of potential concern (both human health and ecological), and provide recommendations for additional sampling, testing, or risk assessment; and corresponding corrective actions. The focus of the Phase II is generally on facilities and potential point sources on the property, which includes:

1. Mixing/loading areas
2. Storage sheds
3. Vehicle turn-arounds
4. Airstrips
5. Cattle dip tanks
6. Pumping stations
7. Burn areas

In addition, limited sampling may be conducted in other areas, such as canals and agricultural fields, in order to identify contaminants that have a more widespread distribution or to establish background levels of contaminants. Media sampled may include soils, sediments, groundwater and occasionally surface water. The most commonly encountered types of contaminants at agricultural sites include pesticides, petroleum hydrocarbons, and various metals.

Chemical concentrations in the various sampled media should be compared with the appropriate ecological screening values to determine if remediation and/or additional sampling is required. Ecological screening values to be used include the following:

1. Soils and sediments: Florida Department of Environmental Protection (FDEP) Sediment Quality Assessment Guidelines (SQAGs)

2. Surface water: Florida Surface Water Quality Standards, or USEPA Ambient Water Quality Criteria for protection of aquatic life

Ecological screening values are discussed in more detail in the next section.

Generally, any point sources identified can be remediated based on the results of the Phase II, with some additional delineation work. If remediation of the point source(s) removes all ecological concerns (i.e., all contaminant concentrations are reduced below screening values), no further assessment work is required on the site. However, if the results of the Phase I and/or Phase II indicate that widespread contamination at levels of ecological concern may be present, then more extensive sampling in the agricultural fields may be required (see next section).

IV. Agricultural Field Sampling and Screening

Generally, contaminant information obtained during a standard Phase I/Phase II Environmental Site Assessment (Phase I/II) is not detailed or comprehensive enough to be suitable for use in an ecological risk assessment (ERA). The methods described in this section are designed to provide detailed information on the distribution and concentrations of contaminants of concern (COCs) identified in the Phase I/II, for use in the food chain model to predict risks to Fish and Wildlife Service trust resources. A major purpose of this section is to determine whether concentrations of contaminants in the farmed areas are uniformly distributed in the fields, or are present as "hotspots" that can be remediated. The method allows for sampling coverage of a large area while attempting to hold down analytical costs. If there is sufficient evidence to expect that pesticide contamination is likely at a site, it may be advantageous to conduct this sampling protocol concurrently with the Phase II assessment.

Sample site selection should be biased in order to maximize detection of agrochemicals in cultivated soils by sampling the entire cultivated area when possible. Random sampling on properties characterized by a mixed land use is not likely to provide the greatest degree of representation regarding contamination commonly associated with agricultural production (*i.e.*, insecticides, herbicides, fungicides, fertilizers, etc.). Prior to developing a sampling strategy, each property's land use should be reviewed in terms of spatial and temporal variables, placing the greatest sampling priority on those areas which were intensively managed for agricultural production (e.g., cultivated fields). Conversely, a lesser priority should be given to rangelands and abandoned or vacant lots which have limited or no historical agricultural land

uses. Some exceptions to this rationale would include commercial and industrial land uses which are sparsely distributed within the geographic areas currently under consideration for incorporation into CERP projects. In most cases, the use of random sampling is limited to those properties demonstrating homogeneous land use across the majority of the property.

A. Sample collection

Soil samples will be collected using a stainless steel spoon or hand auger from 0-6 inches below land surface. This interval represents the biologically relevant depth for interaction with surface water and biological receptors. It is important that care is taken not to include sample material from more than 6 inches deep, as this may result in dilution and underestimation of contaminant concentrations. Between samples, sampling equipment should be decontaminated using standard procedures to prevent cross-contamination between samples. (Decontamination between subsamples (see below) will not be necessary because subsamples will be mixed together to form a composite.) Immediately following collection, samples should be placed on ice and submitted as soon as possible to the laboratory for analysis.

Before being placed in the sample jar, all soil samples (discreets and composites) should be thoroughly homogenized until they appear completely uniform in texture and color. Analytical laboratories should be instructed that samples received from the field should be thoroughly homogenized again in the jar before an aliquot is removed for extraction.

B. Analytical parameters

If it has been determined during the Phase I/II that a property has a history of agricultural activity prior to 1985, then each soil analysis should include, at a minimum, organochlorine pesticides (EPA Method 8081), metals (including mercury and copper), and total organic carbon (TOC). If the history of the property or more recent uses suggest that other contaminants may be present, then the list of analytes should be expanded as appropriate. The best available detection limits should be requested of the analytical laboratory, but at a minimum, detection limits (practical quantitation limits) for each chemical should be as low as the corresponding screening value (see below). As a general rule, TOC analysis should be done for all soil and sediment samples. TOC is essential for food chain modeling and interpretation of individual sample results, bioassay results, etc.

C. Discreet sampling for small properties (<500 acres)

Discreet sampling will be required for agricultural areas less than 500 acres in size. Discreet sample sites should be established at regular intervals across the property, at a density of at least one sample per 10-20 acres. The actual sampling density will depend on the size of the property, analytical cost per sample, likelihood of contamination, and other factors, and will be specified in the proposed sampling plan and agreed to by consensus between the District and the Service. A minimum of 10 samples will be necessary for most properties. Some exceptions to this

minimum sample size will occur where parcels are small (<100 acres) or demonstrate a combination of land uses (i.e., residential "ranchettes", small scale livestock/garden/nursery properties, rock mining pits, etc.) where only a small percentage of the overall area was cultivated. Careful consideration should be given prior to using a sample size smaller than 10. As sample size decreases, statistical variation tends to increase, thereby increasing the size of confidence intervals used to determine the 95 percent UCL of the mean for any given analyte. Higher UCL values may increase the probability that samples will exceed ecological screening values, thereby necessitating expanded sampling, risk assessment, and subsequent clean up. Also, higher UCL values will generate correspondingly higher Hazard Quotients (HQ) in food chain modeling exercises associated with Ecological Risk Assessments (ERA).

Within this framework, actual sample location is at the discretion of the project manager. This agricultural field sampling is in addition to, and separate from, Phase II sampling that may be focusing on facilities with a high likelihood of contamination, such as pump stations, storage sheds, mixing/loading areas, airstrips, vehicle turn-arounds, cattle dip tanks, etc. The exact location of each sample should be recorded using GPS.

D. Composite sampling for large properties (>500 acres)

The large size of some of the properties being acquired (up to 20,000 acres) makes it difficult to characterize contaminant distribution and concentrations with confidence while staying within a reasonable cost. In order to address this problem, the following sampling strategy has been developed jointly by the Service and South Florida Water Management District (District).

Using aerial photographs, a 50-acre grid pattern will be established on each property or agricultural area greater than 500 acres in size. The grids should be located and confirmed in the field using GPS. Using a random number generator, specific 50-acre grids will be selected for sampling. The number of grids selected will depend on the size of the property. Obviously, the most desirable situation would be complete coverage of all present and former agricultural areas. For example, for a 1000-acre parcel, all 20 of the 50-acre grids would be sampled. For a very large property where complete coverage is not possible due to budget constraints, a pre-arranged fraction of the 50-acre grids should be selected. For example, a 5000-acre parcel would be divided into 100, 50-acre grids. Perhaps half (50) of these grids would then be randomly selected for sampling. The number of grids to be selected will be pre-determined for each site by consensus between the District and the Service, based on site-specific factors.

Each of the 50-acre areas will be subdivided into ten 5-acre plots. One soil sample will be collected from each of the 5-acre plots in the 50-acre grid. The location of each subsample should be exactly determined using GPS. The 10 subsamples are then composited into one sample and thoroughly mixed. This composite sample, representing the entire 50-acre grid, is then submitted to the laboratory for analysis and/or testing.

E. Ecological screening values

Ecological screening values are used to identify areas that may require further attention. The Florida Department of Environmental Protection's (FDEP) Sediment Quality Assessment Guidelines (SQAGs) for Florida Inland Waters (MacDonald et al. 2003) should be used as screening values whenever possible. The SQAGs were developed for assessing sediment quality in Florida waters, based on the probability of effects on aquatic organisms. For each contaminant there are two SQAGs: Threshold Effect Concentration (TEC) and Probable Effect Concentration (PEC). TECs were formulated to define concentrations of contaminants below which biological effects are not expected. PECs were developed to define ranges of concentrations above which biological effects are likely.

In most cases the TEC will serve as the initial screening value, especially when using the composite-random sampling design. Use of PECs as screening values may be justified under some circumstances for certain contaminants. For some contaminants, SQAGs have not yet been developed. The U.S. Environmental Protection Agency's Ecotox Thresholds (USEPA, 1996), the National Oceanic and Atmospheric Administration's ER-Ls and ER-Ms (Long and Morgan, 1990), or other ecologically-based guidelines should be used when SQAGs are not available. For some chemicals such as metals, information on natural background levels may have to be considered. Human health-based guidelines for cleanup of contaminated sites, such as FDEP's Soil Cleanup Target Levels, should not be used for this purpose.

F. Sites which exceed the PEC

Sediments with concentrations of contaminants above the PEC are considered to represent significant and immediate hazards to exposed organisms. If any of the 50-acre composite samples, described above, exceeds the PEC or other appropriate probable effect-level screening value, it will be necessary to return to that 50-acre grid and obtain individual samples from each of the ten 5-acre sub-areas, which together formed the original composite. These samples should be taken as close as possible to the original sample locations. These discreet samples should then be submitted to the laboratory for analysis. The purpose of this follow-up sampling is to determine the distribution of contaminants within the 50-acre grid; i.e, do the data indicate the presence of one or more "hotspots," or is the contaminant(s) more or less evenly distributed over the site. If only one or two of the individual (5-acre) samples are elevated, the District may choose to remediate these areas in order to reduce the contaminant levels of the 50-acre grid to below PEC. Conversely, follow-up sampling may indicate that most or all of the 50-acre grids contain elevated levels of contaminants. Remediation of widespread contamination over such a large area may not be practical. In such a case, further testing and completion of an ecological risk assessment (ERA) will be necessary in order to refine our understanding of the hazards to federal trust resources associated with contaminants on the site. These tests and assessments should include: (1) elutriate studies, (2) sediment bioassays, and (3) ERA with food chain modeling. In addition, if any of the contaminants have a tendency to accumulate in aquatic organisms or biomagnify in the food chain, such as organochlorine pesticides, PCBs,

PCDDs/PCDFs, and some metals, bioaccumulation studies are recommended. Specific tests and methods to be used are discussed in the following sections.

As stated above, follow-up sampling of discreet locations within a 50-acre grid is intended to determine the distribution of contaminants within the grid, and should not constitute an attempt to confirm or refute the original composite result. If widely disparate results are obtained upon follow-up (discreet) sampling compared with the original composite, this suggests that some error has occurred in sampling, homogenization, or laboratory analysis. In these cases, the original composite result will represent the 50-acre grid in question, barring some evidence to the contrary suggesting that the follow-up result is actually more representative of contaminant concentrations in the grid.

In order to avoid the above situation, it is strongly recommended that discreet samples collected in the field, following homogenization, be split into two jars. One sample jar will be used for producing the composite by mixing with the other samples representing a particular 50-acre grid; the other jar of each pair would be stored at 4 degrees centigrade for possible future analyses. If screening levels for any analytes of interest are exceeded in the composite sample analyses, then all 10 of the subsample aliquots used to make that sample will be reanalyzed for the observed compounds to identify more precisely the location of the observed contaminant(s). Of course, use of this methodolgy may be problematic for very large properties due to limited storage space.

G. Sites which exceed only the TEC

In general, a few scattered exceedances of a TEC by an individual contaminant at a site, when there are no PECs exceeded, is not considered to be a significant cause for concern. However, if enough samples exceed the TEC, such that the mean (estimated by the 95 percent upper confidence limit (UCL) of the mean) for the entire site (i.e., the mean of all discreet samples for a small site, or the mean of all 50-acre composites for a large site) is above the TEC, serious widespread ecological effects are possible. To evaluate this, the mean and the 95 percent UCL of the mean should be calculated for each contaminant of concern. In most cases, if the 95 percent UCL for all contaminants is below the TEC, no further action will be necessary. However, if the 95 percent UCL for any contaminant exceeds the TEC, then the additional testing and an ERA (as described above for PEC exceedances) will be necessary. These tests and assessments should include: (1) elutriate studies, (2) sediment bioassays, (3) ERA with food chain modeling, and (4) bioaccumulation studies for lipophilic contaminants. In addition, if TECs are exceeded by more than one contaminant in the same grid(s), further testing and studies will be necessary to address possible synergistic or additive effects of these co-contaminants. Bioassays will be useful in this case to identify potential toxicity from multiple contaminants that would not be predicted by using individual screening values. Specific tests and methods to be used are discussed in the following sections.

V. Desorption Studies

Contaminated soils inundated during the process of wetland restoration may release soil bound pollutants into the pore and surface waters. Soil or sediment characteristics governing pollutant desorption (e.g., total organic carbon, grain size, pH) will vary among locations. In addition, weathering or aging of some contaminants may alter their bioavailability from that predicted in the published literature. This necessitates site-specific desorption studies to accurately assess pollutant availability to aquatic organisms. Pollutant desorption is assessed on soils from the location using ASTM method E-1195-01, "Method for Determining a Sorption Constant (Koc) for an Organic Chemical in Soil and Sediments." This method simulates flooding of site soils and measures release of contaminants from the soil over time. Filtered pore water samples are collected and analyzed for COCs after 3, 7, 14, and 21 days contact time. These results are used to determine a site-specific organic carbon partitioning coefficient (Koc), an estimate of pollutant partitioning between sediments and water. This value can be used in food chain models for predicting aquatic and terrestrial organism exposure to pollutants.

Soils used in the desorption study should represent, as near as possible, the maximum detected concentration of the contaminant on the site, in order to ensure that measurable levels of the particular COC are released into the water. Bulk soil samples collected for this purpose must be thoroughly mixed. To ensure uniform contaminant concentrations, samples should be collected and analyzed from several locations within the bulk soil sample (e.g., top, middle, and bottom of the container). In order to be useful, the water analysis results must show evidence that steady-state concentrations have been reached within the 21-day duration of the test. Contaminant concentrations in water obtained during the desorption study may be compared with Florida Surface Water Quality Standards.

VI. Sediment Toxicity Testing

Toxicity testing with representative aquatic invertebrates and vertebrates allows prediction of soil bound pollutant toxicity to aquatic organisms if the location is converted to a wetland. For properties requiring an ecological risk assessment, the following sediment toxicity tests should be conducted:

1. Amphipod (*Hyalella azteca*) 10-day sediment bioassay (flow-through)
2. Midge (*Chironomus tentans*) 10-day sediment bioassay (flow-through)
3. Fathead minnow (*Pimephales promelas*) 7-day sediment bioassay (static renewal)

"Standard Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates (ASTM E-1706-95)," "Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates (USEPA/600-R-99/064)," and "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms (USEPA/600/4-91/002)" provide standard methods to assess soil-associated pollutant effects upon aquatic organisms.

Endpoints measured in these tests are survival and growth. Any statistically significant impacts upon these endpoints in any test are considered direct evidence of potential impairment of the prospective benthic/aquatic community in the restored wetland.

As with the other sediment studies, bulk soil samples collected for this purpose must be thoroughly mixed, and uniformity of contaminant concentrations should be confirmed by sampling from several locations within the bulk soil sample. Soils used in the sediment toxicity tests should represent, as near as possible, the maximum detected concentration of the contaminant on the site.

VII. Bioaccumulation Studies

Factors affecting pollutant accumulation by aquatic organisms can vary among locations. Accurate prediction of pollutant bioaccumulation at a location requires site-specific bioaccumulation studies, using species representative of those that may exist on the location once flooded. For properties requiring an ecological risk assessment, the following bioaccumulation studies should be conducted:

1. Oligochaete (*Lumbriculus variegatus*) 28-day bioaccumulation study
2. Fathead minnow (*Pimephales promelas*) 28-day bioaccumulation study

Methods described in "Great Lakes Dredged Material Testing and Evaluation Manual (USEPA and Army Corps of Engineers, 1998)" and "Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates (ASTM E-1688)" should be used to determine the bioaccumulation potential of soil-associated pollutants. These results are used to determine a site-specific octanol-water partitioning coefficient (Kow), an estimate of pollutant partitioning (bioconcentration) between water and the body fat of the exposed organism. This information is utilized in food chain models for estimating contaminant uptake from water and accumulation in various trophic levels.

Soils used in the bioaccumulation studies should represent, as near as possible, the maximum detected concentration of the contaminant on the site, in order to ensure that measurable levels of the particular COC are released into the water and taken up by the organisms. Bulk soil samples collected for this purpose must be thoroughly mixed. To ensure uniform contaminant concentrations, samples should be collected and analyzed from several locations within the bulk soil sample (e.g., top, middle, and bottom of the container). In order to be useful, the concentration of contaminant(s) in the test organisms must show evidence that steady-state conditions have been reached within the 28-day duration of the test.

VIII. Aquatic Food Chain Modeling

In the absence of direct measures of effects, it becomes necessary to estimate or predict potential pollutant effects upon the Service's trust resources and other organisms that may utilize the created wetland, reservoir, or STA. Testing that directly assesses soil bound pollutant toxicity to organisms, other than benthic invertebrates and fish, is relatively time consuming and costly. Food chain models allow prediction of effects on higher level organisms by combining data from the site-specific desorption and bioaccumulation studies with information on dietary composition, consumption rates, body weights, etc. and literature toxicity data.

The Service's trust resources include migratory birds and Federally listed threatened or endangered species. The bald eagle (*Haliaeetus leucocephalus*), white pelican (*Pelecanus erythrorhynchos*), snail kite (*Rostrhamus sociabilis*), osprey (*Pandion haliaetus*), clapper rail (*Rallus longirostris*), and wood stork (*Mycteria americana*) are federal trust species that should be considered as representative target organisms. Where bioaccumulating pollutants are present, a maximally exposed piscivorous bird must always be included. Generic fish species (omnivorous and higher level predatory fish) may be used as aquatic focal species. At a minimum, the food chain model should assess risk to the following groups (trophic levels) of target organisms:

1. Benthic invertebrates (detritivores)
2. Omnivorous fish
3. 1st order carnivorous fish (trophic level 3)
4. 2nd order carnivorous fish (trophic level 4)
5. Omnivorous bird
6. 1st order carnivorous bird
7. 2nd order carnivorous bird
8. Threatened and endangered species

The following potential routes of exposure should be included in the model:

1. Direct exposure to contaminated water/sediments
2. Sediment ingestion
3. Water ingestion
4. Food ingestion

The following transfer mechanisms and processes should be included:

1. Desorption from sediment to water
2. Bioconcentration from water
3. Bioaccumulation through ingestion of contaminated prey
4. Biomagnification with increasing trophic level

Once the target species' exposure to pollutants has been modeled, the potential risk to the species needs to be assessed by comparing the modeled exposure to a toxicity reference value (TRV). Perhaps the most relevant endpoints for assessing risk are effects upon (1) survival and (2) reproduction. In the absence of toxicity tests performed with the specific target species, TRVs for the pollutant(s) of interest must be obtained from the literature. Where possible, the ideal TRV will have been generated using a similar exposure route for a taxonomically related species. Uncertainties arising from the use of TRVs based on different exposure routes or unrelated species should be discussed in the risk assessment. In general, the most sensitive TRV should be utilized to assess risk to the target species.

Risk is expressed by calculating a hazard quotient (HQ), which is simply the ratio of the modeled exposure (numerator) and TRV (denominator). HQs above one indicate a potential for adverse effects to occur in a species under a given exposure scenario. The higher the HQ above one, the greater the risk that adverse effects will occur. HQs below one generally indicate that adverse effects are unlikely. HQs that are greatly different from one provide the greatest level of certainty in their interpretation.

IX. Final Report

Upon completion of all sampling, chemical analyses, laboratory studies, and food chain modeling, a draft Phase I/II Environmental Site Assessment and Ecological Risk Assessment report should be prepared which identifies all potential hazards to ecological receptors and provides recommendations for corrective actions and/or management of the project that will reduce the hazards to acceptable levels. The Service will review the draft report and provide concurrence or make recommendations for changes or additions. The final report will incorporate Service recommendations, providing an accurate and complete report which can be used as a planning tool to optimize wetland restoration efforts and minimize adverse affects to fish and wildlife resources.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
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December 6, 2005

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

Dear Colonel Carpenter:

The Service is pleased to provide the enclosed protocol titled "A General Approach for Documenting Endangered Species Act (ESA) Compliance in Project Implementation Reports (PIRs) for the Comprehensive Everglades Restoration Plan (CERP)".

The protocol provides guidance on how the Service and the Corps can proceed through PIR and operational plan development while meeting the requirements for consultation under Section 7 of the ESA.

If you have any questions regarding this protocol, please feel free to contact me or Barry Rosen at 772-562-3909.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

Enclosure

cc:
District, West Palm Beach, Florida (Carol Wehle)
DOI, Miami, Florida (Rock Salt)
DOI, Washington, DC (Don Jodrey)
Service, Atlanta (David Horning)
Service, Jacksonville, Florida (Miles Meyer

TAKE PRIDE IN AMERICA

Annex A3-200

A General Approach for
Documenting Endangered Species Act (ESA) Compliance
In Project Implementation Reports (PIRs) for the
Comprehensive Everglades Restoration Plan (CERP)

1. Background

a. Section 7(a)(1) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) (ESA) states that "Federal agencies shall, in consultation with and with the assistance of the Secretary (of Interior), utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species ..." Section 7 provides the framework and general process for Federal agencies to "consult" with the U.S. Fish and Wildlife Service or National Oceanic and Atmospheric Administration - National Marine Fisheries Service, (hereafter referred to as the Services), depending on the affected species, when a proposed activity may affect a listed species under their jurisdiction. Additional guidance for Section 7 consultation is provided in the ESA, the Services' joint implementing regulations at 50 CFR Part 402, (Interagency Cooperation), and the ESA Consultation Handbook.

b. The U.S. Army Corps or Engineers (Corps) Planning Guidance Notebook (ER 1105-2-100, Appendix C, pages C-8 through C-11) describes specific procedures for addressing ESA requirements for feasibility-level studies. The guidance, as described therein, generally calls for all informal and required formal consultation efforts to be completed by the time the study is completed and recommended for authorization in a report by the Chief of Engineers.

2. Discussion of the Issue

a. Since the overall purpose of the Comprehensive Everglades Restoration Plan (CERP) is to restore the Everglades ecosystem and species assemblages, CERP implementation is expected to provide large-scale, long-term benefits to the ecosystem and listed species, though individual actions may result in smaller-scale or short-term adverse effects to one or more listed species. In most cases where adverse effects to listed species are expected to result from habitat change (e.g., upland to wetland), formal consultation should be completed and the Services' biological opinion(s) issued at the Project Implementation Report (PIR) stage. However, for some CERP components, effects on listed species depends on how the project or component will be operated to modify hydrologic conditions (quantity, quality, timing and distribution) to achieve ecosystem restoration objectives. This protocol provides options for addressing those special circumstances.

b. For the majority of CERP components, more than one listed species will be affected. Scientific information is likely to be available during development of the PIR to support a "may affect, not likely to adversely affect" determination during informal consultation for some of these species. The PIR should include the Corps's "complete consultation initiation package," which may include the draft PIR and a Biological Assessment and the Services' concurrence

letter(s) for listed species that may be affected, but are not likely to be adversely affected, by the CERP project component.

c. For some CERP components, potential adverse effects to listed species will be assessed in the PIR phase, though potential effects may depend on how that component is operated, both as a stand-alone feature and as part of a complex network of interrelated features. There will generally be flexibility through continuous system performance monitoring and adaptive management to refine and adjust the quantity, timing, distribution, and quality of water to meet restoration objectives and conserve listed species. Formal consultation may be completed, even under circumstances where there is some uncertainty, with an understanding that implementation of a CERP component will proceed with a commitment to adaptive management, including a commitment to perform ecological performance monitoring, make adjustments to the operational plan over time, if necessary, and/or reinitiate formal consultation, as necessary, to minimize adverse effects to listed species. The Services will err on the side of the species when completing their biological opinion in these cases since monitoring and adaptive management will not prevent initial adverse effects from occurring.

d. In cases where additional operational plan detail is required to fully assess project effects to listed species, formal section 7 consultation may continue under the regulatory timeframes into post-PIR phases, but will be concluded prior to any irreversible or irretrievable commitment of resources. Though all CERP PIRs are required to include an initial operational plan, this protocol item addresses occasions when the level of detail in the operational plan at the project development stage, or the level of certainty with the potential effects from operational plan implementation to listed species, may make it difficult to complete formal section 7 consultation. The Services will err on the side of the species in preparing their biological opinion to assess potential adverse effects and incidental take that may occur prior to being detected by project monitoring and corrected by adaptive management processes. Early coordination and informal consultation during PIR development will help to identify any project operations that may be likely to jeopardize the continued existence of listed species and to develop alternative operations to avoid the risk of jeopardy to, as well as to minimize the risk of adverse effects and contribute to the recovery of listed species. In addition, ongoing monitoring will identify when reinitiation of formal consultation is needed in the future because initial potential effects analysis or operational uncertainties did not identify or evaluate subsequent adverse effects to listed species.

3. Proposed Approach/Protocol for ESA Documentation in PIRs

a. The ESA compliance objective for all CERP components will be to collect sufficient data and conduct sufficient analyses to complete ESA section 7 consultation during PIR development. The project team, including the Services, will strive to collect, compile, and analyze the best available scientific data necessary to develop the Corps "complete consultation initiation package," including a Biological Assessment, to meet that objective.

b. In some instances, it may be difficult to develop a "complete consultation initiation package," including a Biological Assessment for a CERP component, during preparation of the PIR to complete formal consultation for listed species that may be adversely affected by the

proposed project. This is particularly a concern for those components where operational aspects may significantly influence the effects and where significant additional detailed work is required to refine operational plans. In such cases, the Corps and Services have two options:

1) In accordance with 50 CFR Part 402, the Corps could submit a "complete consultation initiation package," including a Biological Assessment, and request that the Services complete formal consultation and provide a biological opinion within specified regulatory timeframes. The Services would then err on the side of the species in their biological opinion to assess potential adverse effects and incidental take that may occur prior to being detected by project monitoring and corrected by adaptive management processes, and issue a biological opinion which recognizes that implementation of the project may proceed within an adaptive management framework. This would involve a specified level of ecological performance monitoring and an understanding that the operating manual would be refined if the initial operations were not achieving the ecosystem restoration and listed species conservation objectives, and that, if necessary, formal consultation would be reinitiated.

2) On occasion, the Corps and Services could agree to complete ESA section 7 informal consultation during the PIR phase and complete formal consultation on Post-PIR activities. Under this scenario, the PIR would contain the following minimal level of ESA compliance documentation:

(i) The Corps and the Services would complete and document informal consultation for species which the proposed CERP component "may affect, but is not likely to adversely affect." Informal consultation should also identify species that the CERP component "may affect, and is likely to adversely affect" that require formal consultation during detailed design/operational plan refinement.

(ii) Informal consultation with the Services would identify key data requirements and analyses necessary to complete formal ESA section 7 consultation during post-PIR project activities. Initial operational plans should provide reasonable assurance that sufficient flexibility exists within the operational parameters for the proposed CERP component to identify and eliminate from consideration any alternative or "operational scenario" that may be likely to jeopardize the continued existence of listed species. The Corps will provide assurance that no irreversible, irretrievable commitment of resources per section 7(d) of the ESA will occur during post-PIR planning/design efforts with the following, or a similarly-worded, summary statement:

"At this point in the planning process, the Corps assures that no irreversible or irretrievable commitment of resources will occur prior to completion of formal consultation."

(iii) The PIR would contain the Services' response to the Corps' "complete consultation initiation package" including the Biological Assessment and associated discussions between the agencies that reflects the results of informal consultation as described above. If possible, the response should contain some reasonable assurance

that, subject to the completion of additional informal consultation and/or formal consultation as more information becomes available during post-PIR design and operational plan development, a "jeopardy" opinion is not likely. The following (or a similarly-worded) summary statement would provide sufficient assurance:

"Since the overall purpose of the CERP is to restore the Everglades ecosystem, and the accompanying fish and wildlife species, we anticipate that the CERP as a program, as well as each band of CERP components, will result in a net benefit to listed species system-wide. At this point in the planning process, we recognize this project contributes environmental benefits for listed species within the Everglades ecosystem. We will continue to work with the Corps and other Everglades restoration partners, within applicable regulatory timeframes, to complete formal consultation in the post-PIR planning phase prior to any ground disturbing activities. Our efforts may include contributions to develop detailed operation, monitoring, management, maintenance, and adaptive management plan components that contribute to the recovery of listed species and designated critical habitats (and avoid the risk of jeopardizing the continued existence of listed species or adversely modifying designated critical habitats)."

c. In those instances where ESA section 7 consultation cannot be concluded during the PIR phase, formal consultation addressing species which may be adversely affected would be initiated in conjunction with post-PIR design efforts. The timeframe for formal consultation will begin on the date the Services receive and acknowledge receipt of a "complete consultation initiation package" which may include the PIR and a Biological Assessment from the Corps. Pursuant to 50 CFR Part 402.14, if no extension of formal consultation is agreed upon, the Services will issue a biological opinion using the best scientific and commercial data available at that time. The Corps understands that the Services will err on the side of the species when completing their biological opinion in these cases, since monitoring and adaptive management will not prevent adverse effects from occurring. Formal consultation will be concluded prior to any ground disturbing activities and any irreversible or irretrievable commitment of resources for the project.

4. References.

a. Endangered Species Consultation Handbook, U.S. Fish and Wildlife Service and National Marine Fisheries Service, March 1998.

b. Endangered Species Act of 1973, as amended.

c. 50 CFR Part 402, Interagency Cooperation, Endangered Species Act of 1973, as amended.

d. USACE Planning Guidance Notebook, ER 1105-2-100, Appendix C, Environmental Evaluation and Compliance.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
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January 20, 2006

RECEIVED
30 Jan 2006
PD-E

Stuart Applebaum
Chief, Planning Division
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Post Office Box 4970
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Dear Mr. Applebaum:

The Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) for the U.S. Army Corps of Engineers (Corps) regarding the Biscayne Bay Coastal Wetlands (BBCW) Project, a component of the Comprehensive Everglades Restoration Plan (CERP). This PAL is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This letter does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA. This PAL provides guidance and transmits some of our concerns with this project.

Introduction

Planning for the BBCW Project includes the use of hydrologic and hydrodynamic models to evaluate and quantify performance measures. Virtually all of the current project's ecological performance measures require the use of one of these models for their evaluation and quantification. Thus, the evaluation and differentiation of project alternatives and the selection of the Tentatively Selected Plan (TSP) relies on reasonably accurate output from these models.

The hydrologic model selected for use by the Corps is a modified version of the WAterSHed Systems of 1-D Stream-River Networks, 2-D Overland Regimes, and 3-D Subsurface Media (WASH123D). This model utilizes input from the South Florida Water Management Model (SFWMM) as its western boundary condition as modeled under Alt7R5. The WASH123D model is a fully coupled ground-water/surface-water model. Output from the eastern boundary of the WASH123D model feeds directly into the TABS Multi-Dimensional Sediment (TABS-MDS) model, the hydrodynamic model that is used for the bay (i.e., the WASH123D output across its eastern boundary serves as western boundary conditions for the TABS-MDS model). This output from TABS-MDS will be compiled into performance measures for evaluating the primary BBCW objectives for Biscayne Bay estuarine restoration. Thus, reasonably accurate

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input from the WASH123D model to the TABS-MDS model is critical to obtain accurate output from the TABS-MDS model. Both models have been developed by the Corps' Engineer Research and Development Center (ERDC) at the Waterways Experiment Station in Vicksburg, Mississippi.

The Service believes that there are significant problems with the most recent version of the WASH123D model. While the accuracy of the model is difficult to assess due to a lack of documentation, the model appears to be unacceptable in its present form due to excessive ground-water flows, too much or too little water in certain basins, use of varying water budgets among alternatives, and other reasons. Because the WASH123D output provides the western boundary conditions for TABS-MDS model, the Service is uncomfortable using either model at this time to plan the BBCW project.

Interagency Modeling Center Reviews

The Interagency Modeling Center (IMC) reviewed the WASH123D BBCW calibration report submitted by ERDC in December 2004, and the IMC provided extensive comments as part of their review, including the need for additional validation steps before the model could be used to evaluate project alternatives. The IMC noted in its review that "some aspects of the conceptual model, model parameterization, model calibration, model validation and associated assumptions and decisions had not been documented in adequate detail." At that time, the IMC believed that there was need for improvement of the implementation, calibration, and validation of the WASH123D model for the BBCW project before the model could be used with confidence for project purposes.

In October 2005, the IMC was provided the opportunity to review the latest validation report of the model titled "Review of Validation of the WASH123D-BBCW Model; A Proposed Method to Address the Upstream Boundary Differences," prepared by ERDC and dated September 1, 2005. The IMC noted in their review of this latest validation report that the comments they provided on the previous (December 2004) calibration effort had not been addressed. They also stated that "the IMC does not consider the model to be calibrated, and no evidence has been provided that ERDC has improved on the previous calibration effort." The IMC's opinion is that the model parameters and model results carried over from the previous calibration step have compromised the usefulness of current model validation effort. The IMC further states that "the latest model results indicate that considerable additional effort is needed to identify the sources of error of the model predictions of canal flow rates." Finally, it is not apparent to the IMC from the materials provided that the existing model is calibrated and validated to the extent that its results could be used, without further effort, for purposes (*i.e.*, alternative evaluation) described in the Scope of Work (SOW) for this project.

Service Concerns

Over the past year the Corps has acknowledged problems with the WASH123D model and has attempted several procedures to try to rectify these problems. The Service acknowledges and appreciates the tremendous effort ERDC has given to try to correct problems with the WASH123D model to provide a tool that will be relied upon by the Project Delivery Team (PDT) to quantify benefits and differentiate between alternatives. However, the Service believes the latest WASH123D model output is not providing realistic or reasonable data, particularly in the C-100 and C-103 basins, and we have serious reservations that the model will be able to be used for its intended purpose. Specific examples of what the Service believes to be erroneous output from the latest model version include:

1. Historical data and SFWMM output (including the future with and without CERP) indicates that the C-103 Canal provides a relatively large fraction of water to the bay in the project area—on the order of 17 to 33 percent of the total surface flows for 1998-1999 (average rainfall conditions). WASH123D output indicates that percentage of total surface flows through C-103 Canal for existing conditions, future without CERP, and the Yellow Book alternative is 6, 1, and 0.01 percent, respectively.

2. The opposite appears to be true for the C-100 basin (*i.e.,* too much flow). Historical data and SFWMM future without CERP and future with CERP simulations indicate that the proportion of total project-area flows exiting the C-100 Canal is 4, 15, and 18 percent, respectively, for 1995-1996 (wet year). WASH123D output indicates the percentage of total surface flows through C-100 for existing conditions, future without CERP and the Yellow Book alternative is 19, 53, and 69 percent, respectively, for the same time period.

3. WASH output indicates that a very large percentage (~70 to 80 percent) of the total freshwater entering the bay arrives as ground water; whereas, a U.S. Geological Survey (USGS) regional ground-water model for Biscayne Bay indicates that the ground-water discharge rate along the entire western bay coastline is only about 6 percent of the measured surface-water discharge (Langevin 2001). Further, the USGS model suggests that nearly 100 percent of the fresh ground-water discharge is to the northern half of the bay, north of the C-100 Canal. South of C-100 Canal coastal lowlands prevent the water table from rising high enough to drive ground water to the bay. Almost all of the BBCW project area lies south of the C-100 Canal. Limited field data better support the USGS model simulations compared to the WASH123D output.

   It should be noted that what we believe to be erroneously large groundwater transfer from the eastern boundary of the WASH123D model to the western boundary of the TABS-MDS model is resulting in much lower salinity values than would seem reasonable in the nearshore bay waters (as simulated by TABS-MDS). This is producing unrealistically high performance of the salinity-based performance measures for virtually all alternatives, which is resulting in very low, if any, separation between alternatives.

4. The WASH123D existing condition run for the dry year (1999-2000) shows total combined flows through all structures that are more than three times larger than the WASH123D existing condition run for the wet year (1995-1996).

Because the modelers from ERDC have not submitted a calibration/validation report of the latest WASH123D version, it is difficult, if not impossible, to better assess the accuracy and precision of the model. During a meeting on December 15, 2005, ERDC personnel noted that a calibration/validation report will not be available for the latest model version until sometime in March 2006. En lieu of a full report, we recommend that ERDC submit a brief succinct calibration/validation report or, at the very least, provide calibration and validation data or other documentation that the Service and other agencies could examine as soon as possible. In particular, the Service believes the IMC should have the opportunity to review the calibration and validation information and model output from the latest WASH123D version. We believe that it is inappropriate to move forward with quantifying benefits and selecting a TSP without having the model reviewed and accepted as valid by the IMC. Presently, we are unaware of any agency involved with the project, other than the Corps, that is comfortable and confident with the WASH123D model.

The Service is also concerned that the model comparisons (Future without CERP condition and Future with all of CERP condition) used to formulate and evaluate alternatives potentially restricts the restoration benefits produced by the project. The Future with all of CERP condition reduces the quantity of beneficial flows to Biscayne Bay and could be considered a WRDA2000 Savings Clause violation. The Service is concerned that the potential benefits of BBCW are being limited to the amount of restoration that can be achieved given these reduced flows to Biscayne Bay. BBCW features should be formulated based on a more realistic set of flows to Biscayne Bay.

Closing Comments

We would like to reiterate that the WASH123D model version to be used to quantify performance measures and evaluate project alternatives for the BBCW appears to be flawed, and that it should not be used in its present state for plan formulation. We recommend that ERDC provide sufficient calibration and validation documentation to the IMC, the Service, and other interested agencies for review as soon as possible. We believe that moving forward with plan formulation using output from this model is unacceptable for the reasons stated above. We also believe that a more realistic characterization of flows to Biscayne Bay should be used to design the features of the project.

In closing, the Service is committed to providing timely assistance to the Corps and the PDT to ensure the best possible outcome of the BBCW Project. This project has the potential to have wide-ranging beneficial effects on fish and wildlife resources. However, the use of flawed tools, such as the WASH123D model, in plan formulation may result in less than optimum restoration in this area, or worse, it may actually cause further degradation of this valuable resource. We appreciate this opportunity to provide planning guidance to the Corps on the BBCW Project and

look forward to continuing to provide technical support to the Corps during all phases of this important project. If you have any questions regarding this letter, please feel free to contact Patrick Pitts at 772-562-3909, extension 250.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
Biscayne National Park, Homestead, Florida (Sarah Bellmund)
Corps, Jacksonville, Florida (Jeffery Couch, Brad Tarr, Martin Gonzalez, Bob Dunne, Mark Shaffer, Mitch Granat, Eddie Douglass)
DEP, West Palm Beach, Florida (Greg Graves)
ERDC, Vicksburg, Mississippi, (Chuck Tate, Earl Edris, Gary Brown)
Everglades National Park, Homestead, Florida (Ed Kearns)
FWC, Vero Beach, Florida (Dr. Joseph Walsh)
Miami-Dade County DERM, Miami, Florida (Dr. Susan Markley, Steve Blair)
NOAA Fisheries, Miami, Florida (Joan Browder)
Service, Jacksonville, Florida (Miles Meyer)
District, West Palm Beach, Florida (Matt Morrison, Rick Alleman)

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
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September 25, 2006

RECEIVED
2 Oct 2006

Stuart J. Appelbaum
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Appelbaum:

The Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) for the U.S. Army Corps of Engineers (Corps) regarding the Biscayne Bay Coastal Wetlands (BBCW) Project, a component of the Comprehensive Everglades Restoration Plan (CERP). This PAL is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This letter does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the Act. This PAL provides guidance and transmits some of our concerns with this project.

Introduction

Over the past few months, several issues have arisen regarding the planning of the BBCW Project with which the Service has concerns. Specifically, we are concerned with: (1) a 580-acre area within the project benefits footprint that we believe will not be restored as claimed in the benefits analysis given the current design of the preliminary Tentatively Selected Plan (Alternative O); (2) the preferential use of available water in the project area; (3) hydrologic modeling for the project; and (4) possible phasing of the project beyond the Acceler8 Phase 1 and full-project Phase 2 levels. The purpose of this PAL is to describe and document our concerns and provide recommendations, where appropriate, as to how some of the concerns can be alleviated.

Alternative O Concerns

Recently, the BBCW Project Delivery Team (PDT) formulated a project alternative known as Alternative O (for "optimized") that addresses all of the project's ecological objectives. It provides a reasonable degree of flexibility for operational adjustments and future adaptive management capability, and it provides a certain level of water quality treatment by using

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existing freshwater wetlands as polishing areas prior to being discharged to Biscayne Bay. A Cost Effective/Incremental Cost Analysis (CE/ICA) indicates that Alternative O is both cost effective and a best buy for all three project ecological zones, and it approaches the Yellow Book alternative for ecological benefits provided. The CE/ICA analysis also showed that Alternative O has the lowest average annual cost per unit of output for each of the project's three ecological zones. Presently, Alternative O is the National Ecosystem Restoration plan for the BBCW Project.

Colonel Robert M. Carpenter and other Corps upper level management at the Jacksonville office were presented with a description of Alternative O and the benefits analysis results during a meeting on May 15, 2006. During the meeting the Corps accepted Alternative O as the preliminary Tentatively Selected Plan for the project, but mandated that model runs be completed for the Next Added Increment (NAI) and Project Assurances prior to the Alternative Formulation Briefing.

The Service played an integral role in the formulation and evaluation of Alternative O and we view this alternative as a reasonable compromise between two earlier alternatives (Alternatives M and Q). However, we have some concerns regarding the effectiveness of Alternative O in restoring the freshwater wetlands area between C-102 and Military Canal east of L-31E (580 acres in size). According to the most recent version of Alternative O, the hydropattern in the freshwater wetlands in this area will be restored by simply redirecting water from C-102 into L-31E and raising the stages slightly in L-31E. Because this area is overlain with marl soils and up-gradient of L-31E, the Service is doubtful that the hydropattern in these wetlands will be improved significantly, if at all. Even if the groundwater is able to penetrate the marl layer and raise water levels above the land surface, the result may be a stagnant ponding of water in this area. Historically, water moved across the project landscape as sheet flow and we believe that to appropriately restore these wetlands, some level of surface flow will have to be re-established.

The Service recommends including in Alternative O a spreader feature between the Cutler Rock Pit and Military Canal as far west of L-31E as deemed practical. Figure 1 shows a possible placement of the spreader feature that should provide overland surface flow across the wetland area currently assumed to be restored in Alternative O. This spreader feature would be consistent with the spreader canals currently planned between Military Canal, C-103, North Canal, and Florida City Canal. Note that a short conveyance canal would be required to convey water from L-31E to the spreader along the southeastern edge of the Cutler Rock Pit. It is unclear if this conveyance feature could adequately convey water to the spreader feature without some type of pump. Perhaps a better design would be to convey water from C-102 to the spreader via a conveyance canal positioned along the west and southwest sides of the Cutler Rock Pit. This would require relocating the 500 cubic feet per second pump from its present position to the northwest corner of the rock pit. It would also require a longer conveyance feature, resulting in higher costs than the design shown in Figure 1.

We also recommend that this new spreader feature follow an appropriate topographic contour to facilitate surface flow across the wetlands. The north-south and east-west linear spreader features will undoubtedly cross perpendicularly or obliquely to the natural topographic contours, which is not optimal for restoration. If placement is not modified, the Service recommends that the Corps engineer these features to provide appropriate surface flows across the project landscape.

The Service is aware of the contamination found on some of the parcels acquired by the South Florida Water Management District (District) in this area, depicted in Figure 1 as diagonal red lines. However, these lands lie to the west of the wetlands currently targeted for restoration. Note that the proposed spreader has been placed along the eastern side of the contaminated lands. These parcels could then be isolated from hydration by some sort of seepage barrier. Alternately, the spreader feature could be located along Southwest 107th Avenue, which lies along the western edge of the contaminated parcels, and these lands could be included in the restoration footprint after remediation. It should be noted that it has come to our attention that some of the soils on the contaminated parcels have already been removed by development actions (Grossenbacker 2006), so remediation may not be costly for this area.

Priority Distribution of Available Water

As the Corps is well aware, the BBCW Project is in need of additional water to realize full restoration potential. The need to increase freshwater flows to improve ecological conditions in Biscayne Bay has been well documented. The Central and Southern Florida Project Comprehensive Review Study (Restudy) Final Integrated Feasibility Report and Programmatic Environmental Impact Statement (Corps 1999) and the Service's Final FWCA Report on the Restudy (Appendix B of Annex A [Service 1999]) described the need and justification for additional water for the bay. Subsequent documentation describing and addressing the need for additional water in this region can be found in section 601(g)(1) of the Water Resources Development Act of 2000, the December 2002 Preliminary Draft 905 (b) report for the Additional Water for Everglades National Park and Biscayne Bay (Additional Water Study), and the Project Management Plan (PMP) for the BBCW. The PMP states that the "PDT will establish the optimal water requirements and identify unmet requirements" for the project, and that "RECOVER will recommend potential supplemental water supply options to meet the unmet demands." A more detailed summary of this issue can be found in the Service's PAL dated October 23, 2003. To date, the PDT has identified the volume of water needed to restore the project area, which is significantly more than the existing condition or anticipated future flows. It is unclear how much water will be available for the project, but there is little doubt that supplemental water will be needed.

Although the need for additional water for the BBCW Project area has been well documented, the preferential use of available water in the BBCW Project area, if sufficient water for full restoration never becomes available, has not been addressed. The Service believes that if sufficient water is not available for full restoration, there are specific areas that should be given

priority over other areas; namely, the historic primary creek systems found within the project area as identified by Meeder and Harlem (2004). The following provides some background and justification for this recommendation.

Historically, freshwater flowed into lower Biscayne Bay through a series of small creeks (Meeder et al. 1999, 2000, 2001), which provided many benefits to fish and wildlife in this region. The numerous creek systems occurred all along the western shore providing freshwater to the bay across a relatively broad front. This resulted in a relatively stable mesohaline salinity regime along the western shore of the bay, providing habitat for many estuarine organisms, including spotted seatrout (*Cynoscion nebulosus*), red drum (*Sciaenops ocellatus*), common snook (*Centropomus unidecimalis*), pink shrimp (*Farfantepenaeus duorarum*), and various species of seagrasses such as widgeon grass (*Ruppia maritima*), shoal grass (*Halodule wrightii*), and turtle grass (*Thalassia testudinum*). The creeks themselves provided unique and important habitat for other flora and fauna. The creeks provided deep water refugia and low salinities required by the American crocodile (*Crocodylus acutus*). Salinity regimes near the mouths of creeks apparently provided the only suitable living conditions for the eastern oyster (*Crassostrea virginica*) in Biscayne Bay, as evidenced by relic oyster reefs found near the mouths of historic creeks by Meeder et al. (1999). These oyster reefs, in turn, provided habitat for a plethora of estuarine organisms.

Over the last century, anthropogenic changes to the hydrology in this region have disrupted the natural flow pattern described above. Currently, the water that formerly flowed through the major coastal creek systems is drained through large conveyance canals and discharged through water control structures. All five primary conveyance canals in the project area (C-100, C-1, C-102, Military Canal, and C-103) were constructed in the footprint of historic transverse glades and their associated major creeks. This channelization of the watershed has resulted in a disruption of the natural flow of freshwater across a broad front through the myriad of former creeks, significant reduction of ground water discharge to Biscayne Bay (Parker et al. 1955; Parker 1974), and severe salinity fluctuations at the mouths of the canals (Wang et al. 1988) that stresses and/or kills a variety of benthic flora and fauna (Montague and Ley 1993; Serafy et al 1997). The loss of seasonally stable mesohaline conditions along the western shore provided by creek flow is likely the major cause of the reduction in numbers of seatrout and snook, and the total absence of red drum in this area. Also, there are no longer live oyster reefs found in this region. Restoration of the coastal wetlands and the re-establishment of more natural salinity levels in the nearshore water of western Biscayne Bay depend on the redistribution of freshwater from the conveyance canals into a recreated system of the coastal creeks.

Meeder et al. (1999, 2000, 2001) have identified the locations of the historic creeks through analysis of historical photographs, satellite imagery, ground survey, and soil analyses. The creeks were classified according to source water and morphology. Major creeks drained surface water passing through the transverse glades of the coastal ridge, and were distinct from the more

numerous and shorter tidal creeks. These studies have identified a total of 48 creeks that drained the coastal wetlands between Shoal Point and Mowry Canal, including 21 major creeks that connected to the historic transverse glades.

More recently, Meeder and Harlem (2004) identified eight major coastal creek systems in the project area between Shoal and Turkey points, that they deem critical to the restoration of this area. The following criteria were used to select these critical creek systems: (1) suitable adjacent coastline geomorphology for re-establishment of a desired estuarine zone (*i.e.*, shoreline curvature or embayments that reduces immediate mixing of freshwater outflow with bay waters, thus aiding the establishment and maintenance of an estuarine zone); (2) was historically associated with a transverse glade; (3) extensive evidence of a still-functional creek bed; (4) presence of secondary ditches and other modifications to the creek system; and (5) presence of exotic vegetation. These eight creek systems are listed from north to south below (creeks numbers correspond with the numbering system appearing in Meeder et al. 1999). Figure 2 shows the locations of the mouths of these creeks along the western shoreline of the bay. The first three of the following systems are located in Region 1; the remaining five are located in Region 2.

1. Shoal Point (Creek numbers 47 and 48, creeks on Deering Estate)
2. Saga Bay Point (Creek number 42)
3. Black Point (Creek numbers 37 and 41)
4. Creek number 30 (only major creek between C1 and C-102)
5. Fender Point (Creek numbers 18 and 19)
6. Historic Creek Study Site (Creek numbers 11-13, located at point just north of Military Canal)
7. Creek number 6 (just south of Military Canal)
8. Convoy Point (major creek on north end of block defined by C-103 and North Canal, no creek number)

To reiterate, the Service believes that re-establishing appropriate flows into these creek systems to restore oyster reefs and nearshore estuarine habitat is the critical to the success of the BBCW Project. We recognize the fact that the major community components in this system (*i.e.*, freshwater wetlands, mangrove wetlands, and nearshore estuarine habitats) are closely linked, and to achieve full project success all of these components must be restored by reestablishing appropriate hydropatterns, flows, and salinity regimes. However, if the available water is not sufficient to restore all of the creek systems described above or other important community components such as some of the freshwater marsh areas, we believe that the eight primary creek systems described above should be given the highest priority for available water.

Continued Modeling Concerns

As noted above, during the May 15, 2006, meeting the Corps mandated that additional model runs be conducted for the NAI and Project Assurances prior to the Alternative Formulation Briefing. It is the Service's understanding this modeling will involve the use of the WAterSHed Systems of 1-D Stream-River Networks, 2-D Overland Regimes, and 3-D Subsurface Media (WASH123D) hydrologic model and the TABS Multi-Dimensional Sediment (TABS-MDS) hydrodynamic model for Biscayne Bay, both of which are models developed by the Corps. In a PAL dated January 20, 2006, the Service expressed concerns regarding the most recent version of the WASH123D model. In that letter, we noted that while the "accuracy of the model is difficult to assess due to a lack of documentation, the model appears to be unacceptable in its present form due to excessive ground-water flows, too much or too little water in certain basins, use of varying water budgets among alternatives, and other reasons." The PAL included specific examples of what we believe is erroneous output from the model. We also noted in the PAL that "because the WASH123D output provides the western boundary conditions for TABS-MDS model, the Service is uncomfortable using either model at this time to plan the BBCW Project."

During planning team meetings with the Corps' modelers over the past year, the possible source problems with the model output have been discussed. One source of error discussed is the CERP0 output from the South Florida Water Management Model (SFWMM) that is used as the western boundary condition for the WASH123D model. This boundary condition shows higher stages along the western boundary than current conditions, which may account for the large groundwater flux across the eastern boundary of the model as noted in the latest available WASH123D runs. Many of the PDT members believe that because the model was calibrated and validated using empirical data *(i.e.*, observed flows and stages), the model may provide more realistic output if the empirical data is used as the western boundary condition instead of the CERP0 boundary condition. The Corps has agreed to use the western boundary condition used in the calibration/validation model runs for the upcoming NAI runs. The Service believes this is a step in the right direction for obtaining useful model output, and we appreciate the Corps' willingness to conduct these runs. However, the Service continues to have concerns with the WASH123D model. The Corps' Engineering Research and Development Center (ERDA) submitted an updated calibration and validation report in March 2006, and we recently learned that the Interagency Modeling Centers (IMC) recently submitted their review of this report, but this review has not yet been made available. In a conversation with Mitch Granat (Corps modeling liaison) on July 7, 2006, we were informed that the IMC has some of the same earlier concerns about the model. The IMC is scheduled to meet with ERDC's modelers to discuss these concerns. The Service will review the IMC's concerns with this latest validation/calibration report as soon as they become available, and we look forward to being briefed on the outcome of the meeting between ERDC and the IMC.

Phasing of the Selected Plan

During the last BBCW team meeting, the Service learned that at the July 10, 2006, Quality Review Board (QRB) meeting there was considerable discussion regarding the practicality and utility of building the BBCW selected plan in phases at a level beyond the Acceler8 Phase 1 and full-scale Phase 2 levels. Specifically, the Corps and District are concerned that some features of the project, as currently described under Alternative O (the preliminary Tentatively Selected Plan), may not be needed unless or until the South Dade Waste Water Reuse Project (Reuse) comes on line. The specific features that the Corps and District believe may not be utilized without the availability of reuse water were not identified at that meeting. Presumably, these features include spreader canals and culverts for conveying and distributing reuse water during the dry season, and that these features may not be required during the dry season prior to the Reuse Project coming on line due to the current or anticipated future lack of freshwater available to the project during this season. The Corps and District noted at the QRB that upcoming modeling of the NAI should provide the information required to determine the levels and extent of additional phasing for the project.

The Service is concerned with the above line of reasoning for additional project phasing, mainly because we believe that all project features presently described in Alternative O will be utilized during the wet season using current and anticipated future water availability for the project. We believe the NAI analysis will support this view, but we believe the action agencies should consider the project feature needs for redirecting and distributing wet season flows, in addition to dry season requirements, when considering additional phasing levels for the BBCW Project.

Closing Comments

We would like to reiterate that Alternative O needs some refinement, most critical of which is the area between C-102 and Military Canal east of L-31E. We recommend adding a spreader feature in this area to properly restore the hydropattern and surface flows to those freshwater wetlands. Without this feature, we believe the restoration of these wetlands will not be realized. The Service also recommends that the primary creek systems in the project area be given priority for receiving available water. The Service views the restoration of these creeks systems as the lynchpin for restoring productive estuarine habitat along the western shore of central and southern Biscayne Bay. The Service applauds the Corps' willingness to include additional model runs that incorporate the western boundary conditions used in the calibration and validation runs for the NAI and Project Assurances analyses. We believe that these runs will provide a more realistic characterization of flows to Biscayne Bay that should be used to design and evaluate the features of the project instead of the runs that rely on CERP0 condition output from the SFWMM as the western boundary condition. Lastly, we believe that additional formal phasing of the project should not be necessary, given the need for features to redirect and distribute wet season flows to the wetlands and nearshore bay areas within the project footprint as presently described in Alternative O.

In closing, the Service is committed to providing timely assistance to the Corps and the PDT to ensure the best possible outcome of the BBCW Project. This project has the potential to have wide-ranging beneficial effects on fish and wildlife resources. We appreciate this opportunity to provide planning guidance to the Corps on the BBCW Project and look forward to continuing to provide technical support to the Corps during all phases of this important project. If you have any questions regarding this letter, please feel free to contact Patrick Pitts at 772-562-3909, extension 250.

Sincerely yours,

Paul Souza
Acting Field Supervisor
South Florida Ecological Services Office

cc:
Biscayne National Park, Homestead, Florida (Sarah Bellmund)
Corps, Jacksonville, Florida (Jeffery Couch, Brad Tarr, Martin Gonzalez, Mark Shaffer, Mitch Granat, Eddie Douglass)
DEP, West Palm Beach, Florida
ERDC, Vicksburg, Mississippi (Chuck Tate, Earl Edris, Gary Brown)
Everglades National Park, Homestead, Florida (Ed Kearns)
FWC, Vero Beach, Florida (Joseph Walsh)
Miami-Dade County DERM, Miami, Florida (Susan Markley, Steve Blair)
NOAA Fisheries, Miami, Florida (Joan Browder)
Service, Jacksonville, Florida (Miles Meyer)
District, West Palm Beach, Florida (Matt Morrison, Rick Alleman)

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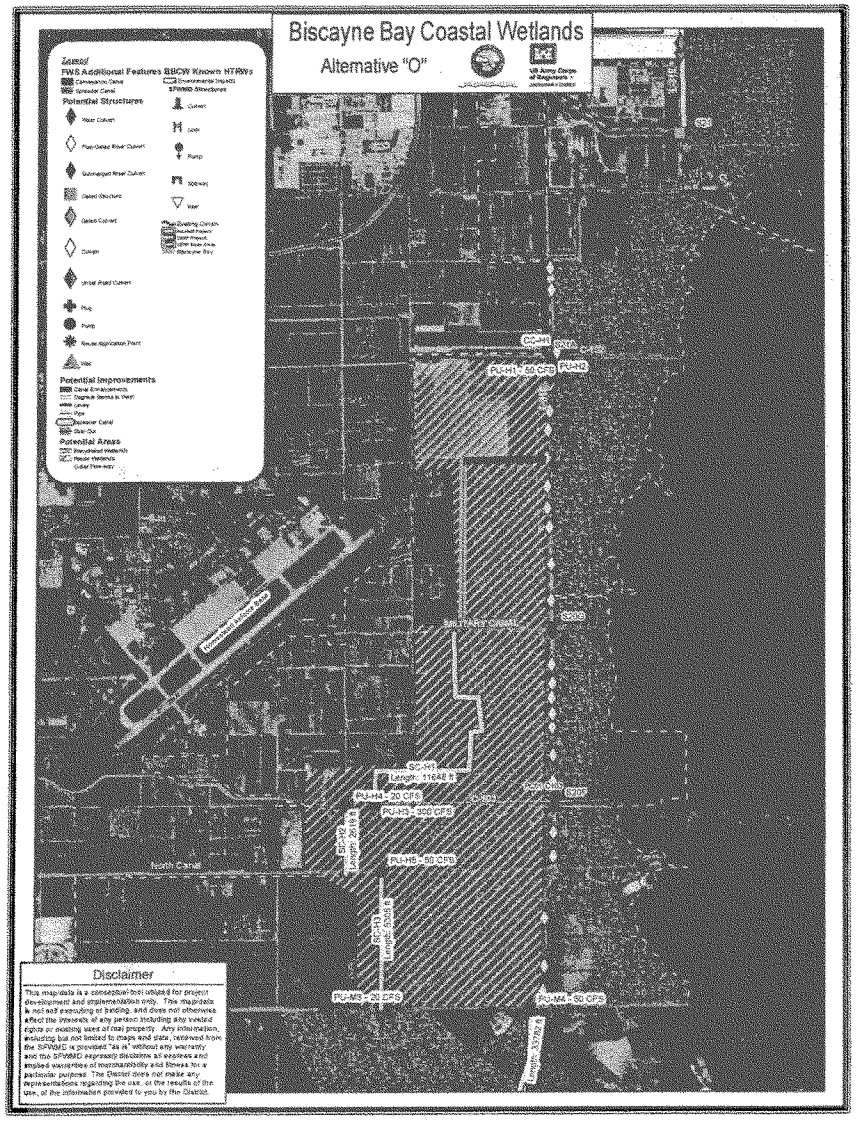

Figure 1. Map of Alternative O depicting the proposed spreader canal (green line) and accompanying conveyance canal (red line).

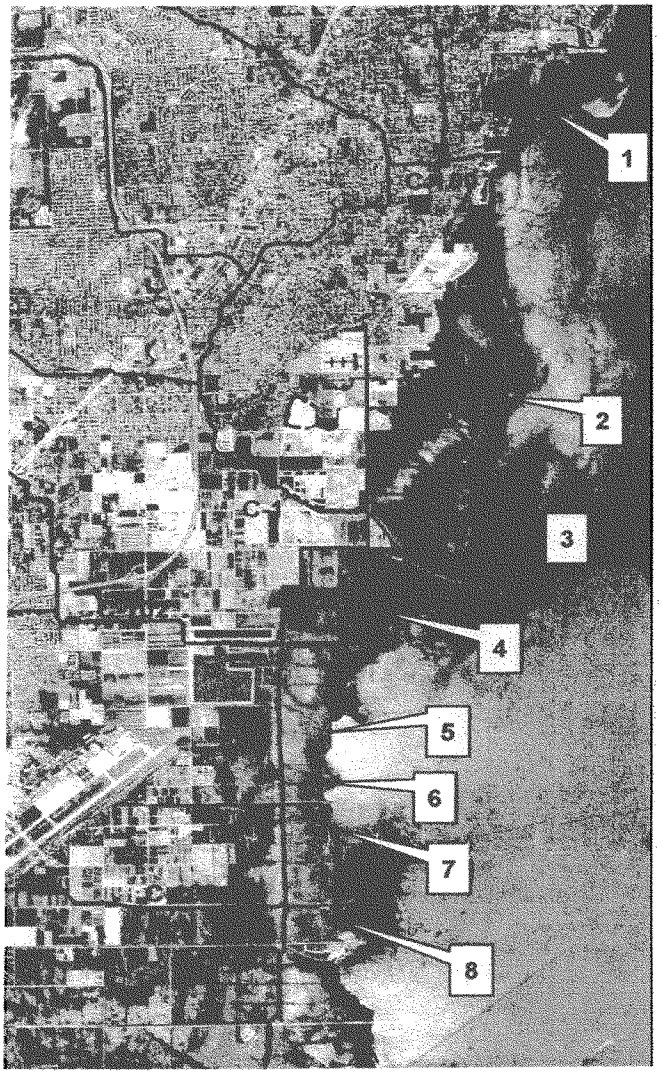

Figure 2. Map of BBCW Project area showing eight primary creek systems.

A.4 BIOLOGICAL ASSESSMENT

ENDANGERED SPECIES ACT
BIOLOGICAL ASSESSMENT

Biscayne Bay Coastal Wetlands Project–Phase 1

Prepared by
Department of the Army
Jacksonville District Corps of Engineers

October 2008

A.4.1 Executive Summary

The primary purpose of the Biscayne Bay Coastal Wetlands project is to redistribute freshwater runoff from the watershed away from the existing canal discharges and into the coastal wetlands adjoining Biscayne Bay to provide a more natural and historic overland flow through existing coastal wetlands. The proposed Biscayne Bay Coastal Wetlands Phase I project will include pumps, a spreader canal, canal staging, and several culvert structures to manage flows for optimal restoration opportunities to adjacent freshwater and saltwater wetlands.

Species and critical habitat identified during informal consultation as potentially affected by the proposed project include seventeen federally listed threatened or endangered species; along with designated critical habitat for the American crocodile, Everglade snail kite, West Indian manatee, Cape Sable seaside sparrow, Johnson's seagrass, elkhorn coral, and staghorn coral.

Based on this biological assessment, including the project commitments and conservation measures described herein, the U.S. Army Corps of Engineers, Jacksonville District has determined that the project "may affect, but is not likely to adversely affect" the American crocodile, American alligator, West Indian manatee, Florida panther, smalltooth sawfish, wood stork, Eastern indigo snake, the Schaus swallowtail butterfly, the green sea turtle, hawksbill sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, the loggerhead sea turtle, the Crenulated lead-plant, Garber's spurge, tiny polygala, deltoid spurge, and Small's milkpea.

Other federally threatened or endangered species that are known to exist or potentially exist within close proximity of the project area, but which would not likely be of concern in this study due to the lack of suitable habitat include, Everglades snail kite, Cape Sable seaside sparrow, roseate tern, beach jacquemontia, Johnson's seagrass, elkhorn coral, and staghorn coral. Potential impacts from project activities to state-listed endangered, threatened, or species of special concern would be minimal and temporary, and not likely to adversely affect any protected species.

Recognizing the possibility of reinitiating consultation, the U.S. Army Corps of Engineers would continue discussions with the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and the Florida Fish and Wildlife Conservation Commission in the event of project design or operational modifications.

Pursuant to Section 7 of the Endangered Species Act of 1973, as amended, the U.S. Army Corps of Engineers is requesting written concurrence from the U.S.

Fish and Wildlife Service and the National Oceanic and Atmospheric Administration Fisheries with the determination of this biological assessment.

A.4.2 Introduction

The purpose of a biological assessment is to evaluate the potential effects of a Federal action (project) on listed and proposed species, and designated and proposed critical habitat. The biological assessment will also determine whether the continued existence of any such species or habitat is likely to be adversely affected by the Federal action. The biological assessment is used in determining whether formal consultation or a conference is necessary [Federal Register 51 (106): Section 402.1 (f), pg. 19960, 3 June 1986] and will be achieved through the following steps:

A. The results of an on-site inspection of the area affected by the Federal action to determine if listed or proposed species are present or occur seasonally.
B. The views of recognized experts on the species at issue.
C. A review of the literature and other information.
D. An analysis of the effects of the Federal action on species and habitat including consideration of cumulative effects, and the results of any related studies.
E. An analysis of alternative actions considered by the Federal agency for the proposed action.

A.4.3 Consultation Summary

As part of the State's Expedited Construction program, the South Florida Water Management District submitted a Department of the Army permit application for the L-31 E Culvert and Deering Flow Way project components. A public notice describing the L-31 E Culvert component was circulated on February 5, 2007, and a public notice describing the Deering Flow Way component was circulated on February 20, 2007.

The U.S. Army Corps of Engineers consulted with the U.S. Fish and Wildlife Service by letters dated March 5, 2007 and August 8, 2007, on the potential effects that the proposed project State Expedited Construction components may have on federally listed threatened and endangered species that may be present in the project study area. The U.S. Fish and Wildlife Service concurred with the U.S. Army Corps of Engineers's "no effect" determination on the Everglade snail kite, Cape Sable seaside sparrow, roseate tern, and beach jacquemontia; and the "may affect, but not likely to adversely affect" determination of the American crocodile, West Indian manatee, Florida panther, wood stork, Eastern indigo snake, the Schaus swallowtail butterfly, the Crenulated lead-plant, Garber's spurge, tiny polygala, deltoid spurge, Small's milkpea, and five species of sea

turtles. The U.S. Army Corps of Engineers coordinated with the National Marine Fisheries Service, Protected Resource Division by letter dated March 5, 2007, for proposed impacts to sea turtles, Johnson's seagrass, the smalltooth sawfish, and the elkhorn and staghorn corals.

A.4.4 Project Description

A.4.4.1 Project Authority

The Biscayne Bay Coastal Wetlands project was formulated and authorized as part of the Central and Southern Florida (C&SF) project Comprehensive Review Study. The C&SF project Comprehensive Review Study, known as the Restudy, was authorized by §309 (1) of the Water Resources Development Act of 1992 (WRDA 1992) (Public Laws [PL] 102-580). This study was authorized by two resolutions of the Committee on Transportation and Infrastructure, United States House of Representatives, dated September 24, 1992. Further, §528 of the WRDA 1996 provided specific direction and guidance for the Restudy. The Comprehensive Everglades Restoration Plan (CERP) was authorized by Section 601 of the WRDA 2000 (PL 106-541), as a framework and guide for modifications to the C&SF project to restore the south Florida ecosystem and to provide for the other water-related needs of the region.

A.4.4.2 Description of Proposed Action

The Biscayne Bay Coastal Wetlands project is a component of the CERP, which was approved by Congress as part of the WRDA 2000 and signed by the President of the United States in December 1999. The CERP is based on the C&SF Project Comprehensive Review Final Study Integrated Feasibility Report and Programmatic Environmental Impact Statement (USACE 1999). The Biscayne Bay Coastal Wetlands project is one of 68 CERP projects. The Biscayne Bay Coastal Wetlands project as defined in the CERP is a multi-purpose project that provides for ecosystem restoration of freshwater wetlands, tidal wetlands, nearshore habitat and water quality enhancement.

The primary purpose of the Biscayne Bay Coastal Wetlands project is to redistribute freshwater runoff from the watershed away from the existing canal discharges and into the coastal wetlands adjoining Biscayne Bay to provide a more natural and historic overland flow through existing coastal wetlands. The Restudy identified a need to replace lost overland flow, rehydrate coastal wetlands and reduce point source freshwater discharges to Biscayne Bay using a system of pumps, and interconnections between coastal canals and operational changes to coastal structures.

The initial phase or Phase 1 of the proposed Biscayne Bay Coastal Wetlands project incorporates restoration components primarily intended to benefit

estuarine resources in three geographical regions that include the Deering Estate, the Cutler Flow Way, and the L-31E Culverts. This increment includes the installation/construction of pump stations, spreader swales, storm water treatment areas, flow ways, levees, culverts, and backfilling canals. The subsequent phase (Phase II), to be addressed in a separate document, will include the Barnes Sound Wetlands, remaining L-31 E Canal culverts, and the North Canal Flow Way.

A.4.4.3 Project Objectives

As outlined in the Project Management Plan (PMP), the objectives of the Biscayne Bay Coastal Wetlands project are to:

- Re-establish productive nursery habitat along the shoreline;
- Redistribute freshwater flow to minimize point source discharges to improve freshwater and estuarine habitat;
- Enhance and improve quantity, quality, timing and distribution of freshwater to the Bay, including Biscayne National Park;
- Preserve and restore spatial extent of natural coastal glades habitat;
- Reestablish connectivity between the Biscayne Bay Coastal Wetlands, C-111 Basin, Model Lands and adjacent basins; and
- Restore nearshore and tidal wetland salinity regimes

The goal of Alternative O Phase 1 of the Biscayne Bay Coastal Wetlands Project is to rehydrate coastal wetlands and reduce point source freshwater discharges into Biscayne Bay, by replacing lost overland flow and partially compensating for the reduction in groundwater seepage by redistributing, through a spreader system, available surface water entering the area from regional canals. The proposed redistribution of freshwater flow across a broad front is expected to restore or enhance tidal wetlands, and nearshore bay habitat.

Restoration of tidal wetlands and nearshore bay habitat is anticipated to be obtained through the re-establishment of sustained estuarine salinities, required in tidal wetlands, and the nearshore bay to provide nursery habitat for fish and shellfish. This project is expected to create conditions that would be conducive to the re-establishment of oysters and other components typical of an estuarine ecosystem. Diversion of canal discharges into coastal wetlands, as opposed to their direct discharge into the Biscayne Bay, is expected to re-establish productive nursery habitat all along the shoreline, and reduce the abrupt freshwater discharges that are physiologically stressful to fish and benthic invertebrates in the bay near canal outlets.

A.4.4.4 Project Location

The project area is located in southeast Miami-Dade County and covers approximately 11,000 acres, from the Deering Estate at the C-100 Canal in the north, south to the Florida Power and Light Turkey Point power plant, generally along L-31E (***Figure A4-1***). The project area to be impacted by Phase 1 Alternative O Phase 1 of the Biscayne Bay Coastal Wetlands project contains approximately 4,800 acres.

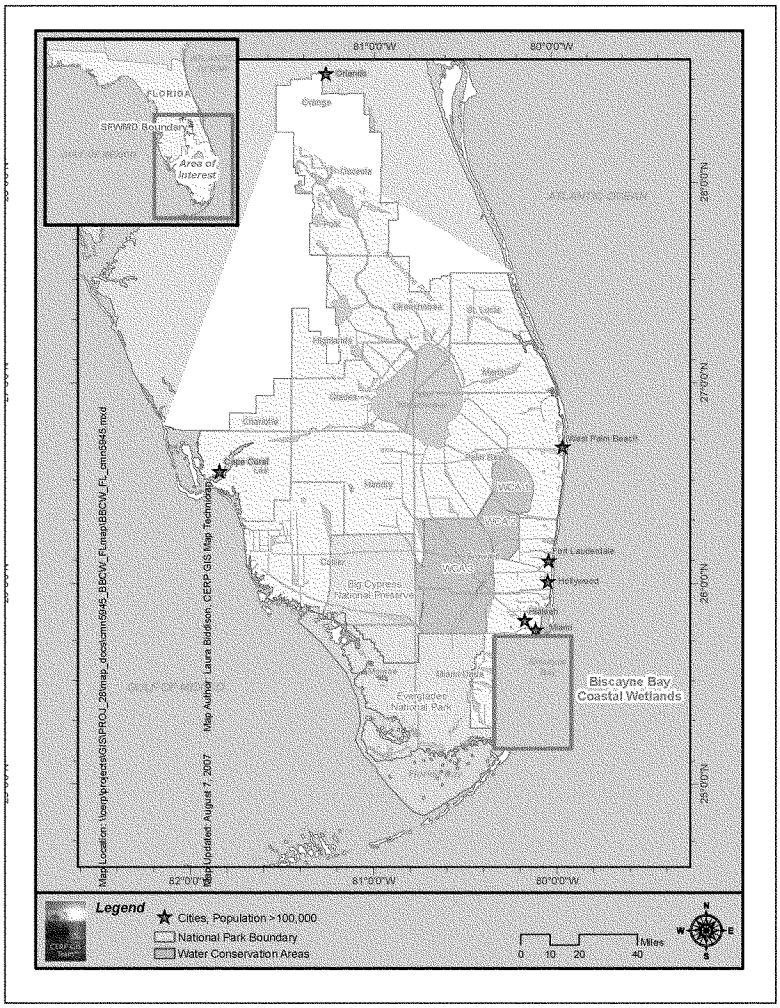

FIGURE A4-1: BISCAYNE BAY COASTAL WETLANDS LOCATION MAP

Deering Estate

The Deering Estate is located in southeastern Miami-Dade County within Section 26, Township 55S, Range 40E. The project is located entirely within the limits of the Deering Estate at Cutler, including the Deering Estate's Powers Addition Parcel. Features of this component include an extension of the C-100A Spur Canal, construction of a freshwater wetland on the Power's Addition Parcel, and delivery of freshwater under Old Cutler Road to the Cutler Drain and finally to coastal wetlands along Biscayne Bay.

The Spur Canal extension and freshwater wetland would run approximately 500 feet through the Power's Addition Parcel. The pump station required to move the water is located on the Power's Addition Parcel and has 100 cubic feet per second (cfs) total capacity. The pump would discharge to a surcharge chamber and then to the 60-inch diameter discharge pipe running under Old Cutler Road and to the outlet structure found on the east side of Old Cutler Road. No further structures are required downstream of the outlet structure as the Cutler Drain is found immediately east of the roadway.

Cutler Wetlands C-1 Flow Way

The Cutler Wetlands C-1 Flow Way is located in southeastern Miami-Dade County within Sections 14, 15, 16, 20, 21, 22, and 23, Township 56S, Range 40E. This component consists of a pump station, a conveyance canal, culverts for roadway and canal crossings, and a spreader canal. Other project features in this area include the plugging of existing mosquito ditches found in the saltwater wetlands east of L-31E Levee and Canal.

The pump station is located on C-1 and would have a 400 cfs total capacity. This water is delivered to a lined conveyance canal that is 6,900 feet in length. The conveyance canal would run under the existing SW 97th Avenue, SW 87th Avenue (L-31E Levee), and across the L-31E Canal via concrete box culverts and deliver water to the spreader canal located in the saltwater wetlands. This spreader canal is divided up into four segments. The first segment runs from the box culverts southward for 2,980 feet. The second segment runs from the box culverts northward for 4,867 feet and the third segment runs from the second segment north eastward for 2,500 feet. The fourth and final segment is a second "tail" to the spreader canal system that continues a little further to the north than segment 3 before it turns eastward and has a length of 2,813 feet. These separate tails are aligned to connect with historic low lying areas that are primary concerns for rehydration.

Approximately 2,500 linear feet of existing mosquito ditches would be plugged. The intent is to discourage the channelization of the water delivered to the area by the spreader canals.

L-31E Culverts

The L-31E Culverts are located in southeastern Miami-Dade County within Sections 28 and 33, Township 56S, Range 40E and Sections 4, 9, and 16, Township 57S, Range 40E. The L-31E North area generally is described as the portion of the project between C-1 on the north to Military Canal on the south. These features include structures that would isolate the L-31E Canal from the major discharge canals (C-102 and Military Canal) as well as gated riser culverts (L-31E Culverts) that would deliver water from the L-31E Canal, through the L-31E Levee, and discharge in the saltwater wetlands to the east. In addition, a pump station would be constructed to mimic the intent of the L-31E Culverts by pumping water over the L-31E Levee and deliver water directly to the saltwater wetlands.

A Gated Riser Structure with a 36-inch culvert would be constructed in the L-31E Canal on the south side of C-102 to isolate the L-31E Canal south of C-102 from the northern reach of L-31E Canal and C-102. An inverted siphon structure would be constructed underneath the Military Canal and would allow for a hydraulic connection of the L-31E Canal north of Military Canal and L-31E Canal south of Military Canal. These structures would allow for operating this reach of the L-31E Canal, from C-102 to C-103, at a higher water level than currently possible and this would assist the L-31E Culverts in discharging water to the saltwater wetlands to the east. Additionally, the L-31E Canal will receive water from the C-102 by a 100 cfs pump station located just south of C-102 (in the same physical structure as the gated riser culvert). A 50 cfs pump station located in L-31E Canal north of C-102 would move water over the L-31E Levee directly to the saltwater wetlands.

The L-31E Culverts, situated on the L-31E North Levee, consists of the installation of five (5) 36-inch corrugated aluminum alloy culverts with flap gates with manatee protective barriers at five different locations. The culverts would gravity discharge to the east at the edge of the wetlands. The downstream side of the culverts would be equipped with aluminum flap gates for backflow prevention. The flap gate would inhibit direct saltwater intrusion during periods of high tide when the tailwater elevation could exceed the headwater elevation.

The L-31E South area is described as the portion of the project between Military Canal on the north and North Canal on the south. These features include structures that would isolate the L-31E Canal from the major discharge canals (Military Canal and C-103) as well as gated riser culverts (L-31E Culverts) that would deliver water from the L-31E Canal, through the L-31E Levee, and discharge in the saltwater wetlands to the east. A pump station would be

constructed to supply the isolated reaches of the L-31E Canal with water. A freshwater wetland system is included in this region.

A gated riser structure with a 36-inch culvert would be constructed in the L-31E Canal on the north side of C-103; this would isolate this reach of L-31E Canal. A 40 cfs pump would work in conjunction with the gated structure on the north side of C-103 to provide water for that reach of L-31E Canal.

Five more L-31E culverts would be constructed in this area, three culverts between Military Canal and C-103, and two culverts between C-103 and North Canal. The design of these culverts would be identical to those described in the L-31E North features section.

The freshwater wetland system consists of two pump stations, a spreader canal, a small berm, and a seepage collector ditch. The first pump will be located on the northwestern edge of the wetland and delivers 40 cfs from C-103 to the spreader canal. The spreader canal runs from C-103 to the North Canal, approximately 2,619 feet. Once filled, the spreader canal would deliver overland flows westward to the freshwater wetland. To help alleviate flooding concerns to the west of the spreader canal, a small berm and seepage collector ditch would be constructed immediately to the west of the spreader canal. Both the berm and seepage collector ditch would be the same length as the spreader canal, 2,619 feet. The seepage collector ditch would discharge via gravity to C-103. The second pump for the wetland is located approximately halfway from the first pump to L-31E Canal and would deliver an additional 40 cfs to the wetland. No spreader canal is associated with this pump; however, water will be delivered directly to a concrete spreader structure.

A.4.5 Description of Listed Species and Designated Critical Habitat

A.4.5.1 Affected Environment

Biscayne Bay is a shallow, subtropical estuary with water depths ranging from one foot to approximately ten feet across the Biscayne Bay. Much of Biscayne Bay is classified as Outstanding Florida Waters (OFW) under Florida Administrative Code (FAC 62-302.400). Historically, freshwater runoff entered Biscayne Bay via overland flow from the Everglades through estuarine coastal wetlands and artesian up-wellings. The water quality in the late 1800s was low in nutrients, low in turbidity, and high in light transmittance; such conditions allowed an abundant coverage of seagrass beds. The Biscayne Bay water quality was still within natural conditions at the time the City of Miami was founded (1896). As development progressed, canal networks were constructed for flood protection and prevention of aquifer saltwater intrusion. The canal network, a system of managed water, had replaced the natural sloughs. Freshwater flow into Biscayne Bay is now dominated by pulse-released direct canal discharges.

Deering Estate Flow Way

A dredged creek channel exists at the Deering Estate and drains upland. A spur canal exists on the west side of Old Cutler Road and drains the existing residential area. Grassed swales exist in the developed residential areas west of the Biscayne Bay Coastal Wetlands Phase 1 project area, as well as the residential areas adjacent to the Cutler Wetlands V-1 Component Flow Way area. Water quantities and water levels in the spur canal and the C-1 Canal through the residential areas are not expected to be altered by this project. No increased potential in flooding of the residential areas would occur. A series of farm ditches, mosquito ditches, and drainage ditches exist within the coastal wetland area.

The 9.7 acre Powers Addition Parcel, or Cutler Glade Rehydration Addition, is located west from Old Cutler Road to the junction of SW 158th and SW 159th Terrace between SW 157th Terrace and the spur canal. Residential areas to the north, south, and west surround the site. The parcel was an active mango and avocado grove with a single family house on the property. The vegetation within this area consists of a mix of herbaceous and woody vegetation including castor bean, cabbage palm, laurel oak, strangler fig, banana trees, avocado trees, mango trees, and other ruderal grasses and shrubs. The proposed system includes a concrete spreader box installed on the east side of Old Cutler Road to distribute water eastward through the Cutler Drain and overland through the coastal wetlands of the Deering Estate to Biscayne Bay.

The Deering Estate covers approximately 460 acres of land, the majority of which is located between Old Cutler Road and Biscayne Bay in southern Miami-Dade County. The estate is on the edge of the Miami Rock Ridge that separates Biscayne Bay from what once was the eastern edge of the Everglades system. A slough historically carried water from the Everglades to Biscayne Bay through what is now known as the Deering Estate.

This area contains some very unique habitat types including pine rocklands (87 acres). Most of the Biscayne Bay Coastal Wetlands project area's tropical hardwood hammock (162 acres) is found here. The pine rocklands occupy the northwest section of this area, whereas the hardwood hammock occupies the central western portion. Coastal band mangrove accounts for 23 percent of the total coverage (110 acres), whereas salt marsh accounts for five percent (23 acres). These two vegetative types lie west of the hammock and pine rocklands habitat. The filled-developed-disturbed class occupies 75 acres or 16 percent of the sub-region.

Cutler Wetlands C-1 Flow Way

The C-1 and C-100 canals drain a basin north and west of the Biscayne Bay Coastal Wetlands Phase 1 project area. The drainage basin is urbanized and developed. The canals follow historic transverse glades and the general drainage of surface water follows in a northwest to southeast direction. The S-21 and S-123 structures control the discharge of freshwater to tide as well as provide flood protection from Biscayne Bay during extreme storm events. Infrastructure to collect, transport, and discharge the fresh water into the wetlands adjacent to Biscayne Bay does not exist. Runoff water collected in the C-1 and C-100 basins is currently discharged to tide at control structures S-21 and S-123. The majority of vegetation in the rehydration area is mangrove forest with Brazilian pepper along the western boundary.

The areas affected by the construction of the flow way include two parcels dominated by Brazilian pepper (located at the western limits of the project area), a freshwater marsh, which is an existing mitigation site (located between SW 97th Avenue and SW 8th Avenue, north of SW 232nd Street) consisting of cattail, primrose willow, torpedo grass, and purple ammannia; an exotic wetland hardwoods dominated by Brazilian pepper (located in the northwest corner of the intersection of 87th Avenue and SW 232nd Street), mosquito ditches and the C-1 Canal. The rehydration area (located between SW 87th Avenue and Biscayne Bay) that would be affected is predominantly mangrove forest and some Brazilian pepper along the western boundary.

L-31E Culverts

The South Florida Water Management District canals exist today to collect and transport storm water from urban and other developed areas in south Miami-Dade County, and continue to provide flood protection. The L-31E Canal provided a salinity barrier between the coastal areas and areas west of 87th Avenue.

The L-31E Canal is a manmade structure that was excavated prior to 1940 to promote water control. The L-31E Levee is composed of spoil material obtained from the excavation of the canal and acts as an access point and road. The levee restricts water from the canal from flowing east to coastal wetlands of Biscayne Bay. The project site includes 415 acres of publicly owned coastal wetlands located between Biscayne Bay and the L-31E levee and canal. The coastal wetlands, which were historically a freshwater marsh, have transitioned to a dwarf mangrove community following the construction of the levee/canal system and subsequent impedance of freshwater flows.

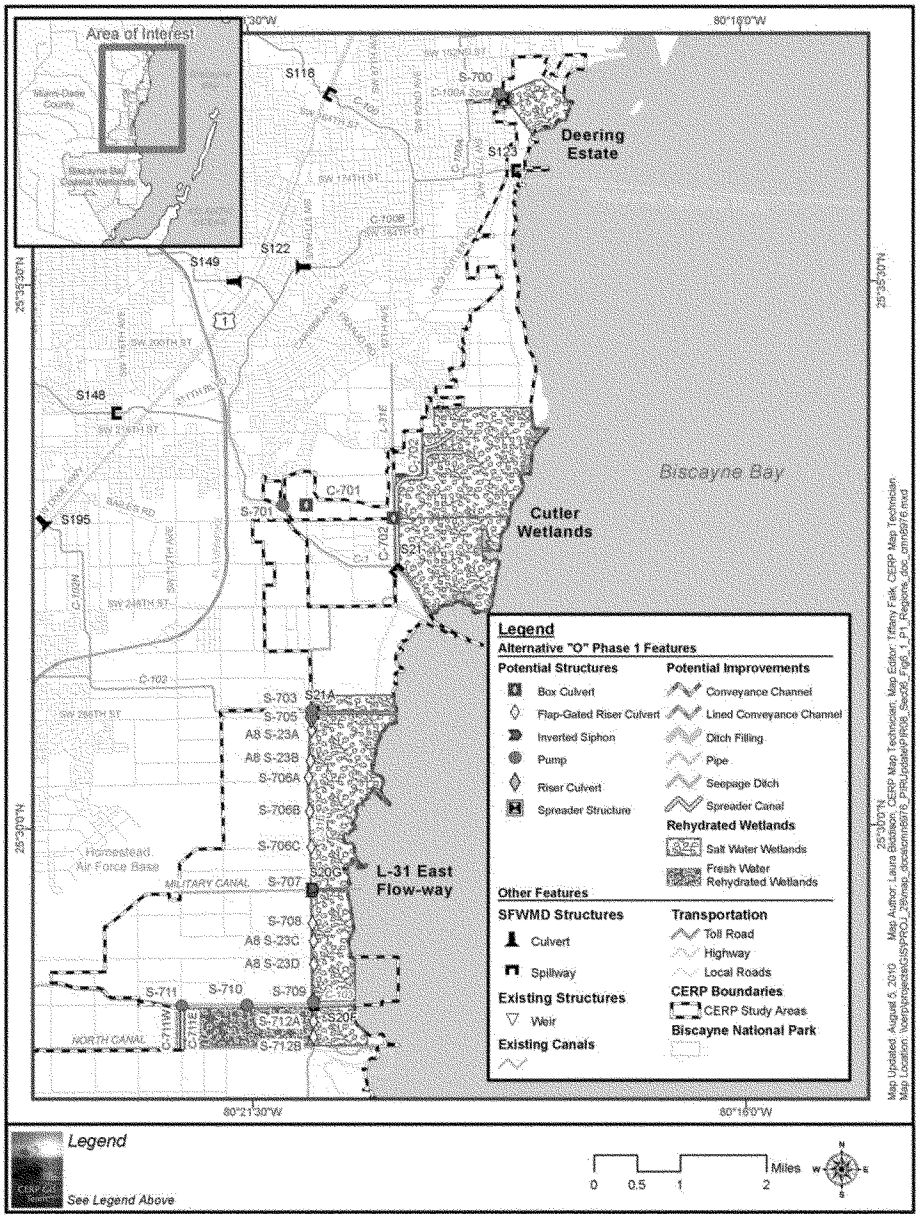

FIGURE A4-2: BISCAYNE BAY COASTAL WETLANDS PROJECT AREA

A.4.5.2 Federally Listed Species

The U.S. Army Corps of Engineers has coordinated the existence of federally listed species with the U.S. Fish and Wildlife Service and with National Oceanic and Atmospheric Administration Fisheries, as appropriate. Specifically, coordination with National Oceanic and Atmospheric Administration Fisheries includes listed fish, marine plants, and sea turtles at sea. Coordination with U.S. Fish and Wildlife Service includes other listed plants and animals (FWS 2004). Twenty-five federally listed threatened and endangered species are either known to exist or potentially exist within the project area and, subsequently, may be affected by the proposed action (***Table A4-1***). Many of the twenty-five threatened and endangered species have been previously affected by habitat impacts resulting from wetland drainage, alteration of hydroperiod, wildfire, and water quality degradation.

Federally listed animal species that exist or potentially exist in the project area include the American crocodile (*Crocodylus acutus*), American alligator (*Alligator mississippiensis*), West Indian manatee (*Trichechus manatus*), Florida panther (*Puma concolor coryi*), smalltooth sawfish (*Pristia pectinata*), wood stork (*Mycteria Americana*), Eastern indigo snake (*Drymarchon corais couperi*), and the Schaus swallowtail butterfly (*Heraclides areistodemus ponceanus*). Five federally listed sea turtles species exist or potentially exist in the project area, including the green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Dermochelys coriacea*), Kemp's ridley sea turtle (*Lepidochelys kempii*), and the loggerhead sea turtle (*Caretta caretta*).

Federally listed plant species that may exist or potentially exist in the project area include the Crenulated lead-plant (*Amorpha herbacea* var. *crenulata*), Garber's spurge (*Chamaesyce garberii*), tiny polygala (*Polygala smallii*, deltoid spurge (*Chamaesyce deltoidea* spp.), Small's milkpea (*Galactia smallii*), beach jacquemontia (*Jacquemontia reclinata*), and Johnson's seagrass (*Halophila johnsonii*). With the exception of the latter two, most of these plant species are associated with pine rocklands, which only occur at the northern extreme of the project area and are highly unlikely to be affected by the project. The southernmost known range of Johnson's seagrass is located at Virginia Key, outside the zone of impacts associated with this project. A number of candidate plant species are known to exist or potentially exist in the project area, most of which are also associated with pine rocklands (FWS 2004).

A.4.5.3 State Listed Species

State listed endangered species that exist or potentially exist in the project include the Arctic peregrine falcon (*Falco peregrinus tundrius*) and Florida mastiff bat (*Eumops glaucinus floridanus*); threatened species include the white-

crowned pigeon (*Columba leucocephalus*), least tern (*Sterna antillarum*), piping plover (*Charadrius melodus*), Miami blackheaded snake (*Tantilla olitica*), and the Everglades mink (*Mustela vison evergladensis*). State-listed species of special concern include the roseate spoonbill (*Ajaia ajaia*), limpkin (*Aramus guarauna*), little blue heron (*Egretta caerulea*), reddish egret (*Egretta rufescens*), snowy egret (*Egretta thula*), tricolored heron (*Egretta tricolor*), white ibis (*Eudocimus albus*), brown pelican (*Pelecanus occidentalis*), black skimmer (*Rynchops niger*), mangrove rivulus (*Rivulus marmoratus*), gopher tortoise (*Gopherus polyphemus*), American alligator (*Alligator mississippiensis*), and the Florida tree snail (*Liguus fasciatus*).

TABLE A4-1: BISCAYNE BAY COASTAL WETLANDS PROJECT PHASE 1 IMPACT ON THREATENED AND ENDANGERED SPECIES

Common Name	Scientific Name	Status	Agency	Not Likely to Adversely Effect	No Effect
Mammals					
Everglades mink	*Mustela vison evergladensis*	T	State		X
Florida mastiff bat	*Eumops glaucinus floridanus*	E	State		X
Florida panther	*Puma concolor coryi*	E	Federal		X
West Indian manatee* (Florida manatee)	*Trichechus manatus*	E	Federal	X	
Birds					
Arctic peregrine falcon	*Falco peregrinus tundrius*	E	State		X
black skimmer	*Rynchops niger*	SC	State		X
brown pelican	*Pelecanus occidentalis*	SC	State		X
Cape Sable seaside sparrow	*Amodramus maritimus mirabilis*	E	Federal		X
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	E	Federal		X
least tern	*Sterna antillarum*	T	State		X
limpkin	*Aramus guarauna*	SC	State		X
little blue heron	*Egretta caerulea*	SC	State		X
piping plover	*Charadrius melodus*	T	State		X
reddish egret	*Egretta rufescens*	SC	State		X
roseate spoonbill	*Ajaja ajaja*	SC	State		X
Roseate tern	*Sterna dougallii*	T	Federal		X

Common Name	Scientific Name	Status	Agency	Not Likely to Adversely Effect	No Effect
	dougallii				
snowy egret	*Egretta thula*	SC	State		X
tri-colored heron	*Egretta tricolor*	SC	State		X
white-crowned pigeon	*Columba leucocephalus*	T	State		X
white ibis	*Eudocimus albus*	SC	State		X
wood stork	*Mycteria americana*	E	Federal	X	
Reptiles					
American alligator	*Alligator mississippiensis*	T/SA	Federal	X	
American crocodile*	*Crocodylus acutus*	T	Federal	X	
Eastern indigo snake	*Drymarchon corais couperi*	T	Federal	X	
gopher tortoise	*Gopherus polyphemus*	SC	State		X
green sea turtle	*Chelonia mydas*	E	Federal	X	
hawksbill sea turtle	*Eretmochelys imbricata*	E	Federal	X	
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	Federal	X	
leatherback sea turtle	*Dermochelys coriacea*	E	Federal	X	
loggerhead sea turtle	*Caretta caretta*	T	Federal	X	
Miami blackheaded snake	*Tantilla oolitica*	T	State		X
Fish					
mangrove rivulus	*Rivulus marmoratus*	SC	State	X	
smalltooth sawfish	*Pristia pectinata*	E	Federal	X	
Invertebrates					
elkhorn coral	*Acropora palmata*	T	Federal		X
Florida tree snail	*Liguus fasciatus*	SC	State		X
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	E	Federal	X	
staghorn coral	*Acropora cervicornis*	T	Federal		X
Plants					
beach jacquemontia	*Jacquemontia reclinata*	E	Federal		X
Crenulated lead-plant	*Amorpha crenulata*	E	Federal	X	

Common Name	Scientific Name	Status	Agency	Not Likely to Adversely Effect	No Effect
deltoid spurge	*Chamaesyce deltoidea deltoidea*	E	Federal	X	
Garber's spurge	*Chamaesycegarberi*	T	Federal	X	
Johnson's seagrass	*Halophila johnsonii*	E	Federal		X
Small's milkpea	*Galactia smallii*	E	Federal	X	
tiny polygala	*Polygala smallii*	E	Federal	X	

* Critical habitat designated for this species
E: Endangered
T: Threatened
SC: Species of Special Concern
SA: Similarity of Appearance species

A.4.5.4 Designated Critical Habitat

In addition to threatened and endangered species, the project area includes designated critical habitats for the American crocodile, the Everglade snail kite, the West Indian manatee, Cape Sable seaside sparrow, Johnson's seagrass, elkhorn coral, and staghorn coral. Maps of critical habitat locations for these species are depicted in ***Figure A4-3*** to ***Figure A4-8***.

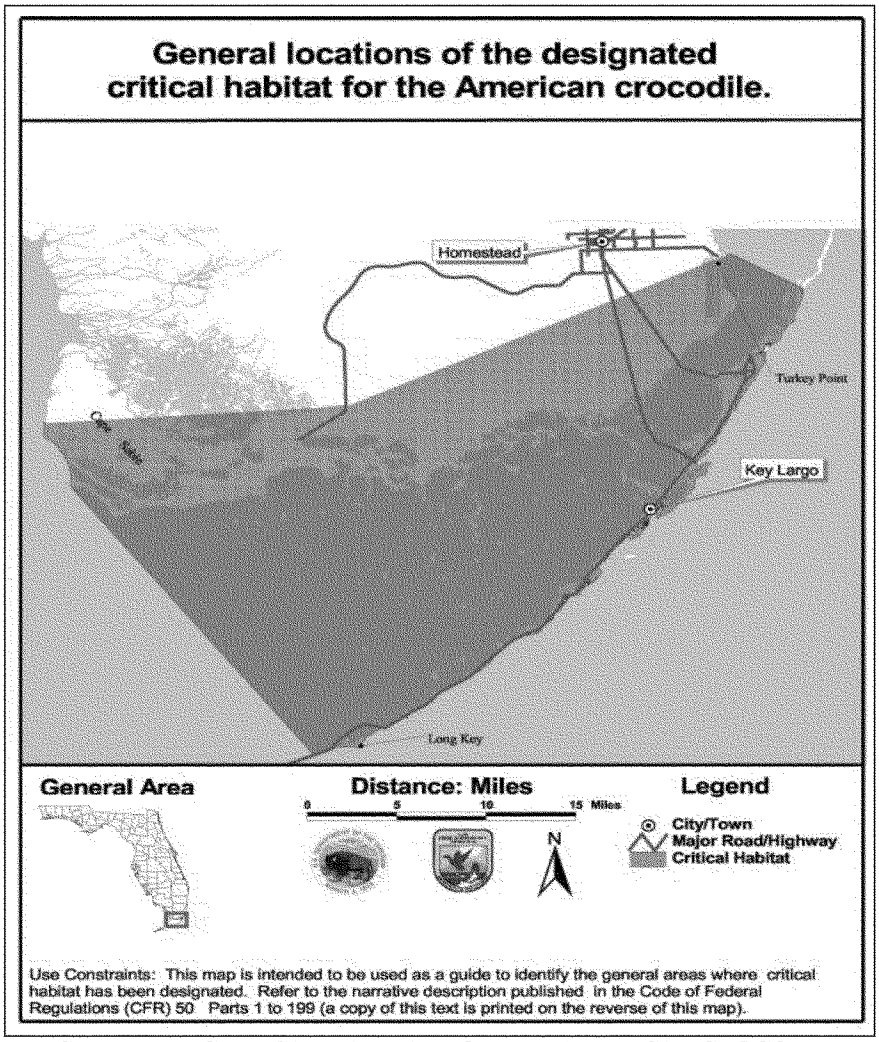

FIGURE A4-3: CRITICAL HABITAT FOR THE AMERICAN CROCODILE

The American crocodile's critical habitat starts at the easternmost tip of Turkey Point and continues southeast and southwest across the southern part of the Biscayne Bay Coastal Wetlands project area. The Model Lands, including the wedge area between U.S. Highway 1 and Card Sound Road, lie within critical habitat for this species (50 CFR; 10-01-00).

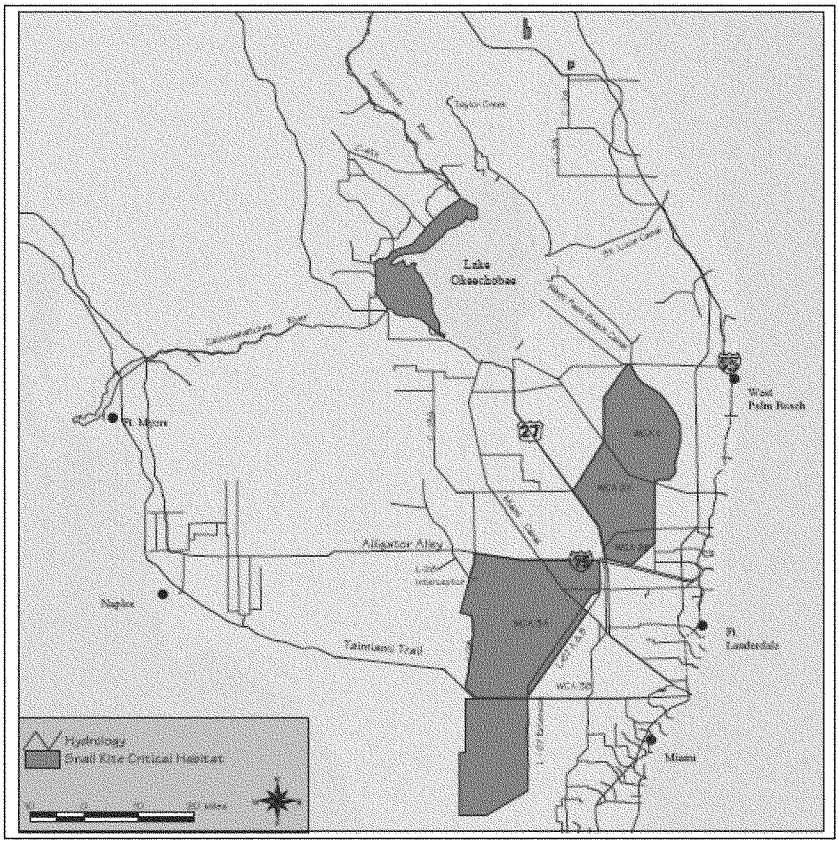

FIGURE A4-4: CRITICAL HABITAT FOR THE EVERGLADE SNAIL KITE

Although previously located in freshwater marshes over considerable areas of peninsular Florida, the range of the Everglade snail kite is currently more limited. This bird is now restricted to several impoundments on the headwaters of the St. John's River; the southwest side of Lake Okeechobee; the eastern and southern portions of Water Conservation Areas (WCA) 1, 2A and 3; the southern portion of WCA 2B; the western edge of WCA 3B; and the northern portion of Everglades National Park (FWS, May 1996).

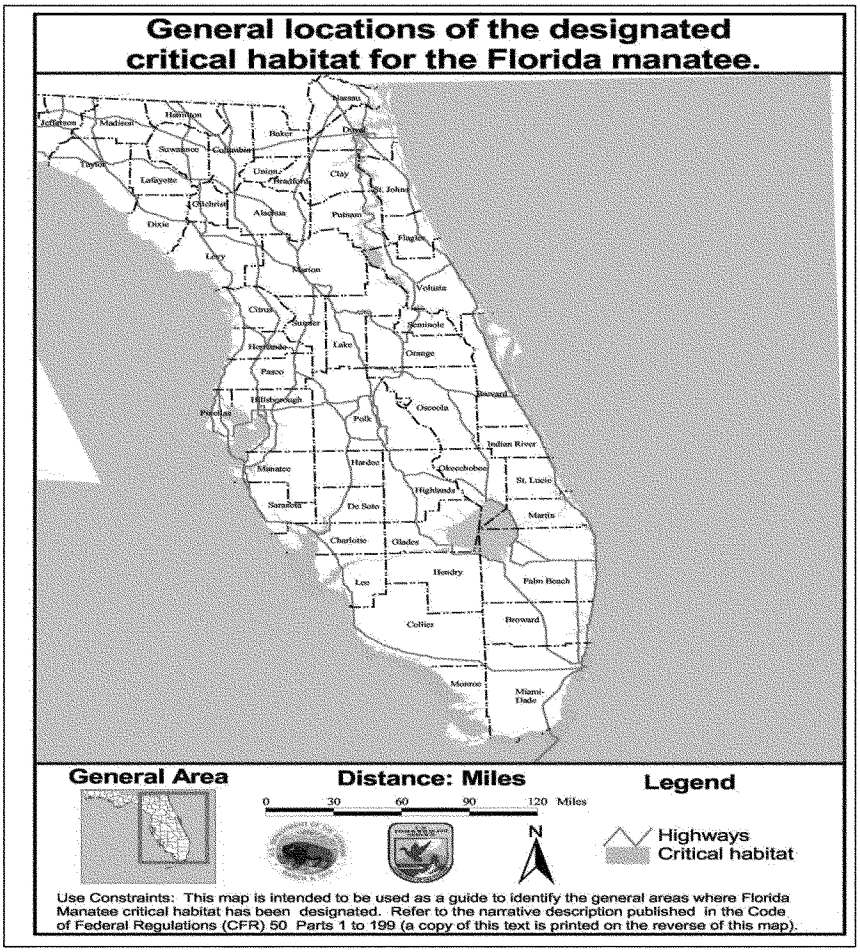

FIGURE A4-5: CRITICAL HABITAT FOR THE WEST INDIAN MANATEE

The West Indian manatee's critical habitat includes all waters of Card, Barnes, Blackwater, Little Blackwater, Manatee and Buttonwood sounds between Key Largo, Monroe County, and the mainland of Miami-Dade County. Card and Barnes sounds are in the southern part of Phase II portion of the project area. The northern part of the Phase 1 portion of the project area lies close to another segment of designated critical habitat for the West Indian manatee. This component is defined as "Biscayne Bay, and all adjoining and connected lakes, rivers, canals and waterways from the southern tip of Key Biscayne northward to and including Maule Lake, Dade County." (CFR 50 Parts 1 to 199; 10-01-00).

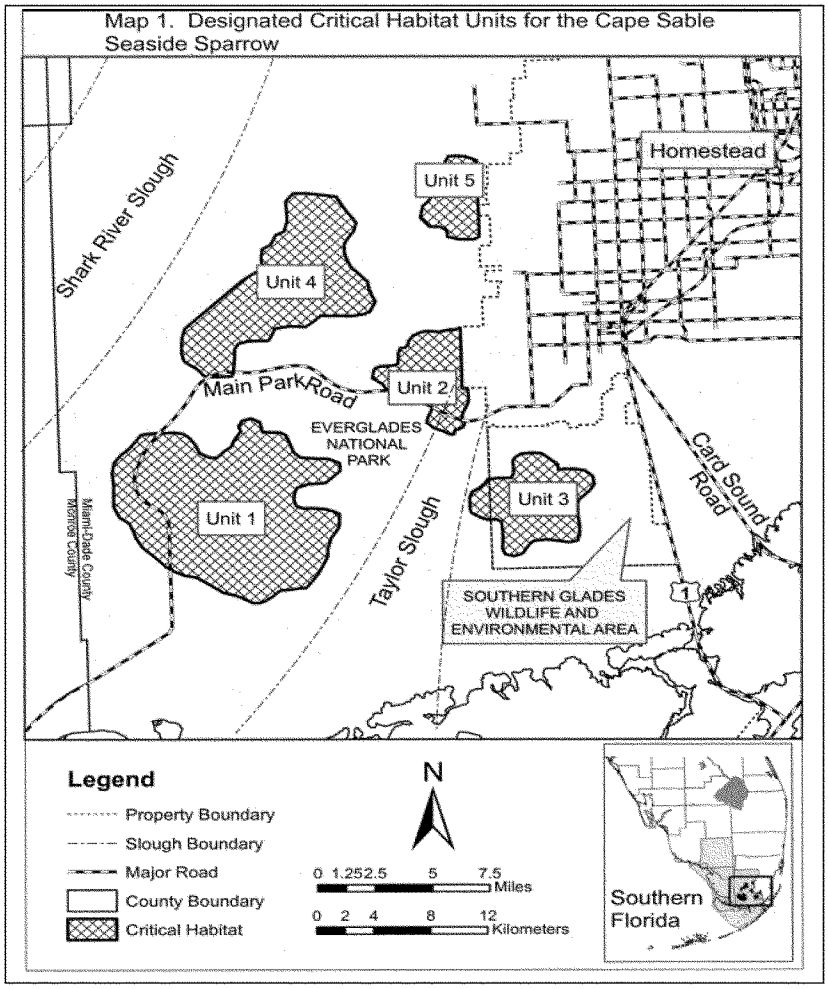

FIGURE A4-6: CRITICAL HABITAT FOR THE CAPE SABLE SEASIDE SPARROW

Designated critical habitat for the Cape Sable seaside sparrow include areas of land, water, and airspace in the Taylor Slough vicinity of Collier, Miami-Dade, and Monroe counties, with the following components: those portions of Everglades National Park within T57S R36E, T57S R36E, T57S R37E, T58S R35E, T58S R36E, T58S R37E, T58«S R35E, T58«S R36«E, T59S R35E, T59S R36E, T59S R37E. Areas outside of Everglades National Park within T55S R37E Sec. 36; T55S R38E Sec. 31, 32; T56S R37E Sec. 1, 2, 11-14, 23-26; T56S R38E

Sec. 5-7, 18, 19; T57S R37E Sec. 5-8; T58S R38E Sec. 27, 29-32; T59S R38E Sec. 4 (CFR Vol. 72, No. 214 / 11-6-07)

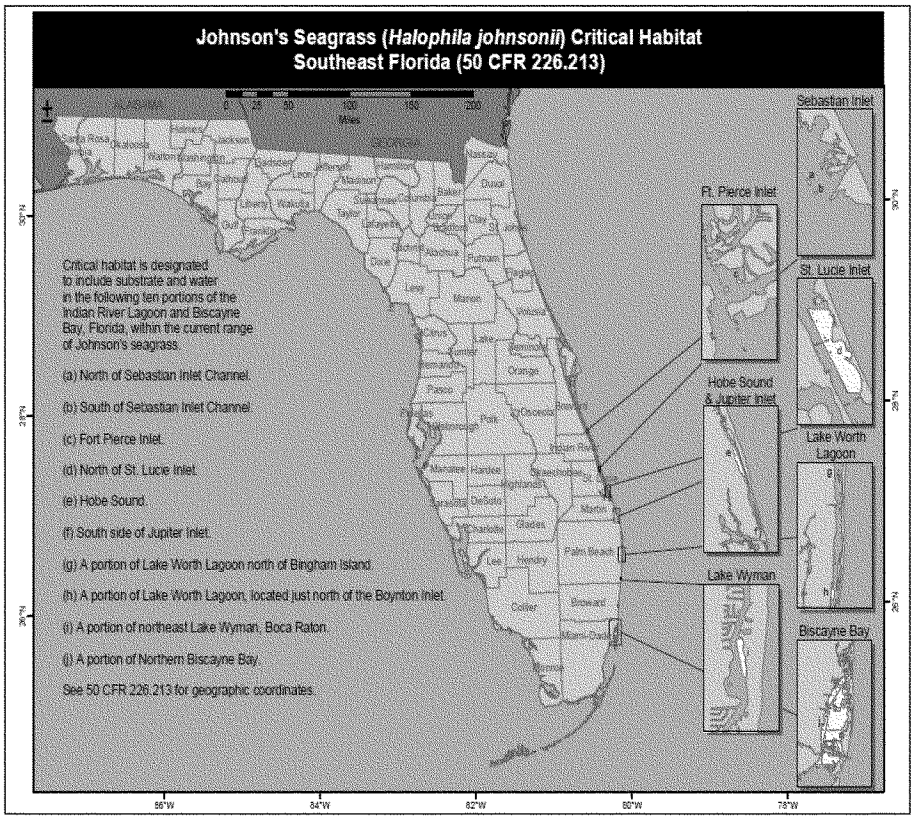

FIGURE A4-7: CRITICAL HABITAT FOR JOHNSON'S SEAGRASS

Designated critical habitat for Johnson's seagrass in proximity of the project area includes a portion of northern Biscayne Bay, specifically the northern boundary of Biscayne Bay Aquatic Preserve at NE 163rd Street, and all parts of the preserve. Central Key Biscayne is currently the southernmost range of the species (50 CFR Ch. II; 10-1-05).

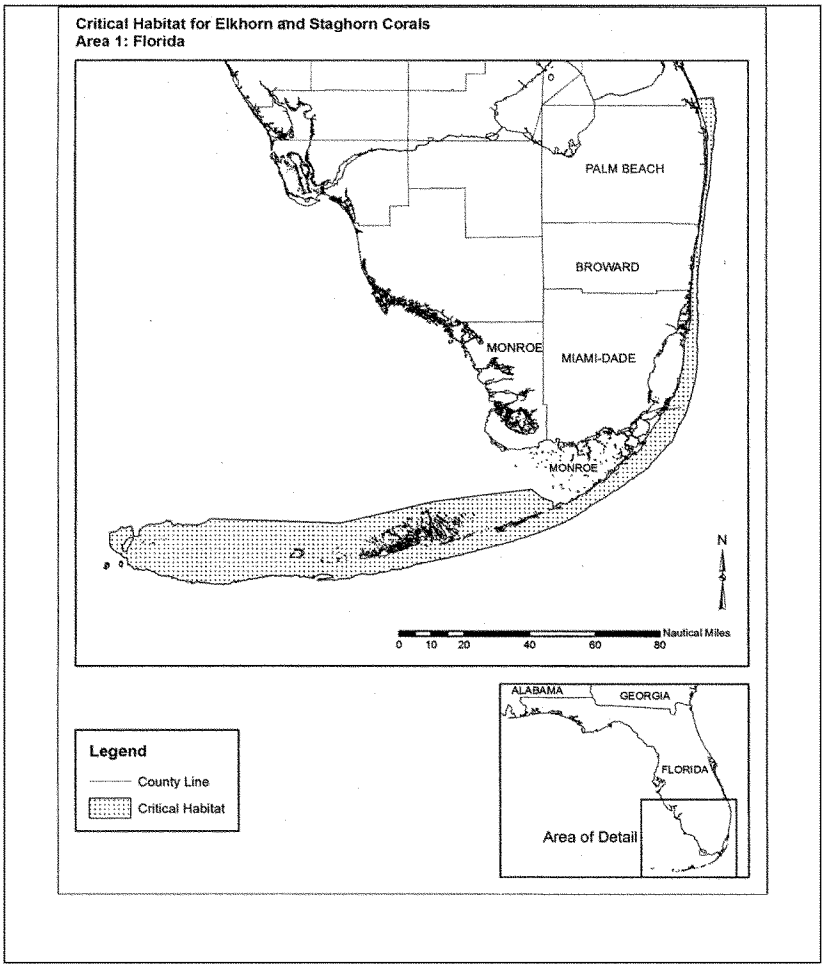

FIGURE A4-8: CRITICAL HABITAT FOR ELKHORN AND STAGHORN CORALS

In southeast Florida, staghorn coral has been documented along the east coast as far north as Palm Beach County in deeper (16 meters to 30 meters) water and is distributed south and west throughout the coral and hard-bottom habitats of the Florida Keys, through Tortugas Bank. Elkhorn coral has been reported as far north as Broward and Miami-Dade counties, with significant reef development and framework construction by this species beginning at Ball Buoy Reef in Biscayne National Park, extending discontinuously southward to the Dry Tortugas (CFR Vol. 73, No. 25, 02-06-08).

A.4.6 Effects of Proposed Action

A.4.6.1 Species Biology and Effect Determination

Federally listed plant and animal species which may have the potential to be affected by the project are discussed in detail below:

A.4.6.1.1 American Crocodile and "May Affect, But Not Likely to Adversely Affect" Determination

Crocodiles are known to exist throughout the project area at densities ranging from 0 to 0.29 crocodiles per kilometer of shoreline (Cherkiss, 1999). Although nesting conditions may be suitable, no successful nests are known to occur within the project boundaries. The cooling canals of Florida Power and Light's Turkey Point Power Plant, which are in close proximity to the project boundary, support the most successful crocodile nesting population in south Florida (Mazzotti et al., 2002). Individuals from this population disperse northward and southward into the Biscayne Bay Coastal Wetlands project area. These cooling canals offer premium nesting habitat because they satisfy the crocodile's two primary nesting requirements–suitable substrate that lays above the normal high water level and adjacent deep-water refugia. While crocodiles prefer sandy substrates, they will often utilize canal spoil banks (Kushlan and Mazzotti, 1989).

Juvenile crocodiles require low salinity for growth and survival, presumably because they have limited physiological capability to osmoregulate. The ideal salinity range for crocodiles is 0 to 20 parts per thousand (ppt) (Mazzotti et al., 2002). As salinity levels increase above 20 ppt, habitat suitability decreases. Redirecting freshwater from conveyance canals into the coastal wetlands would lower salinities there, which should increase suitable habitat for juvenile crocodiles. One of the primary Biscayne Bay Coastal Wetlands project objectives is to restore a more natural salinity gradient to the coastal wetlands. Watershed flow through conveyance canals has robbed these wetlands of vital freshwater for the last several decades, creating an unnaturally high salinity environment, a loss of graminoid marshes and a landward migration of mangrove wetlands.

Although the American crocodile has a high probability of occurrence within the project area due to the presence of available habitat, no more than minimal temporary construction impacts are expected as a result of this project. To further minimize potential impacts, the U.S. Army Corps of Engineers proposes the implementation of habitat management guidelines during project construction for the American crocodile. By implementing this conservation measure, the project may affect, but is not likely to adversely affect the American crocodile.

American Crocodile Critical Habitat

According to 50 CFR 17.95, the easternmost tip of Turkey Point defines the northern boundary of designated critical habitat for the American crocodile. Turkey Point is approximately one mile south of the southernmost culvert proposed between C-103 and North Canal; therefore, redirecting canal water through tidal wetlands into bay waters could affect American crocodiles and their designated critical habitat. However, a reduction in estuarine and nearshore salinities through project implementation should ultimately enhance crocodile habitat within the project area. It is therefore determined that this project may affect, but would not likely adversely affect critical habitat for the American crocodile.

A.4.6.1.2 American alligator and "May Affect, But Not Likely to Adversely Affect" Determination

The American alligator is listed as threatened by the U.S. Fish and Wildlife Service due to similarity of appearance to another listed species, the American crocodile. The American alligator has a high potential for occurring within the project area due to field observations and the presence of available habitat. However, no more than minimal temporary construction impacts to the American alligator are expected as a result of this project. Therefore, the project may affect, but would not likely to adversely affect the American alligator.

A.4.6.1.3 The West Indian Manatee and "May Affect, But Not Likely to Adversely Affect" Determination

The West Indian manatee, or sea cow, is a large, plant-eating aquatic mammal that can be found in the shallow coastal water, rivers and springs of Florida. Florida is essentially the northern extent of the West Indian manatee's range, though some manatees occasionally are reported farther north (FPL, 1989).

The West Indian manatee lives in freshwater, brackish and marine habitats, and can move freely between salinity extremes. It can be found in both clear and muddy water. Water depths of at least three to seven feet (one to two meters) are preferred and flats and shallows are avoided unless adjacent to deeper water. During the summer months, manatees range throughout the coastal waters, estuaries, bays, and rivers of both coasts of Florida and are usually found in small groups. During the winter, manatees tend to congregate in warm springs, and outfall canals associated with electric generation facilities (FPL, 1989).

Over the past centuries, the principal sources of manatee mortality have been opportunistic hunting by man and deaths associated with unusually cold winters. Today, poaching is rare, but high mortality rates from human-related

sources threaten the future of the species. The largest single mortality factor is collision with boats and barges. Manatees are killed in flood gates and canal locks, by entanglement or ingestion of fishing gear, and through loss of habitat and pollution (FPL, 1989).

Manatees have been observed throughout Biscayne Bay, mainly in conveyance canals within the project area and adjacent nearshore seagrass beds. The extensive acreages of seagrass beds in the Bay provide important feeding areas for manatees. Manatees depend upon canals as a source of freshwater and resting sites. It is highly likely that manatees depend on the deep canals as a cold-weather refuge. The relatively deep waters of the canals respond more slowly to temperature fluctuations at the air/water interface than the shallow bay waters. Thus, the canal waters remain warmer than open bay waters during the passage of winter cold fronts.

Diversion of water from the canals in the project area would result in reducing the frequency of gate openings which should reduce the risk of harm from structures to manatees. Redirecting freshwater from canals could provide additional drinking water sources along the shoreline. Although diverted freshwater is expected to change the salinity regime in the nearshore area, sea grass species composition may be altered but should not affect overall seagrass biomass.

Due to the known presence of manatees within the project study area; Standard Manatee Construction Conditions would be implemented during construction of the proposed project to avoid any potential impacts. These measures include the need to avoid vessel equipment collisions with manatees and the use of siltation curtains during construction to minimize sediment deposition on existing foraging habitat; follow the Fish and Wildlife Service's (2006) manatee requirements for culverts (Guidelines for Culverts Located in Manatee-Accessible CERP Projects); should blasting be necessary, follow the Fish and Wildlife Service's "Guidelines for the Protection of Marine Animals During the Use of Explosives In the Waters of the State of Florida" and monitor local wildlife activity during this action. This measure requires a qualified fish and wildlife biologist, approved by the FWS and the FWC, should be present throughout blasting activities to monitor fish and wildlife response and offer advice to construction personnel. Following these conditions should avoid or minimize effects to manatees during construction. Finally, manatee barriers will be included at all pump station intake sites and culverts, which will ensure protection of manatees. With the commitment to use the Standard Manatee Construction Conditions and the additional measures described above, the project may affect but would not likely adversely affect the West Indian manatee.

West Indian Manatee Critical Habitat

The project area lies between two areas of designated critical habitat for the West Indian manatee. The Culvert component between C-103 and North Canal is approximately four miles from the northernmost area of designated manatee critical habitat while the other critical habitat area is approximately three miles north of the project area. Diversion of canal water through the wetlands is expected to have localized effects on nearshore salinities, and possibly affect the species composition of seagrass. It is unlikely; however, that the project would adversely affect overall biomass of seagrass, therefore impacts to manatee foraging areas would not be significant. Therefore, the proposed project may affect, but would not likely adversely affect designated critical habitat for the West Indian manatee.

A.4.6.1.4 Florida Panther and "May Affect, But Not Likely to Adversely Affect" Determination

The panther, also known as cougar, mountain lion, puma and catamount, was once the most widely distributed mammal (other than humans) in North America and South America, but it is now virtually exterminated in the eastern United States. Habitat loss has driven the subspecies known as the Florida panther into a small area, where the few remaining animals are highly inbred, causing such genetic flaws as heart defects and sterility. Recently, closely-related panthers from Texas were released in Florida and are successfully breeding with the Florida panthers. Increased genetic variation and protection of habitat may save the subspecies.

One of 30 cougar subspecies, the Florida panther is tawny brown on the back and pale gray underneath, with white flecks on the head, neck and shoulder. Preferred habitat consists of Cypress swamps, pine and hardwood hammock forests. Present population estimations range from 30-50 individuals. The main survival threats 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.

Although potentially suitable habitat occurs within the project area, and diversion of water from canal structures into coastal wetlands could affect panther habitat, there have been no recent confirmed sightings of Florida panthers in the project area. Reference is made to the revised Panther Key and Panther Focus Area Map for use in determining effects to the Florida panther. The proposed Biscayne Bay Coastal Wetlands project Phase I is outside the primary zone for Florida panther habitat. A temporary increase in traffic due to project construction is anticipated, however, the project is not expected to contribute to long-term increases or significant changes in vehicle traffic patterns. Despite short-term concerns with panthers crossing roads during

searches for food, the project may affect, but is not likely to adversely affect the Florida panther.

A.4.6.1.5 Smalltooth Sawfish and "May Affect, But Not Likely to Adversely Affect" Determination

Smalltooth sawfish have been reported in the Pacific and Atlantic Oceans, and the Gulf of Mexico; however, the United States population is found only in the Atlantic Ocean and Gulf of Mexico. Historically, the United States population was common throughout the Gulf of Mexico from Texas to Florida, and along the east coast from Florida to Cape Hatteras. The current range of this species includes peninsular Florida, but is relatively common only in the Everglades region at the southern tip of the state.

Juvenile sawfish use shallow habitats with a lot of vegetation, such as mangrove forests, as important nursery areas. Many such habitats have been modified or lost due to development of the coastal areas of Florida and other southeastern states. The loss of juvenile habitat likely contributed to the decline of this species.

The smalltooth sawfish has the potential to be found within the Biscayne Bay, and the juveniles could potentially occur and feed in the red mangrove wetlands. With the proposed project, the smalltooth sawfish may benefit as a result of the redistribution of freshwater runoff from the watershed away from the existing canal discharges into the coastal wetlands adjoining Biscayne Bay to provide a more natural and historic overland flow. With the expectation of improved wetland habitat, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the U.S. Army Corps of Engineers has determined the smalltooth sawfish may be affected, but is not likely to be adversely affected by the proposed project.

A.4.6.1.6 The Wood Stork and "May Affect, But Not Likely to Adversely Affect" Determination

The wood stork is the only stork occurring in the United States. In the United States, the wood stork's range includes Alabama, Florida, Georgia, Louisiana, Mississippi, South Carolina and Texas; however, the only states in which this bird is known to nest are Florida, Georgia and South Carolina (Mazzotti, 1990).

Wood storks are wetland dwellers and use fresh, brackish and saltwater habitats for feeding and nesting. Feeding takes place in shallow ponds, tidal pools, swamps and marshes. Nesting occurs in cypress, hardwood and mangrove swamps. The extreme dependence of the wood stork on naturally functioning wetlands makes it an excellent indicator of the health of wetland ecosystems (Mazzotti, 1990).

The Wood stork was once a common sight in Florida wetlands. However, between the 1930s and 1960s, there was a serious decline in this species. One reason for the decline in population has been the changes in the hydrologic regime of the Everglades, which affected its foraging habitat and food production (Mazzotti, 1990).

The U.S. Fish and Wildlife Service Standard Local Operating Procedure for Endangered Species defines the core foraging area for wood storks to be within 18.6 mile (30 kilometer) radius of breeding colonies. Based on research information available in U.S. Fish and Wildlife Service databases, the project area lies within the core foraging area of one historic and two active wood stork colonies. As a result of this information, the U.S. Army Corps of Engineers will include conservation measures during construction for the wood stork as outlined in the Habitat Management Guidelines for the Wood Stork in the Southeast Region (FWS, 1990).

Natural foraging areas are expected to increase as normal hydroperiods return to the Everglades proper. This project is designed to enhance or restore wetland habitat functions by removing point source discharges of freshwater directly into Biscayne Bay, rehydrating coastal wetlands, and restoring historical overland flows of freshwater. With the expectation of improved wetland habitat and the implementation of Habitat Management Guidelines, the U.S. Army Corps of Engineers has determined the wood stork may be affected, but would not likely be adversely affected by the proposed project.

A.4.6.1.7 The Eastern Indigo Snake and "May Affect, But Not Likely to Adversely Affect" Determination

The Eastern indigo snake is the largest 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 sand-hills, to cabbage palm hammocks, to hydric hardwood hammocks (Schaefer and Junkin, 1990). Eastern indigo snakes need relatively large areas of undeveloped land to maintain their population. The main reason for the species' decline is habitat loss due to land 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).

The presence of Eastern indigo snakes in the Biscayne Bay Coastal Wetlands project area is likely due to potentially favorable habitat. In fact, Eastern indigo snakes have been sighted along some of the levees, particularly the L-31E Levee. Based on this knowledge, standard protection measures regarding the Eastern

indigo snake and associated gopher tortoise burrows would be included in the environmental protection plan when the U.S. Army Corps of Engineers proceeds to the plans and specifications phase for this project. In addition to implementing the standard protection measures, removal of non-native vegetation will be conducted utilizing herbicide treatment methods instead of mechanical methods in order to further minimize potential impacts to indigo snakes in the project area. As a result of implementing the Biscayne Bay Coastal Wetlands project, the U.S. Army Corps of Engineers has determined the Eastern indigo snake may be affected, but would not likely be adversely affected by the proposed project.

A.4.6.1.8 Schaus Swallowtail Butterfly and "May Affect, But Not Likely to Adversely Affect" Determination

The Schaus swallowtail butterfly is a large dark brown and yellow butterfly originally listed as an endangered species because of population declines caused by the destruction of its tropical hardwood hammock habitat, mosquito control practices, and over-harvesting by collectors.

The present distribution of the Schaus swallowtail butterfly extends from southern Miami-Dade County through the Keys in Biscayne Bay and north to southern Key Largo in the Upper Keys, to Lower Matecumbe Key in the Middle Keys. Schaus swallowtail butterfly distribution is limited to tropical hardwood hammocks and is concentrated in the insular portions of Miami-Dade and Monroe counties, from Elliott Key in Biscayne National Park and associated smaller Keys to central Key Largo (FWS, 1999).

Suitable habitat remaining from historical values for this species is estimated as 43 percent in Biscayne National Park and 17 percent for north Key Largo. The decline has been attributed primarily to habitat destruction (FWS, 1999). Dense, mature, subtropical hardwood hammock habitat with natural and manmade openings is found in the Deering Flow Way of the Biscayne Bay Coastal Wetlands Phase 1 component. Rehydration of this area should restore the natural vegetative communities associated with tropical hardwood hammocks, which is expected to contribute to the continued survival of the Schaus swallowtail butterfly and its primary food plant, torchwood. As a result of habitat enhancement, the U.S. Army Corps of Engineers has determined that the proposed project may affect, but would not likely adversely affect the Schaus swallowtail butterfly.

A.4.6.1.9 The Crenulated Lead Plant, Garber's Spurge, Tiny Polygala, Deltoid Spurge, Small's Milkpea and "May Affect, But Not Likely to Adversely Affect" Determination

The primary habitat for the Crenulated lead-plant, Garber's spurge, tiny polygala, deltoid spurge and Small's milkpea are pine rocklands; this habitat is located in Deering Estate at the northern extreme of the Biscayne Bay Coastal Wetlands project area. The Deering Flow Way component is anticipated to restore hydrology through the Deering Glade with no changes in groundwater or surface water elevations anticipated to communities higher than the hardwood hammock. Little ponding is anticipated in the hardwood hammock with water movement back into the ground and out into Biscayne Bay, therefore, any effect on pine rocklands is expected to be insignificant. Therefore, the U.S. Army Corps of Engineers has determined the project may affect, but would not likely adversely affect the Crenulated lead-plant, Garber's spurge, tiny polygala, deltoid spurge, and Small's milkpea.

A.4.6.1.10 Green Sea Turtle and "May Affect, But Not Likely to Adversely Affect" Determination

The green sea turtle weighs approximately 150 kilograms and lives in tropical and sub-tropical waters. Areas that are known as important feeding areas for the green turtles in Florida include the Indian River Lagoon, the Florida Keys, Florida Bay, Homosassa, Crystal River and Cedar Key. Green turtles occupy three habitat types: high energy oceanic beaches, convergence zones in the pelagic habitat, and benthic feeding grounds in the relatively shallow, protected waters. Females deposit eggs on high energy beaches, usually on islands, where a deep nest cavity can be dug above the high water line. Hatchlings leave the beach and move in the open ocean. Green sea turtles forage in pastures of seagrasses and/or algae, but small green turtles can also be found over coral reefs, worm reefs, and rocky bottoms.

Seagrasses are expected to benefit from the re-direction and dispersion of fresh water across the wetland systems prior to entering the Bay. This could have a beneficial effect on sea turtles known to feed on seagrasses and/or benthic invertebrates in the project area. As a result, although green sea turtles are expected to be found foraging in nearshore seagrass habitats within Biscayne Bay, the project should not have an adverse effect on foraging opportunities or sea turtle feeding habits. Additionally, no green sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the U.S. Army Corps of Engineers has determined the green sea turtle may be affected, but would not likely be adversely affected by the proposed project.

A.4.6.1.11 Hawksbill Sea Turtle and "May Affect, But Not Likely to Adversely Affect" Determination

The hawksbill sea turtle is a small to medium-sized marine turtle weighing up to 15 kilograms in the United States. The hawksbill sea turtle lives in tropical and sub-tropical waters of the Atlantic, Pacific, and Indian oceans. Areas that are known as important feeding areas for hawksbill turtles in Florida include the waters near the Florida Keys and on the reefs off Palm Beach County. Hawksbill turtles use different habitat types at different stages of their life cycle. Post hatchlings take shelter in weed lines that accumulate at convergence zones. Coral reefs are the foraging habitat of juveniles, sub-adults, and adults. They are known to inhabit mangrove-fringed bays and estuaries, particularly along the eastern shore where coral reefs are absent. Hawksbill sea turtles feed predominantly on sponges and nest on low and high energy beaches, frequently sharing the high-energy beaches with green sea turtles. Nests are typically placed under vegetation.

Although hawksbill sea turtles are expected to be found foraging near coral reef habitats within Biscayne Bay, the increased freshwater flows associated with Phase 1 of the Biscayne Bay Coastal Wetlands project may reduce nearshore salinity concentrations but should not have an adverse effect on sponges or other food sources utilized by this species. Additionally, no hawksbill sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the U.S. Army Corps of Engineers has determined the hawksbill sea turtle may be affected, but would not likely be adversely affected by the proposed project.

A.4.6.1.12 Leatherback Sea Turtle and "May Affect, But Not Likely to Adversely Affect" Determination

The leatherback sea turtle is the largest living turtle and weighs up to 700 kilograms. The leatherback lives in tropical and sub-tropical waters. Habitat requirements for juvenile and post-hatchling leatherbacks are virtually unknown. Nesting females prefer high-energy beaches with deep unobstructed access. Leatherbacks feed primarily on jellyfish.

Although leatherback turtles are expected to be found foraging in nearshore habitats within Biscayne Bay, the increased freshwater flows associated with the Biscayne Bay Coastal Wetlands Phase 1 project may reduce nearshore salinity concentrations but should not have an adverse effect on jellyfish or other food sources utilized by this species. Additionally, no leatherback sea turtles would attempt to utilize areas for nesting purposes since there is no suitable

habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the U.S. Army Corps of Engineers has determined the leatherback sea turtle may be affected, but would not likely be adversely affected by the proposed project.

A.4.6.1.13 Kemp's Ridley Sea Turtle and "May Affect, But Not Likely to Adversely Affect" Determination

The Kemp's ridley sea turtle is the smallest of all sea turtles and weighs up to 45 kilograms. This species is a shallow water benthic feeder consuming mainly algae and crabs. Juveniles grow rapidly. Juveniles and sub-adults have been found along the eastern seaboard of the United States and in the Gulf of Mexico. However, the major nesting beach for the Kemp's ridley sea turtle is on the northeastern coast of Mexico.

This species occurs mainly in coastal areas of the Gulf of Mexico and in the northwestern Atlantic Ocean. The post-pelagic stages are commonly found dwelling over crab-rich sandy or muddy bottoms. Juveniles frequent bays, coastal lagoons and river mouths.

Although Kemp's ridley sea turtles could be found foraging in nearshore habitats within Biscayne Bay, this species is not expected to be found within the direct area of influence associated with the Biscayne Bay Coastal Wetlands Phase 1 project. Additionally, no Kemp's ridley sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the U.S. Army Corps of Engineers has determined the Kemp's ridley sea turtle may be affected, but would not likely be adversely affected by the proposed project.

A.4.6.1.14 Loggerhead Sea Turtle and "May Affect, But Not Likely to Adversely Affect" Determination

Loggerhead sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic, Pacific and Indian oceans. Females select high energy beaches on barrier strands adjacent to continental land masses for nesting. Steeply sloped beaches with gradually sloped offshore approaches are favored. After leaving the beach, hatchlings swim directly offshore and eventually are found along drift lines. They migrate to the near-shore and estuarine waters along the continental margins and utilize those areas as the developmental habitat for the sub-adult stage. Loggerheads are predators of benthic invertebrates.

Although loggerhead sea turtles are expected to be found foraging in nearshore habitats within Biscayne Bay, the increased freshwater flows associated with the Biscayne Bay Coastal Wetlands Phase 1 project may reduce nearshore salinity concentrations but should not have an adverse effect on crustaceans, mollusks or other invertebrate food sources utilized by this species. Additionally, no loggerhead sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the U.S. Army Corps of Engineers has determined the loggerhead sea turtle may be affected, but would not likely be adversely affected by the proposed project.

Federally threatened or endangered species that are known to potentially exist within close proximity of the project area, but which would not likely be of concern are discussed in detail below:

A.4.6.1.15 The Everglades Snail Kite and "No Effect" Determination

The Everglades snail kite inhabits relatively open freshwater marshes, which support adequate populations of apple snail, upon which this bird feeds almost exclusively. Favorable areas consist of extensive shallow, open water such as sloughs and flats, vegetated by sawgrass and spikerush (*Eleocharis* spp). The areas are often interspersed with tree islands or small groups of scattered shrubs and trees which serve as perching and nesting sites. The water level must be sufficiently stable to prevent loss of the food supply through drying out of the surface.

The Everglades snail kite is threatened primarily by habitat loss and destruction. Widespread drainage has permanently lowered the water table in some areas. This drainage permitted development in areas that were once Everglades snail kite habitat. In addition to loss of habitat through drainage, large areas of marsh are heavily infested with water hyacinth, which inhibits the Everglades snail kite's ability to see its prey (FWS, May 1996).

Although some Everglades snail kite foraging occurs in the freshwater wetlands within the project area, the overall utilization of project waters for a food base is minimal due to tidal influence resulting in brackish to hyper-saline conditions which are typically unsuitable for their main food source, the apple snail. Rehydration of freshwater wetlands between North Canal and C-103 should increase foraging opportunities for the snail kite. Because of potential expansion of foraging opportunities in the freshwater wetlands west of L-31E, and the unsuitability of the brackish coastal wetlands east of L-31E for apple snails, the U.S. Army Corps of Engineers has determined the proposed project would have no adverse effect on the Everglade snail kite.

Everglade Snail Kite Critical Habitat

Additionally, the project would have no effect on critical habitat for the Everglade snail kite.

A.4.6.1.16 Cape Sable seaside sparrow and "No Effect" Determination

Cape Sable seaside sparrows are medium sized sparrows restricted to the Florida peninsula. They are non-migratory residents of freshwater to brackish marshes. The Cape Sable seaside sparrows are known to nest in mixed marl prairie communities that often include muhly grass *(Muhlenbergia filipes*). These short-hydroperiod prairies contain moderately dense, clumped grasses, with open space permitting ground movements by the sparrows. They commonly feed on soft-bodied insects from low-lying vegetation and avoid sites with permanent water cover.

The known distribution of the Cape Sable seaside sparrow is restricted to two areas of marl prairies east and west of Shark River Slough in the Everglades region, and the edge of Taylor Slough along the southern boundary of the water preserve area project at the Bird Drive Basin in Miami-Dade County.

Alterations of their habitat have occurred as a result of changes in the distribution, timing, and quantity of water flows in south Florida. Water flow changes appear to be the leading contributor to the decline in Cape Sable seaside sparrow population, which subsequently threatens the subspecies with extinction. Competition and predation also threatens the Cape Sable seaside sparrow. Raccoons *(Procyon lotor*), snakes, rice rats *(Oryzomys palustris*) and hawks may be the chief predators.

The closest prairie habitat and Cape Sable seaside sparrow sub-populations lie miles to the west or south of the project area. Sub-population F of the Cape Sable seaside sparrow is located 16.2 miles west of the Cutler Flow Way component. Sub-population C lies 15 miles west of the L-31E Culvert component and Sub-population D lies approximately ten miles southwest of the freshwater wetlands between C-103 and North Canal. Because the habitat in the project area is not suitable for this species, the U.S. Army Corps of Engineers has determined the project would have no effect on the Cape Sable seaside sparrow.

A.4.6.1.17 Roseate Tern and "No Effect" Determination

The roseate tern, a coastal species, nests on open sandy beaches away from potential predation and human disturbance. This species feeds in nearshore surf on small schooling fishes. In southern Florida, the roseate tern normally nests on isolated islands, rubble islets and dredge spoil. The only suitable nesting habitat for this species near the project area occurs on the Black Point

jetty and shore of spoil islands located just off the mouths of the C-102 and C-103 Canals. The proposed Biscayne Bay Coastal Wetlands project is not likely to affect these nesting areas. Therefore, the U.S. Army Corps of Engineers has determined the project would have no effect on the roseate tern.

A.4.6.1.18 Beach Jacquemontia and "No Effect" Determination

Beach jacquemontia is a coastal dune species. There is no habitat for this species within the Biscayne Bay Coastal Wetlands project area or areas anticipated to be affected by the project. Therefore, the U.S. Army Corps of Engineers has determined the project would have no effect on the beach jacquemontia.

A.4.6.1.19 Johnson's Seagrass and "No Effect" Determination

Johnson's seagrass is a rare plant that may have the most limited distribution of any seagrass in existence. It frequently occurs in small isolated patches from centimeters to a few meters in diameter. Johnson's seagrass appears to reproduce only through asexual branching. There are no known seed banks. The leaves are generally two to five centimeters in length, and the rhizome internodes rarely exceed three to five centimeters in length. Johnson's seagrass prefers to grow in coastal lagoons in the intertidal zone, or deeper than many other seagrasses. It fares worse in the intermediate areas where other seagrasses thrive. The species has been found in coarse sand and muddy substrates and in areas of turbid waters and high tidal currents. Johnson's seagrass is more tolerant of salinity, temperature, and desiccation variation than other seagrasses in the area. It has a disjunct and patchy distribution along the east coast of Florida from central Biscayne Bay to Sebastian Inlet. The largest patches have been documented inside Lake Worth Inlet. The southernmost distribution is reported to be in the vicinity of Virginia Key in Biscayne Bay.

Johnson's seagrass is not expected to be found within the project site since the southernmost distribution is reported to be in the vicinity of Virginia Key in Biscayne Bay (FR Vol. 63, No.177. 1998). Since the northernmost project limits are south of Virginia Key, the U.S. Army Corps of Engineers has determined the project would have no effect on Johnson's seagrass.

Johnson's seagrass Critical Habitat

Since the northernmost project limits are south of the known distribution area for this species, the project would have no effect on critical habitat for Johnson's seagrass.

A.4.6.1.20 Elkhorn Coral and "No Effect" Determination

Elkhorn coral is a large, branching coral with thick and sturdy antler-like branches. The dominant mode of reproduction is asexual, with new colonies forming when branches break off of a colony and reattach to the substrate. Sexual reproduction occurs via broadcast spawning of gametes into the water column once each year in August or September. Individual colonies are both male and female (simultaneous hermaphrodites). Colonies are fast growing: branches increase in length by two to four inches (five to ten centimeters) per year, with colonies reaching their maximum size in approximately ten to 12 years. Elkhorn coral was formerly the dominant species in shallow water (three to 16 feet [one to five meters] deep) throughout the Caribbean and on the Florida Reef Tract, forming extensive, densely aggregated thickets in areas of heavy surf. Coral colonies prefer exposed reef crest and fore reef environments in depths of less than 20 feet (six meters), although isolated corals may occur to 65 feet (20 meters). Elkhorn coral is found on coral reefs in southern Florida, the Bahamas, and throughout the Caribbean. Its northern limit is Broward County, off Pompano Beach, and it extends south to Venezuela. Since 1980, populations have collapsed throughout their range from disease outbreaks with losses compounded locally by hurricanes, increased predation, bleaching, elevated temperatures and other factors.

Elkhorn coral may be found outside the waters of Biscayne Bay, specifically within the offshore reef track in Biscayne National Park where salinities are stable (35 ppt) and more representative of open ocean conditions. The reef tract is approximately five to eight miles seaward of the shoreline. Anticipated salinity alterations resulting from project activities are not expected to occur beyond 1,500 meters from shore. Because the reef tract where elkhorn coral resides is several miles outside of any projected salinity changes, the U.S. Army Corps of Engineers has determined the proposed project would have no effect on elkhorn coral.

Elkhorn Coral Critical Habitat

Salinities, due to project operations, will not be altered in the vicinity of critical habitat; therefore, the project would have no effect on critical habitat for elkhorn coral.

A.4.6.1.21 Staghorn Coral and "No Effect" Determination

Staghorn coral is a branching coral with cylindrical branches ranging from a few centimeters to over six and a half feet (two meters) in length. The dominant mode of reproduction for staghorn coral is asexual fragmentation, with new colonies forming when branches break off a colony and attach to the substrate. Similar to elkhorn coral, sexual reproduction occurs via broadcast spawning of

gametes into the water column once each year in August or September. Individual colonies are both male and female. This coral exhibits the fastest growth of all known western Atlantic corals, with branches increasing in length by four to eight inches (ten to 20 centimeters) per year. Staghorn coral has been one of the three most important Caribbean corals in terms of its contribution to reef growth and fish habitat. Staghorn coral occur in back reef and fore reef environments from 0-98 feet (0-30 meters) deep. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability. Staghorn coral occur on the Florida Reef Tract north of the Florida Keys off the Atlantic coast of southeast Florida, and colonies are also found throughout the Florida Keys, the Bahamas and the Caribbean islands. This coral occurs in the western Gulf of Mexico, but is absent from United States waters in the Gulf of Mexico. It also occurs in Bermuda and the west coast of South America. The northernmost documented colony of staghorn coral occurs offshore from Palm Beach County, Florida. The greatest source of region-wide mortality for staghorn coral has been disease outbreaks, mainly of white band disease. Other, more localized losses have been caused by hurricanes, increased predation, bleaching, algae overgrowth, human impacts and other factors. This species is particularly susceptible to damage from sedimentation and is sensitive to temperature and salinity variation.

Staghorn coral may be found outside the waters of Biscayne Bay, specifically within the offshore reef track in BNP where salinities are stable (35 ppt) and more representative of open ocean conditions. The reef tract is approximately five to eight miles seaward of the shoreline. Anticipated salinity alterations resulting from project activities are not expected to occur beyond 1,500 meters from shore. Because the reef tract where staghorn coral resides is several miles outside of any projected salinity changes, the U.S. Army Corps of Engineers has determined the proposed project would have no effect on staghorn coral.

Staghorn Coral Critical Habitat

Salinities, due to project operations, will not be altered in the vicinity of critical habitat designated for staghorn coral; therefore, the project would have no effect on critical habitat for this species.

A.4.6.2 State Listed Species

The project area contains habitat suitable for the nesting and/or foraging of seven state-listed threatened and endangered species and thirteen species of special concern. Threatened and endangered species include the arctic peregrine falcon, and Florida mastiff bat, the white-crowned pigeon, least tern, piping plover, Miami black-headed snake, and the Everglades mink. Species of special concern include the roseate spoonbill, limpkin, little blue heron, reddish egret, snowy egret, tricolored heron, white ibis, brown pelican, black skimmer,

mangrove rivulus, gopher tortoise, American alligator, and the Florida tree snail.

While small foraging or nesting areas utilized by many of these species may be affected by this project, construction impacts would be minimal and temporary, and not likely to adversely affect any protected species. A successful implementation of existing wetlands restoration would increase the functional capacity of affected habitats, thus benefiting the species utilizing these areas. Therefore, no adverse impacts are anticipated to state listed species as a result of this project.

A.4.6.3 Other Species Discussion

On July 9 2007, the U.S. Fish and Wildlife Service published the final rule in the Federal Register announcing the removal of the bald eagle from the federal list of endangered and threatened wildlife. The rule became effective on August 8, 2007. However, this species remains protected under the Migratory Bird Treaty Act and the Bald Eagle Protection Act, therefore potential impacts from project activities are included in this discussion.

Until recently, the most proximal bald eagle site was located on West Arseniker Key, which is southeast of Turkey Point and approximately 3.4 miles from the project boundary. However, a nest has recently been recorded in the Black Creek wetlands within the project area. Another known nest is located 13 miles northeast of the Deering Estate subcomponent. Due to the confirmation of these nests it can be surmised that habitat is conducive for bald eagle nesting and foraging within the project area.

While small areas of foraging habitat utilized by the bald eagle may be affected during construction of this project, impacts to these areas are not likely to adversely affect this protected species. Furthermore, the Biscayne Bay system provides foraging habitat away from proposed construction activities. The diversion of canal discharges is expected to spread freshwater over a larger area of wetlands which should provide more foraging opportunities for the bald eagle. As a result, the project may affect, but would not likely adversely affect the bald eagle.

A.4.6.4 Direct Effects

The proposed Biscayne Bay Coastal Wetlands Phase I project consists of three geographical regions that include the Deering Estate, the Cutler Flow Way, and the L-31E culverts. These regions along with areas impacted by project features are depicted in ***Figure A4-9, Figure A4-10, Figure A4-11*** and ***Figure A4-12***.

FIGURE A4-9: BISCAYNE BAY COASTAL WETLANDS DEERING ESTATE

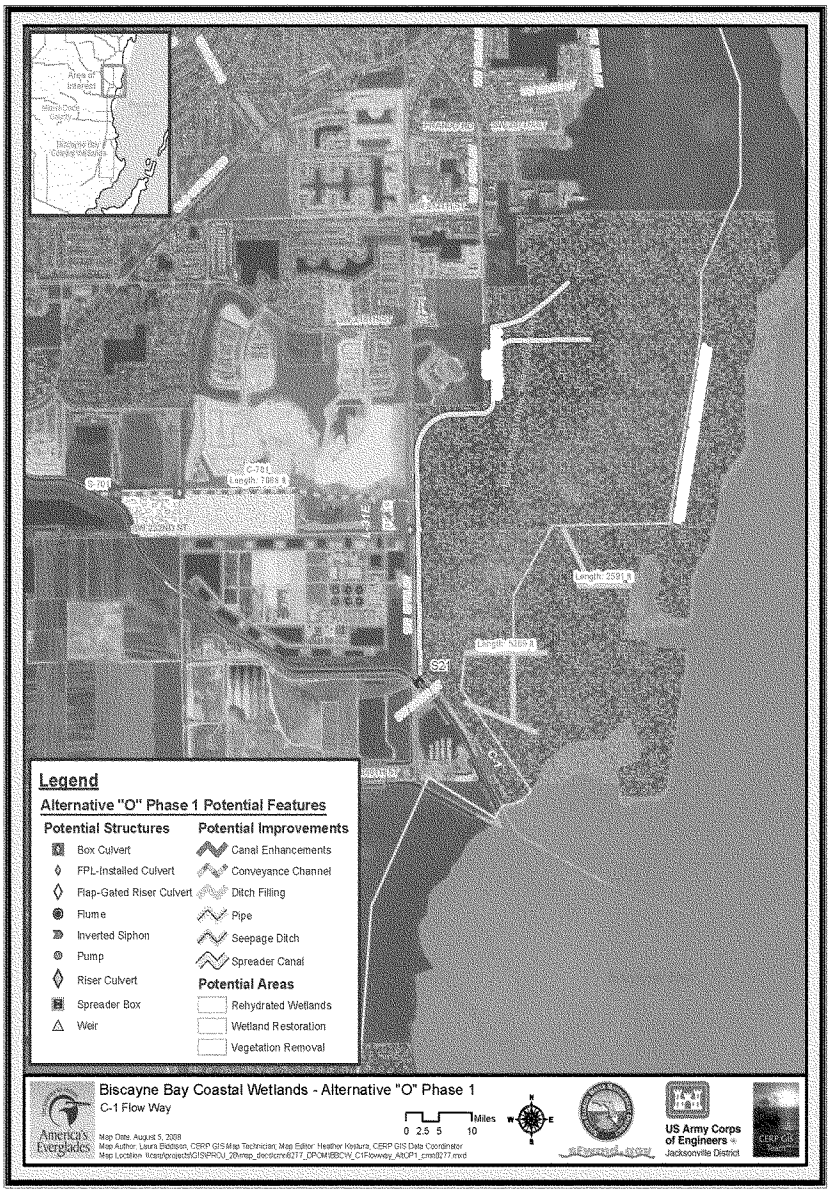

FIGURE A4-10: BISCAYNE BAY COASTAL WETLANDS C-1 FLOW WAY

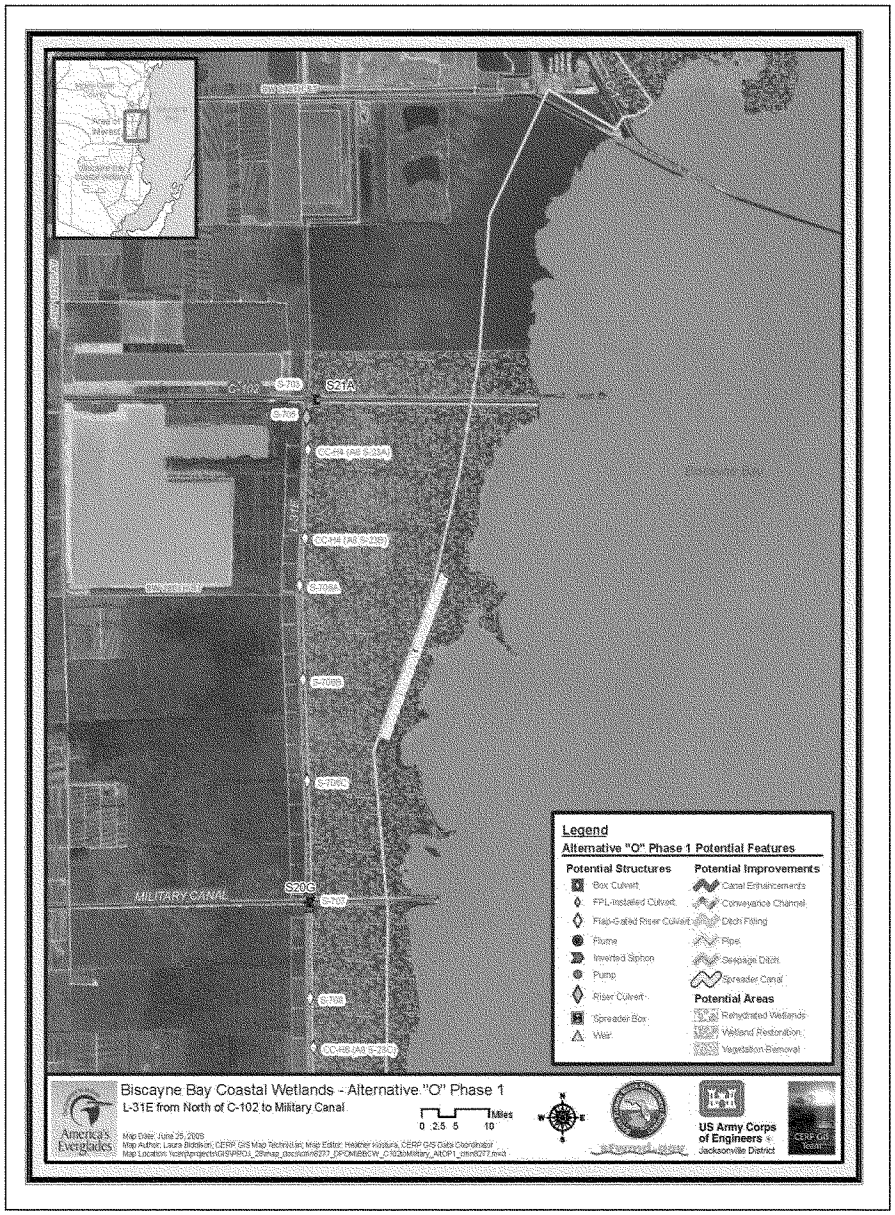

FIGURE A4-11: BISCAYNE BAY COASTAL WETLANDS L-31 FROM NORTH OF C-102 TO MILITARY CANAL

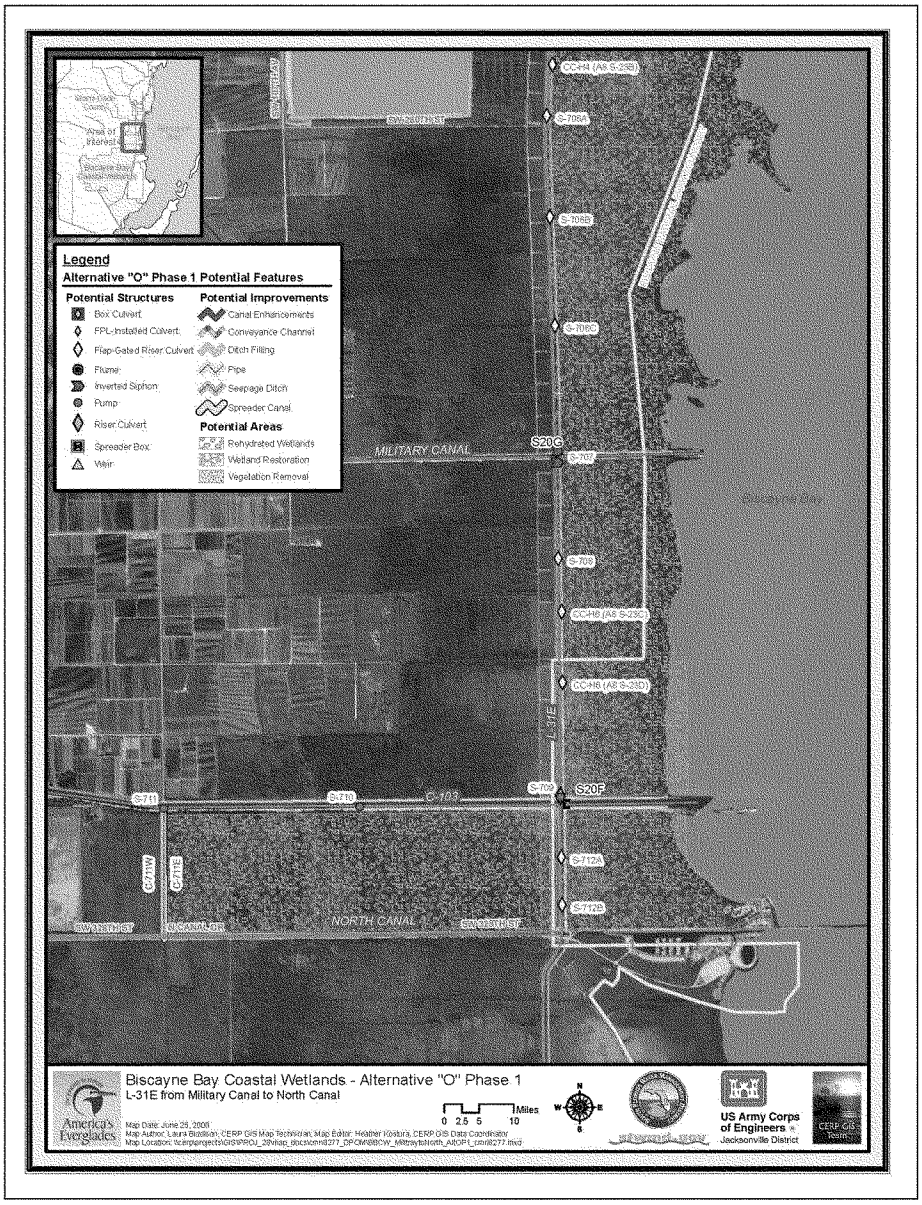

FIGURE A4-12: BISCAYNE BAY COASTAL WETLANDS L-31E FROM MILITARY CANAL TO NORTH CANAL

The presence of a system of coastal wetlands integrated by the inflow of freshwater, and to varying degrees by tidal exchange is essential to the restoration of a fully functional Biscayne Bay ecosystem. The proposed Biscayne Bay Coastal Wetlands project components would improve freshwater delivery to freshwater and coastal wetlands. Construction of the project would redistribute flow to the saltwater wetlands and nearshore bay areas which may result in desirable changes to salinity. Changes in salinity may affect water quality, seagrasses, and/or marine flora and fauna in the nearshore areas, although the impacts to the aquatic resources are anticipated to be beneficial. The Biscayne Bay Coastal Wetlands Phase I project is required to meet state water standards. Currently the source water, which would be redistributed throughout the coastal wetlands and eventually make its way to Biscayne Bay, meets Class 3 standards. Project construction activities should have limited impacts to existing vegetative communities in the project area and no effect on the nearshore communities adjacent to the project area (***Table A4-2***).

Deering Estate

Within the Deering Estate, the habitat types potentially impacted by project features include an excavated Spur Canal off the C-100 Canal, an abandoned mango and avocado grove on the Powers Addition Parcel and old Cutler Road. The project benefits include the restoration of historical overland flows of freshwater through a mixed forested wetland system that includes pine rockland and rockland hammock transitioning into a mixed forested wetland, and then a red-mangrove dominated wetland system. Restoration of overland freshwater flows would occur on the east side of Old Cutler Road within the Deering Estate at the Cutler Wetlands and would enhance existing wetland habitat for the benefit of plant and animal resources. The restored hydrology would increase the periodic inundation of the surrounding wetlands, which should enhance the habitat value of that system utilized by fish and wildlife resources including potential Federal and/or state listed species that inhabit the area. Constructing the spur canal extension and the pump station would occur on uplands that have been utilized for agricultural purposes. This project is expected to have a beneficial effect on the fish and wildlife resources including threatened and endangered species utilizing the affected project area.

Cutler Wetlands C-1 Flow Way

Within the Cutler Wetlands C-1 Flow Way, the habitat types to be potentially impacted by project features include the C-1 and L-31 canals, exotic wetland hardwood areas dominated by Brazilian pepper, a man-made freshwater marsh dominated by cattails, a forested wetland dominated by Brazilian pepper, and a forested mangrove swamp. The project benefits include the enhancement of forested upland areas, the rehydration of coastal wetlands, and the restoration of

historic overland flows of water through coastal wetlands. The upland enhancement would increase habitat value to Federal and/or state listed species along this project segment by removing dense stands of invasive, exotic species and replanting native vegetation between the C-1 Canal and SW 87th Avenue. The rehydration of coastal wetlands would occur on the east side of SW 87th Avenue and would enhance the wetland habitat value of this system for several Federal and/or state listed plant and animal species. The restoration of historic, overland surface water flows would be accomplished by filling in pre-determined ditches that were previously excavated, and altered surface water drainage and inundation periods in the coastal wetlands east of SW 87th Avenue. The restoration of historic drainage and inundation periods should enhance wetland habitat utilized by fish and wildlife resources including federal and/or state listed species. Rerouting water from the C-1 Canal to the rehydration area would improve wetland hydrology. The removal of exotic vegetation from the wetlands would improve wetland function and value.

L-31E Culvert Segment

Within the L-31E Culvert segment, the habitat types to be affected include the L-31E Canal, a filled levee road, a graminoid marsh system with sparse mangroves, and a forested mangrove swamp. The project benefits include the restoration of historic overland water flows and rehydration of coastal wetlands by the installation of culverts. The rehydration and restoration of coastal wetlands would occur along the east side of the L-31E Canal and would enhance the wildlife habitat of these coastal wetlands for potential utilization of wildlife including federal and/or state listed species.

A.4.6.4.1 Impacts to Vegetative Communities

A discussion and quantification of projected impacts to the vegetative communities is summarized in ***Table A4-2***.

The features of the Biscayne Bay Coastal Wetlands Phase 1 project include pumps, a spreader canal, canal staging, and several culvert structures to manage flows for optimal restoration opportunities to adjacent freshwater and saltwater wetlands. Project construction activities should have minimal adverse impacts to existing vegetative communities and no effect on nearshore habitats. The existing (preconstruction) vegetative communities consist of pine flatwoods; tropical hardwoods; mixed wetland hardwoods; saltwater marshes, freshwater marshes, mangrove swamps; exotic wetland hardwoods; and vegetated non-forested wetlands. Other existing habitats include abandoned groves; tree nurseries; and exotic vegetation such as Brazilian pepper and Australian pine.

Post-construction, the project would consist of approximately 4,800 acres of rehydrated wetlands, restored wetlands, and exotic vegetation removal. The direct effects of this project to existing vegetative communities include the displacement of 18 acres for canal widening and construction along with a minimal loss of vegetation for other project feature construction that includes a small berm, seepage collector ditch, pump structures and associated pump stations. Despite the direct removal of wetland vegetation, this project would compensate for this loss with the restoration and rehydration of approximately 4,800 acres of freshwater and coastal wetlands.

TABLE A4-2: DESCRIPTION AND QUANTIFICATION OF HABITATS AFFECTED BY THE BISCAYNE BAY COASTAL WETLANDS PROJECT PHASE 1

Project Sub-Region	Construction Features	Vegetative Type	Acres Impacted
Deering Estate	Pump station, spur canal extension	Mixed Forested Wetlands	6.0
Cutler C-1	Pumps, conveyance canal, spreader	Herbaceous Upland Shrub & Brushland Mangrove Swamp Mixed Wetland Hardwoods Mixed Shrubs	0.9 3.9 2.1 31.5 6.7
L-31	Pumps, spreader, culverts	Mangrove Swamps Mixed Wetland Hardwoods Mixed Shrubs Wetland Forested Mixed Freshwater Marshes	3.0 2.5 3.0 1.4 0.3
Total Acres Affected			**61.3**

A.4.6.5 Indirect Effects

The Deering Estate component would ultimately improve water quality in Biscayne Bay by redirecting the freshwater flows across coastal wetlands that currently discharges directly into Biscayne Bay via the C-1 Canal.

The Cutler Wetlands C-1 Flow Way component routes water from the C-1 Canal to a rehydration area. A spreader swale would be created to distribute the water across the rehydration area. This project would include exotic vegetation removal from parcels located along the flow way, and the back-filling of select mosquito ditches located within the rehydration area.

The installation of culverts along L-31E would partially restore historic overland water flows, rehydrate the coastal wetlands, and ultimately improve water

quality in Biscayne Bay. The culverts are intended for use without the stop logs within the riser.

As a result of rehydration and overall restoration of freshwater and coastal wetland systems, this project is expected to indirectly benefit natural resources, including threatened and endangered species. Marine organisms associated with hard bottom communities will benefit from the reduction of point-source canal discharges into Biscayne Bay which stabilize water quality and salinities required to improve and sustain the nearshore communities. Seagrasses, and Sea turtles who feed on seagrasses and/or benthic invertebrates in the project area, are also expected to benefit from the redirection and dispersion of fresh water across the wetland systems prior to entering the Bay.

A.4.6.6 Interrelated and Interdependent Actions

Each of the Biscayne Bay Coastal Wetland project components is independent. However, each individual overall goal is similar in that the projects propose to ultimately restore the overland sheet flow through the construction of spreader canals and other features. Restoration of the 13,000 acre project area will be achieved through two separate phases; Phase 1 is expected to restore approximately 4,800 acres. The more natural water flow would improve the ecology of Biscayne Bay including its freshwater and tidal wetlands, nearshore bay habitat, estuarine nursery habitat, oysters, and the oyster reef community, as well as water quality enhancement. Each component contributes to help improve water quality in Biscayne Bay.

A.4.6.7 Potential Incidental Take Resulting from Project Activities:

Due to the limited direct impacts anticipated, along with no planned in-water construction, no incidental take of any species is expected.

A.4.6.8 Cumulative Effects of State and Private Actions in the Project Area

The Deering Estate was developed during the late 1800s with dredging of the slough (i.e., Cutler Creek I, 1899), and an elaborate system of flood control canals was created in the 1950s. The new system diverted water around the Deering Estate, exiting to the Bay on the property's southern border thus modifying the primary inflow area to the historic Cutler Slough, which conveyed freshwater through what is now known as the Deering Glade. Dredging of Cutler Creek significantly modified the natural hydroperiod by directing inflows deeper in the wetland/floodplain and creating a channelized surface outflow route (i.e. the Cutler Creek Canal) that historically did not exist. These hydrologic alterations have impacted the lands which include a habitat continuum ranging from pine rockland and rockland hammock to tidally-influenced mangrove wetlands.

In the 1920s a network of canals were constructed to provide drainage and flood protection. District canals collect and transport storm water from urban and other developed areas in south Miami-Dade County to provide flood protection. The C-1 Canal is located west of and adjoining the western section of the project and drains existing residential and agricultural areas. The C-102 Canal and the C-103 Canal drain into separate basins, while the Military Canal drains storm water from the Homestead Air Force base. The L-31E Canal runs parallel to the shore and acts as a salinity intrusion barrier.

Farm, mosquito and drainage ditches exist within the coastal wetland areas east of SW 87th Avenue, east of the L-31E canal near the C-102 Canal, and within the target rehydration areas. Runoff water collected in the canal basins is currently discharged to tide at control structure S-21 (C-1 Canal), S-21A (C-102 Canal), S-20F (C-103 Canal) and S-20G (Military Canal) under the South Florida Water Management District Criteria for flood control. The L-31E Culverts project is a component of the larger L-31E Flow Way project, which installs additional culverts among large improvements that include pumps, a spreader canal, and modifications to control structure operating criteria.

As development increases in the Miami-Dade area, it is anticipated that the loss of functional value of the estuarine habitats will continue to decline. As the freshwater discharges in the Biscayne Bay via the canals, the productivity and health of the submerged aquatic vegetation decreases.

A.4.6.9 Cumulative Effects of Proposed Action

As outlined in the project objectives, the project features are designed to enhance or restore wetland and nearshore bay habitat functions by removing point source discharges of freshwater directly into Biscayne Bay, rehydrating coastal wetlands, and restoring historical overland flows of freshwater.

Within the Deering Estate, the project benefits include the creation of an educational, wetland area and the restoration of historical overland flows of freshwater through a mixed forested wetland system and the surrounding mangrove wetland. The wetland creation area which will be constructed on the west side of Old Cutler Road within the Powers Addition Parcel could provide additional wetland habitat for wildlife resources including Federal and state listed species. Restoration of overland freshwater flows would occur on the east side of Old Cutler Road within the Deering Estate at Cutler Wetlands and would enhance existing, mixed forested wetland habitat for fish and wildlife resources including Federal and/or state listed plant and animal species. The restored hydrology would increase the periodic inundation of the surrounding mangrove wetlands, which would enhance the habitat value of that system for fish and wildlife resources including federal and/or state listed species.

Within the Cutler Wetlands C-1 Flow Way, the project benefits include the rehydration of coastal wetlands, and the restoration of historic overland flows of water through coastal wetlands. The upland enhancement would increase habitat value to Federal and/or state listed plant and animal species along this project segment by removing dense stands of invasive, exotic species and replanting with native vegetation between the C-1 Canal and SW 87th Avenue. The rehydration of coastal wetlands would occur on the east side of SW 87th Avenue and would enhance the wetland habitat value of this system for utilization of fish and wildlife resources. The restoration of historic, overland surface water flows will be accomplished by filling in pre-determined ditches that were previously excavated and altered surface water drainage and inundation periods in the coastal wetlands east of SW 87th Avenue. The restoration of historic drainage and inundation periods would enhance the wetland habitat available to fish and wildlife resources and potentially for federal and/or state listed species.

Within the L-31E Culvert segment, the project benefits include the restoration of historic overland water flows and rehydration of coastal wetlands. The rehydration and restoration of coastal wetlands would occur along the east side of the L-31E Canal and a spreader canal from C-103 to the North Canal would deliver overland flows eastward to hydrate freshwater wetlands. These operations are expected to enhance the wildlife habitat of these wetlands for several federal and/or state listed species.

A.4.7 Conservation Measures

The U.S. Army Corps of Engineers acknowledges the potential usage and occurrence of the previously discussed threatened and endangered species within the Biscayne Bay Coastal Wetlands Phase 1 project boundaries. Disturbance of listed species would be minimized or avoided by limiting construction and other disturbances during critical times. This project would follow the Sea Turtle and Smalltooth Sawfish Construction Conditions dated March 23, 2006. The U.S. Army Corps of Engineers also proposes to implement habitat management guidelines for the wood stork, construction protection measures for the American crocodile; and the standard manatee measures, Eastern indigo snake (including removal of non-native vegetation utilizing herbicide treatment methods), and shorebird protection measures established by the State of Florida Fish and Wildlife Conservation Commission, the Audubon Society, and the U.S. Fish and Wildlife Service.

A.4.8 Conclusion

The U.S. Army Corps of Engineers, Jacksonville District acknowledges the probable existence of 17 federally listed threatened and endangered species within the boundaries of the Biscayne Bay Coastal Wetlands Phase 1 project.

Based on available information, it is evident that the American crocodile, American alligator, West Indian manatee, Florida panther, smalltooth sawfish, wood stork, Eastern indigo snake, the Schaus swallowtail butterfly, the green sea turtle, hawksbill sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, the loggerhead sea turtle, the Crenulated lead-plant, Garber's spurge, tiny polygala, deltoid spurge, and Small's milkpea resides, travels, and/or forages within the project area and could be affected by future operations of the project.

Other federally threatened or endangered species that are known to exist or potentially exist within close proximity of the project area, but which would not likely be of concern in this study due to the lack of suitable habitat include, Everglade snail kite, Cape Sable seaside sparrow, roseate tern, beach jacquemontia, Johnson's seagrass, elkhorn coral, and staghorn coral. Potential impacts from project activities to state-listed endangered, threatened, or species of special concern would be minimal and temporary, and not likely to adversely affect any protected species.

As a result of the implementation of the conservation measures identified in ***Section A.3.7***, it is the determination of the U.S. Army Corps of Engineers that the proposed project may affect, but would not likely adversely affect the American crocodile, American alligator, West Indian manatee, Florida panther, smalltooth sawfish, wood stork, Eastern indigo snake, the Schaus swallowtail butterfly, the green sea turtle, hawksbill sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, the loggerhead sea turtle, the Crenulated lead-plant, Garber's spurge, tiny polygala, deltoid spurge, and Small's milkpea.

The U.S. Army Corps of Engineers further determines that due to the lack of suitable habitat, implementation of the proposed project will have no adverse effects to the Everglades snail kite, Cape Sable seaside sparrow, roseate tern, beach jacquemontia, Johnson's seagrass, elkhorn coral, and staghorn coral.

The U.S. Army Corps of Engineers will continue discussions with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and the Florida Fish and Wildlife Conservation Commission in the event of project design or operational modifications. This document will be submitted for informal consultation with the U.S. Fish and Wildlife Service and National Marine Fisheries Service pursuant to Section 7 of the Endangered Species Act.

A.4.9 List of Preparers

Coordination and contacts were made with the following people during preparation of this Biological Assessment for the Biscayne Bay Coastal Wetlands Phase 1 project.

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A.4.11 Appendix 1: Standard Protection Measures

SEA TURTLE AND SMALLTOOTH SAWFISH CONSTRUCTION CONDITIONS

The permittee shall comply with the following protected species construction conditions:

a. The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.
b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.
c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.
d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.
e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.
f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.
g. Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the primary consultation.

Revised: March 23, 2006

A.4.12 USFWS Concurrence Letter on the Biological Assessment

United States Department of the Interior

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

November 18, 2009

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Post Office Box 4970
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Service Federal Activity Code: 41420-2006-FA-0261
Service Consultation Code: 41420-2006-R-0569
Date Received: October 29, 2008
Project: Biscayne Bay Coastal Wetlands Phase 1
County: Miami-Dade

Dear Dr. Griffith:

The Fish and Wildlife Service (Service) has reviewed your Biological Assessment (BA) dated October 29, 2008, and other information submitted by the U.S. Army Corps of Engineers (Corps) for the Comprehensive Everglades Restoration Plan (CERP) Biscayne Bay Coastal Wetlands (BBCW) Phase I Project Clean Water Act section 404 permit application. This letter 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.*); the Fish and Wildlife Coordination Act of 1958, as amended (48 Stat. 401: 16 U.S.C. 661 *et seq.*); and the Marine Mammal Protection Act of 1972, as amended (MMPA) (16 U.S.C. 1361 *et seq.*). These comments are to be used in your determination of 404(b)(1) Guidelines compliance (40 CFR 230) and in your public interest review (33 CFR 320.4) as they relate to the protection of fish and wildlife resources. Your letter requested Service concurrence with the Corps' effect determinations under the ESA. A complete administrative record of this consultation is on file in the Service's South Florida Ecological Services Office; Vero Beach, Florida.

CONSULTATION HISTORY

In a letter dated January 24, 2005, the Service provided the Corps with a threatened and endangered species list for the BBCW project area. The Corps consulted with the Service on the State of Florida's Expedited Construction Program (also known as Acceler8) BBCW project through letters dated March 5, 2007, and August 8, 2007, on the potential effects that the proposed project components may have on federally listed threatened and endangered species that may be present in the project study area. The BBCW Acceler8 Project is very similar in purpose and footprint to the BBCW Phase 1 Project. The Corps' consultation with the Service included the L 31 E Culvert (SAJ-1994-1327), the Deering Flow-way (SAJ-2007-139), and the

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Cutler Flow-way (SAJ-2006-7926) components. The Service agreed with the Corps's "no effect" determination on the Everglade snail kite (*Rostrhamus sociablis plumbeus*), Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*), roseate tern (*Sterna dougallii dougallii*), and beach jaquemontia (*Jacquemontia reclinata*). The Service also concurred with the Corps' "may effect, but not likely to adversely affect" determination on the American crocodile (*Crocodylus acutus*), West Indian manatee (*Trichechus manatus*), Florida panther (*Puma concolor coryi*), wood stork (*Mycteria americana*), bald eagle (*Haliaeetus leucocephalus*), eastern indigo snake (*Drymarchon corais couperi*), loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), Kemp's Ridley sea turtle (*Lepidochelys kempii*), hawksbill sea turtle (*Eretmochelys imbricate*), Schaus swallowtail butterfly (*Heraclides aristodemus ponceanus*), crenulated lead-plant (*Amorpha crenulata*), Garber's spurge (*Chamaesyce garberii*), tiny polygala (*Polygala smallii*), deltoid spurge (*Chamaesyce deltoidea* ssp. *Deltoidea*), and Small's milkpea (*Galactia smallii*). The Service also concurred with the Corps' "may effect, but not likely to adversely affect" determination for critical habitat for the American crocodile and West Indian manatee. In its March 5 and August 7, 2007, consultation letters, the Corps included Johnson's seagrass (*Halophila johnsonii*), smalltooth sawfish (*Pristia pectinata*), elkhorn coral (*Acropora palmata*), and staghorn coral (*Acropora cervicornis*). The Service recommended that the Corps consult with the National Oceanic and Atmospheric Administration (NOAA) Fisheries on these species as well as for all sea turtles in the water as these species fall under NOAA's jurisdiction. The above is documented in the Service's concurrence letter dated August 8, 2007.

The BBCW Acceler8 project will begin construction in Fiscal Year 2010; whereas, the BBCW Phase 1 Project has yet to be approved by Congress and construction is not anticipated to begin for several more years. Thus, the BBCW Acceler8 Project and BBCW Phase 1 Project are considered separate and require separate ESA consultation, even though the projects are very similar. Through coordination with the Corps subsequent to the BBCW Acceler8 consultation, the threatened and endangered species list for Phase 1 of the BBCW project was modified to exclude the bald eagle. The bald eagle was federally delisted as a threatened species under the ESA on July 9, 2007. Therefore, the Corps' BA dated October 29, 2008, for the BBCW Phase 1 Project includes all of the federally listed species and critical habitat consulted on for the BBCW Acceler-8 Project (listed above) except for the bald eagle.

PROJECT AUTHORIZATION AND PURPOSE

The Biscayne Bay Coastal Wetlands project is a component of CERP, which was approved by Congress as part of the WRDA 2000 and signed by the President of the United States in December 1999. The CERP is based on the Central and Southern Florida Project Comprehensive Review Study (Restudy) (Corps 1999). The Biscayne Bay Coastal Wetlands project is one of 68 CERP projects. The Biscayne Bay Coastal Wetlands project as defined in the CERP is a multi-purpose project that provides for ecosystem restoration of freshwater wetlands, tidal wetlands, nearshore habitat and water quality enhancement.

The goal of the BBCW Project is to restore or enhance freshwater wetlands, tidal wetlands, and nearshore bay habitat by redirecting freshwater from major conveyance canals into adjacent coastal wetlands. The intent is to rehydrate the coastal wetlands, provide a more natural flow of freshwater to western Biscayne Bay, and reduce harmful point source discharges to the bay. The project includes pump stations, spreader swales, flow-ways, levees, culverts, and backfilling or plugging drainage and mosquito ditches. The project is located in southeast Miami-Dade County and includes undeveloped coastal wetlands extending from the C-100 Basin south through the Model Lands to Barnes and Card Sounds.

As outlined in the BBCW Project Management Plan, the objectives of the Biscayne Bay Coastal Wetlands project are to:

1. Re-establish productive nursery habitat along the shoreline;
2. Redistribute freshwater flow to minimize point source discharges to improve freshwater and estuarine habitat;
3. Enhance and improve quantity, quality, timing and distribution of freshwater to the Bay, including Biscayne National Park;
4. Preserve and restore spatial extent of natural coastal glades habitat;
5. Reestablish connectivity between the Biscayne Bay Coastal Wetlands, C 111 Basin, Model Lands and adjacent basins; and
6. Restore nearshore and tidal wetland salinity regimes.

For various reasons, construction of the BBCW Project will be phased over time. For planning purposes, the Corps will seek authorization for the project via two Project Implementation Reports (PIRs). PIR 1 describes the National Ecosystem Restoration (NER) Plan and Phase 1 of that Plan. Phase 1 includes components of the BBCW Acceler8 project and additional management measures and features that address primarily restoration of saltwater wetlands and nearshore bay areas. This increment includes the installation of pump stations, spreader swales, flow-ways, levees, culverts, and backfilling canals. Phase 2 will include the remaining features of the Tentatively Selected Plan (Alternative O) that will not be constructed under Phase 1, including the Barnes Sound Wetlands, remaining L-31 E Canal culverts, and the North Canal Flow-way.

This consultation addresses only Phase 1 of the BBCW Project.

PROJECT DESCRIPTION

The BBCW Phase 1 Project includes approximately 4,800 acres (ac) of salt water wetlands along the southwestern shore of Biscayne Bay between Shoal Point and Turkey Point in southeastern Miami-Dade County, along with approximately 4,800 ac of nearshore bay habitat. It is comprised of three primary geographic components: (1) the Deering Flow-way, (2) Cutler Flow-way, and (3) L-31E Culverts. Each component is described in detail below.

Deering Flow-way Component

The Deering Flow-way Component is located on the Charles Deering Estate at Cutler which is located in Sections 25 and 26, Township 55 South, Range 40 East, between Old Cutler Road and Biscayne Bay in southern Miami-Dade County. Features of this component include an extension of the C-100A Spur Canal and construction of a 2-acre freshwater wetland on the Power's Addition Property, and delivery of freshwater under Old Cutler Road to the Cutler Drain and coastal wetlands along Biscayne Bay (Figure 1). The Estate covers approximately 460 ac on the bayward edge of the Miami Rock Ridge that separates Biscayne Bay from what once was the eastern edge of the Everglades. A slough (*i.e.*, Cutler Creek in 1899) historically carried water from the Everglades to the bay through what is now the Deering Estate. The Estate was developed during the late 1800s which included dredging of the slough. Dredging of Cutler Creek modified the natural hydroperiod by directing inflows deeper in the floodplain and creating a channelized surface outflow route that historically did not exist. An elaborate system of flood control canals was created in this region in the 1950s, which diverted water around the Deering Estate, exiting to the bay on the property's southern border. These hydrologic alterations have impacted the lands on the estate, which include a habitat continuum ranging from pine rockland and rockland hammock to tidally influenced mangrove wetlands.

The proposed Deering Flow-way Component is designed to restore freshwater flows through the estate by routing water from the Spur Canal (off C-100A) to the east side of Old Cutler Road and onto the Estate (Figure 1). The Spur Canal would be extended approximately 500 feet (ft) across the southern portion of the Powers Property, a 9.7 ac tract that is part of the Deering Estate and is located west from Old Cutler Road to the junction of SW 158th and SW 159th Terrace between SW 157th Terrace and the Spur Canal. A 100 cubic feet per second (cfs) capacity pump station will be installed on the Powers Property to pump water from the Spur Canal Extension through a series of pipes underneath Old Cutler Road. A concrete spreader box will be installed on the east side of Old Cutler Road to distribute water eastward through the Cutler Drain and overland through the coastal wetlands toward Biscayne Bay. The Powers Property is surrounded by residential areas to the north, south and west. This parcel was an active mango (*Mangifera* spp.) and avocado (*Persea* spp.) grove with a single family house on the property. The vegetation within this area consists primarily of ruderal grasses, the grove trees, plus a scattered mix of herbaceous and woody vegetation including castor bean (*Ricinus communis*), cabbage palm (*Sabal palmetto*), laurel oak (*Quercus laurifolia*), strangler fig (*Ficus citrifolia*), banana trees (*Musa* spp.), and other species that occur in disturbed areas like roadsides, trails, or parking lots. The spur canal extension, pump station, conveyance pipe, and spreader feature are anticipated to displace 6.1 ac of the habitat described above and 0.02 ac of tropical hardwood hammock (Table 1).

The Deering Estate contains some unique habitat types, including pine rocklands (87 ac) that occupy the northwest section of the property. Its location and higher elevation will preclude the pine rocklands from being affected by changes in hydrology anticipated by project implementation. Most of the Biscayne Bay Coastal Wetlands project area's tropical hardwood hammock (162 ac) occupies the central western portion of the Deering Estate. Coastal band

mangrove accounts for 23 percent of the total coverage (110 ac), whereas salt marsh accounts for 5 percent (23 ac). These two vegetative types lie west of the hammock and pine rocklands habitat. The project should benefit the hardwood hammock and mangrove habitat through increased hydration from water redirected from the C-100 spur canal.

Cutler Flow-way Component

The Cutler Flow-way Component is located in southeastern Miami-Dade County within Sections 14, 15, 16, 17, 20, 21, 22 and 23, Township 56 South, and Range 40 East. It consists of a pump station, a conveyance canal, culverts for roadway and canal crossings, and a spreader canal (Figure 2). Other project features in this area include a gated culvert structure in the L-31E Canal and the plugging or back-filling of existing mosquito ditches found in the saltwater wetlands east of L-31E Levee and Canal.

The Cutler Flow-way Component is designed to route water from the C-1 Canal in the vicinity west of SW 97th Avenue and SW 232nd Street, to the rehydration area located east of SW 87th Avenue and south of the eastward extension of SW 232nd Street (Figure 2). A 400 cfs capacity pump station will be installed on the C-1 Canal, west of SW 97th Avenue and south of the western extension of SW 232nd Street. An open conveyance channel will extend 6,900 ft from the pump station, underneath SW 97th Avenue and SW 87th Avenue, to the rehydration area east of SW 87th Avenue south of the eastern extension of SW 232nd Street. A spreader swale will be created south and north of the eastward extension of SW 232nd Street, adjacent to and parallel of the east side of SW 87th Avenue to distribute the water across the rehydration area. The planned length of the spreader swale is 13,213 ft.

Features constructed for the Cutler Flow-way Component of the project (pump station, conveyance channel, and spreader canal) will affect 48.2 ac of non-native vegetation (almost exclusively Brazilian pepper [*Schinus terebinthifolius*]), 25.7 ac of native vegetation (mostly mangroves), and 12.4 ac of native and non-native mixed vegetation communities (Table 1). Also, approximately 2,500 linear ft of material will be used to plug existing mosquito ditches. The intent is to discourage the channelization of the water delivered to the area by the spreader canals.

The gated culvert structure located in L-31E Canal will be used for operational flexibility of the water levels in the reach of L-31E Canal north of C-1. It will be operated to limit the loss of freshwater through the existing coastal structure S-21 while still providing flood protection. The rehydration area (located between SW 87th Avenue and Biscayne Bay) that will be affected by redirected water from the C-1 is primarily a mangrove swamp that is a mix of red (*Rhizophora mangle*), white (*Laguncularia racemosa*), and black mangroves (*Avecinnia germinans*), and includes a mix of white mangrove, buttonwood (*Conocarpus erectus*) and Brazilian pepper in the western part.

L-31E Culvert Component

The L-31E Culverts Component is located in southeastern Miami-Dade County within Sections 28 and 33, Township 56 South, Range 40 East and Sections 4, 9, and 16, Township 57 South, Range 40 East. The L-31E Canal is a manmade canal that was excavated prior to 1940 to promote water control and serve as a salt water intrusion barrier. The L-31E Levee is composed of spoil from the excavation of the canal and acts as an access point and road. The levee restricts water from the canal from flowing east to coastal wetlands of Biscayne Bay. Historically, the coastal wetlands between L-31E and the bay were characterized as a relatively thin band of mature coastal mangrove forest along the shoreline with an extensive freshwater graminoid marsh community between the mangrove band and the location of L-31E. Construction of the levee and canal system and subsequent impedance of freshwater flows caused a transition of graminoid marsh to dwarf and transitional mangrove communities. The L-31E Culvert Component has two restoration sub-components, as follows:

L-31E North

The L-31E North area generally is described as the portion of the project between C-1 Canal and Military Canal. These features include structures that will isolate the L-31E Canal from the major discharge canals (C-102 and Military Canal) as well as gated riser culverts that will deliver water from the L-31E Canal, through the L-31E Levee, and discharge in the saltwater wetlands to the east (Figure 3). In addition, a pump station will be constructed to mimic the intent of the L-31E Culverts by pumping water over the L-31E Levee and deliver water directly to the saltwater wetlands just north of C-102.

Gated riser structures with 36-inch culverts will be constructed in L-31E Canal on the south side of C-102 and on the north side of Military Canal, to isolate that reach of L-31E Canal. These structures will allow operating L-31E Canal at a higher water level than currently possible and this will assist the L-31E Culverts in discharging water to the saltwater wetlands to the east. It is in this reach that five separate culverts will be located in L-31E. Additionally, this reach of L-31E Canal will be fed water from the C-102 by a 100 cfs pump station located just south of C-102 (in the same physical structure as the gated riser culvert).

The L-31E Culverts, situated on the L-31E North levee, consists of the installation of five 36-inch Corrugated Aluminum Alloy Culverts with flap gates with manatee protective barriers at five different locations. The culverts will gravity discharge to the east at the edge of the wetlands. The downstream side of the culverts will be equipped with aluminum flap gates for backflow prevention. The flap gate will inhibit direct saltwater intrusion during periods of high tide when the tailwater elevation could exceed the headwater elevation.

L-31E South

The L-31E South area generally is described as the portion of the project between Military Canal and North Canal (Figure 4). These features include structures that will isolate the L-31E Canal

from the major discharge canals (Military Canal and C-103) as well as gated riser culverts (L-31E Culverts) that will deliver water from the L-31E Canal, through the L-31E Levee, and discharge in the saltwater wetlands to the east. A pump station will be constructed to supply the isolated reaches of L-31E Canal with water. A freshwater wetland system is included in this region.

Gated Riser Structures with 36-inch culverts will be constructed in L-31E Canal on the south side of Military Canal and the north side of C-103, which will isolate this reach of L-31E Canal. A 40 cfs pump will work in conjunction with the gated structure on the north side of C-103 to provide water for that reach of L-31E Canal. Five additional culverts will be constructed in this area that will feed water from L-31E eastward to the salt water wetlands—three between Military Canal and C-103 and two between C-103 and North Canal. The design of these culverts will be identical to those described in the L-31E North section.

The freshwater wetland system consists of two pump stations, a spreader canal, a small berm, and a seepage collector ditch. The first pump is located on the northwestern edge of the wetland and delivers 40 cfs from C-103 to the spreader feature. The spreader canal runs from C-103 to the North Canal, approximately 2,619 ft. Once filled, the spreader canal will deliver overland flows westward to the freshwater wetland. To help alleviate flooding concerns to the west of the spreader canal, a small berm and seepage collector ditch will be constructed immediately to the west of the spreader canal, both the same length as the spreader canal, 2,619 ft. The seepage collector ditch will discharge via gravity to C-103. The second pump for the wetland is located approximately halfway from the first pump to L-31E Canal and will deliver an additional 40 cfs to the wetland. No spreader canal is associated with this pump and instead will deliver directly to a concrete spreader structure.

Features constructed for the L-31E Culverts component of the project (pump stations, spreader ditch, seepage canal, culverts, and risers) will impact 1.5 ac native vegetation, 4.9 ac of non-native vegetation (Brazilian pepper and Australian pine), and 4.3 ac of native and non-native mixed vegetation communities (Table 1).

THREATENED AND ENDANGERED SPECIES

The Corps' October 29, 2008, BA identified federally listed threatened and endangered species potentially affected by the BBCW Phase 1 Project. As noted above, the species list resulted from previous coordination between the Corps and the Service, including a species list provided to the Corps by the Service in a letter dated January 24, 2005. Subsequent coordination between the Corps and the Service resulted in modification of the Corps's October 29, 2008, BA species list. Table 2 provides a list of federally protected species potentially affected by the BBCW Phase 1 Project and the Corps effect determinations.

In addition to federally threatened and endangered species, the project area includes designated critical habitat for the American crocodile, Everglade snail kite, West Indian manatee, and Cape Sable seaside sparrow (Figure 5).

Table 2. Status (E=Endangered, T= Threatened) of federally listed species that may be affected by the Biscayne Bay Coastal Wetlands Phase 1 Project components, and the Corps' Endangered Species Act effect determinations.

Status	Common name	Scientific name	Not Likely To Adversely Effect	No Effect
E	West Indian manatee	*Trichechus manatus*	x	
	West Indian manatee critical habitat		x	
E	Florida panther	*Puma concolor coryi*	x	
E	wood stork	*Mycteria americana*	x	
T	American crocodile	*Crocodylus acutus*	x	
	American crocodile critical habitat		x	
T	eastern indigo snake	*Drymarchon corais couperi*	x	
E	green sea turtle	*Chelonia mydas*	x	
E	Kemp's Ridley sea turtle	*Lepidochelys kempii*	x	
E	hawksbill sea turtle	*Eretmochelys imbricata*	x	
E	leatherback sea turtle	*Dermochelys coriacea*	x	
T	loggerhead sea turtle	*Caretta caretta*	x	
E	smalltooth sawfish	*Pristia pectinata*	x	
E	Shaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	x	
E	crenulated lead plant	*Amorpha crenulata*	x	
T	Garber's spurge	*Chamaesyce garberii*	x	
E	tiny polygala	*Polygala smallii*	x	
E	deltoid spurge	*Chamaesyce deltoidea* ssp. *deltoidea*	x	
E	Small's milkpea	*Galactia smallii*	x	
T	Johnson's seagrass	*Halophila johnsonii*	x	
E	Everglade snail kite	*Rostrhamus sociablis plumbeus*		x
	Everglade snail kite critical habitat			x
E	Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*		x
	Cape Sable seaside sparrow critical habitat			x
T	roseate tern	*Sterna dougallii dougallii*		x
E	beach jacquemontia	*Jacquemontia reclinata*		x
T	elkhorn coral	*Acropora palmata*		x
T	staghorn coral	*Acropora cervicornis*		x

The Corps should consult with the National Oceanic and Atmospheric Administration (NOAA) Fisheries, Miami Office (305-595-8352), regarding effects to sea turtles at sea, Johnson's seagrass, smalltooth sawfish, and elkhorn and staghorn corals. Also, the study area includes critical habitat for Johnson's seagrass, elkhorn coral, and staghorn coral. The Corps should consult with NOAA Fisheries concerning these critical habitats.

West Indian Manatee

West Indian manatees occur throughout Biscayne Bay, but are most frequently observed in tributaries and near-shore seagrass beds (Service 1999). The extensive acreages of seagrass beds in the bay provide foraging areas for manatees. Manatees also depend upon canals as a source of freshwater and resting sites. Also, the species uses the deep canals as a cold-weather refuge. The relatively deep waters of the canals respond more slowly to temperature fluctuations at the air-water interface than the shallow bay waters. Thus, the canal waters remain warmer than open bay waters during the passage of winter cold fronts. Manatees are present year-round, and are most abundant in winter, when more than 130 have been counted on a single day in Biscayne Bay (Mayo and Markley 1995). Biscayne Bay is a seasonal migratory corridor for manatees, thus the total number of animals using the Biscayne Bay area is likely to be greater than the maximum number observed on any given day.

The diversion of water from the C-100, C-1, C-102, and C-103 canals would result in reducing the frequency of gate openings at the S-123, S-21, S21A, and S20F structures, which should benefit manatees by reducing the risk of harm (*e.g.*, injury) from these structures. Presently, manatees often congregate on the bayward side of gates to drink freshwater leaking through the gates. The Service does not anticipate any change in the availability of freshwater to manatees at the structures as water will continue to leak through the gates regardless of any change in opening or closing frequency. Also, redirecting freshwater from these canals should also provide additional and unimpeded sources of freshwater for manatees to drink along the bay shoreline in the project area, at least during the wet season (June through November) and early part of the dry season (December through May). The freshwater diverted from the canals to the nearshore areas is likely to lower the salinity regime in the nearshore area, which may affect species composition of local seagrass communities. For example, shoal grass (*Halodule wrightii*) and widgeon grass (*Ruppia maritima*) may increase in density and spatial extent, whereas, turtle grass (*Thalassia testudinum*) may decrease given the variability of these species tolerances to salinity (Fonseca et al. 1998). However, the overall seagrass biomass from these three species is not anticipated to be affected by the salinity changes. Seagrass is an important food source for manatees (Service 1999).

Potential project construction effects on manatees are limited to the extension of the spur canal on the Powers Property, the construction of the pump feature on the C-1, and the construction of the L-31E culverts. To ensure protection of manatees during construction of these features, the Corps, in its October, 29, 2008, BA, has committed to implement the *Standard Manatee Construction Conditions* (FWC 2005). In a BA addendum received by email (dated October 29, 2009) the Corps has agreed to follow the Service's (2006) manatee requirements for culverts (*Guidelines for Culverts Located in Manatee-Accessible CERP Projects*). Should blasting be necessary, the Corps has also agreed (in October 29, 2009, BA addendum) to follow the Service's "Guidelines for the Protection of Marine Animals During the Use of Explosives In the Waters of the State of Florida" and monitor local wildlife activity during this action. A qualified fish and wildlife biologist, approved by the Service and the FWC, should be present throughout blasting activities to monitor fish and wildlife response and offer advice to construction

personnel. Following these conditions should avoid or minimize effects to manatees during construction. Additionally, manatee barriers will be included at all pump station intake sites and culverts, which will ensure protection of manatees. The Corps has determined the proposed BBCW Phase 1 Project "may affect, but is not likely to adversely affect the West Indian manatee." The Service concurs with this determination.

West Indian Manatee Critical Habitat

According to 41 FR 41914, the project area lies between two components of designated critical habitat for the West Indian manatee (Figure 5). One of these components is defined as "all waters of Card, Barnes, Blackwater, Little Blackwater, Manatee, and Buttonwood Sounds between Key Largo, Monroe County, and the mainland of Dade County." The southernmost culvert proposed for the L-31E Culvert component lies about 5 miles (mi) from the northernmost area of this component of manatee critical habitat. The other component is defined as "Biscayne Bay, and all adjoining and connected lakes, rivers, canals, and waterways from the southern tip of Key Biscayne northward to and including Maule Lake, Miami-Dade County." The southern boundary of this critical habitat component is approximately 3 mi north of the project area. Redirecting canal water through the wetlands will have localized effects on nearshore salinities, and thus on submerged aquatic habitats, as noted above. The project is not expected to appreciably affect bay waters more than a mile from the project area and, therefore, is not anticipated to affect manatee critical habitat. The Corps has determined that the proposed BBCW Phase 1 Project "may affect, but is not likely to adversely affect" designated critical habitat for the West Indian manatee. The Service concurs with this determination.

Florida Panther

The proposed BBCW Phase 1 Project is located outside the Panther Focus Area as defined by the Service (2007) and the Primary and Secondary Zones as defined by Kautz et al. (2006). There have been no confirmed sightings of panthers in the BBCW Phase 1 project area. FWC telemetry data indicate that the closest a collared panther has come to the project area occurred during the late 1980s. This individual utilized a large portion of the Model Lands Basin between the Florida Power and Light's Turkey Point Power Plant cooling canals and Card Sound Road, generally south of the project area, in 1988. This individual was a victim of a motor vehicle collision and died the same year. Two relatively recent panther mortalities located just south of the project area provide evidence that the project site may occasionally be used by dispersing panthers. Panther UCFP80 was killed by a motor vehicle on Card Sound Road on February 2, 2006, and panther UCFP96 was killed by a vehicle on U.S. Highway 1 just south of Card Sound Road on May 9, 2007 (Figure 5).

The rehydration of mangrove wetlands will have discountable effects because panthers do not readily use this habitat type. The 400-ac freshwater forested wetland targeted for restoration is considered suitable panther habitat and the desired restoration condition for this area (graminoid marsh) is also suitable panther habitat. Therefore, effects on panther habitat from restoration of this area should be insignificant. Rehydration should not affect the panther's primary food

sources—white-tailed deer (*Odocoileus virginianus*) and feral hogs (*Sus scrofa*)—because these prey items do not inhabit saltwater wetlands and have not been reported from the freshwater wetland in the project area. No new roads are proposed by the project and use of existing roads will increase only temporarily during the construction phase, thus the project should have only minimal and temporary effects on vehicle traffic patterns. Based on this information, the Corps determined that the project "may affect, but is not likely to adversely affect" the Florida panther. The Service concurs with this determination.

Wood Stork

The wood stork is primarily associated with freshwater and estuarine habitats for nesting, roosting, and foraging. They have nested, at one time or another, in every county in south Florida. According to the Service's GIS database, the project area lies within the outer limit of the core foraging area (an 18.6-mi radius circle from the colony center) of three active wood stork colonies (Figure 5). The "Tamiami Trail West" colony is located 17.8 mi northwest of the Deering Flow-way Component and it has been active since at least 1992 (according to the Service's GIS database). There were 400, 75, and 900 to 1000 active nests at this colony in 2006, 2007, and 2009 respectively. The "Tamiami Trail East" colony is located approximately 16 mi northwest of the project area and had been inactive since 1992 when there were 130 nests. However, in 2009 the colony became active again with 30 nests reported. The third colony, (WCA 3B Mud East) is located 18.1 mi northwest of the Deering Flow-way Component. The data indicates a declining trend in numbers of wood stork nests at this site. The colony was established in 2004, with 130 nests that year. There were 20 nests at the colony in 2005, 12 nests in 2006, and 7 failed nests in 2009.

The wood stork typically uses freshwater marshes, ponds, ditches, tidal creeks and pools, impoundments, pine and cypress depressions, and swamp sloughs for foraging. They forage effectively in shallow-water areas with concentrated prey, such as wetland depressions subject to seasonal drying. Redirection of freshwater into coastal wetlands should improve foraging habitat for the wood stork. The primary enhancement should occur during the wet season when most of the water diversion will occur. Rehydrating and lowering salinity in the coastal wetlands is anticipated to increase preyfish production during the wet season (Lorenz 2000). A more natural dry season recession is also anticipated, which should concentrate prey during the wood stork nesting season. Primary benefits to wood storks should occur in the Cutler Flow-way and L-31E Culvert components, where habitat enhancement will be on the order of several hundred acres for the wetlands east of the Cutler Flow-way and perhaps tens to hundreds of acres east of the L-31E culverts. The extent of habitat enhancement is unclear due to the uncertainty with determinations of the spatial extent of wetlands that will be rehydrated with the available water. Although approximately 21 ac of low-quality wood stork habitat is proposed to be removed by installation of the Cutler Flow-way pipeline and spreader canal and 0.02 ac of dwarf mangrove habitat is proposed to be removed by installation of the L-31E culverts, the extent of habitat enhancement mentioned above should provide an overall benefit within the project area.

The Corps has proposed in its October 29, 2008, BA to include measures for the wood stork as outlined in the *Habitat Management Guidelines for the Wood Stork in the Southeast Region* (Service 1990) in the permit conditions. Particularly relevant for the BBCW Phase 1 Project are the management zones and guidelines for the protection of feeding sites. There should be no human intrusion into feeding sites when storks are present. Depending upon the amount of screening vegetation, human activity should be no closer than between 300 ft (where solid vegetation screens exist) and 750 ft (no vegetation screen). According to its October 29, 2008, BA and permit conditions, the Corps has determined that the proposed BBCW Phase 1 Project "may affect, but is not likely to adversely affect the wood stork." The Service concurs with this determination.

American Crocodile

American crocodiles are occasionally found in the project area. Crocodiles have been documented to occur in wetland areas of central and southern Biscayne Bay at densities ranging from 0 to 0.29 crocodiles per kilometer of shoreline (Cherkiss 1999), which suggests a low probability of crocodiles occurring in the project area. Canal banks similar to the L-31E levee are generally suitable for nest sites, and the berms associated with the old east-west agricultural secondary canals may also be suitable for nesting. Thus, nesting habitat is available in the project area. However, nesting within the project area is not well documented. A nesting attempt was made on the bank of the L-31E near its intersection of the Goulds Canal (within 0.5 mile of the L-31E Culvert Component) in 2005, but the nest failed (Michael Cherkiss, University of Florida, telephone communication, March 27, 2007). The nearest consistent nesting occurs at Chapman Field Park located approximately 1 mi north of the Deering Flow-way component. The other nearest known nest sites are located at the cooling canals of Florida Power and Light's Turkey Point Power Plant, which supports the most successful nesting population in south Florida (Mazzotti et al. 2002). The northern end of the cooling canal system is located approximately 2 mi from the southern end of the L-31E Culvert Component.

Construction of culverts, risers, and pump stations on the levees in the project area will impact approximately 4.5 ac of levee that is potential crocodile nesting habitat. This is a relatively small footprint considering the approximately 720 ac of levee associated with the C-1, L-31E, C-102, Military Canal, C-103, and North Canal levees within the project boundaries. These levees are very likely sub-optimal nesting habitat, given that no successful crocodile nests have been documented on them in the project area. Also, at least 5.5 ac of new berm or levee associated with the spreader features will be created by the project, which should be suitable as crocodile nesting habitat. The spatial extent of new berm created by the project more than offsets levee area lost by installation of culverts, risers, and pump stations.

Because reptiles usually avoid areas of human activity, it is expected that the crocodiles would avoid the area during construction activity. However, the most likely potential effects on crocodiles will occur during project construction due to the temporary increase in human activity, including an increase in vehicular use, along the levee roads associated with the major conveyance canals (C-1, C-102, C-103, and North Canal) and L-31E Canal. Because of the

possibility of crocodiles nesting or being present in the project area, and because vehicular traffic will temporarily increase during project construction, which may affect crocodiles if they are present, the Corps has proposed in their October 29, 2008, BA to include American crocodile construction protection measures as a permit condition (enclosure). The Service supports these measures to minimize disturbing crocodiles during construction activities.

All three project components are anticipated to lower salinity in their respective areas. Reducing salinities in these wetlands would improve hatchling and juvenile crocodile habitat. Optimal salinity for juvenile crocodiles is 0 to 20 parts per thousand in the wetlands and coastal creeks during the wet season and partway through the dry season (approximately June through January) (Mazzotti et al. 2002). Presently, salinity along the nearshore area is generally above this preferred range (Biscayne National Park 2006). Thus, the project should provide ecological benefits to American crocodiles.

Based on its October 29, 2008, BA and required permit conditions, the Corps has determined the project "may affect, but is not likely to adversely affect" the American crocodile. The Service concurs with this determination.

American Crocodile Critical Habitat

According to 41 FR 41914, the easternmost tip of Turkey Point defines the northern boundary of designated critical habitat for the American crocodile (Figure 5). Turkey Point is about 3 mi south of the southernmost culvert proposed for the L-31E Culvert component. Therefore, it is unlikely the project will appreciably affect crocodile critical habitat. The effects of redirecting canal water through the wetlands should have a localized effect on tidal wetlands and nearshore salinities that lie outside of the American crocodile critical habitat. Also, project implementation should enhance crocodile habitat within the project area, but outside critical habitat. In its October 29, 2008, BA the Corps determined that the project "may affect, but not likely to adversely affect" critical habitat for the American crocodile. The Service concurs with this determination.

Eastern Indigo Snake

Eastern indigo snakes occur throughout south Florida and use a variety of habitats including pine flatwoods, pine rocklands, tropical hardwood hammocks, a variety of wetland types (including mangrove wetlands), and other developed and undeveloped cover types. Because these habitats are typical of the project area, the proposed project may affect eastern indigo snakes or their habitat. Anecdotal evidence suggests that indigo snakes use the L-31E levee for sunning and resting (Dr. Jack F. Meeder, Florida International University, telephone communication, November 8, 2002). Indigo snakes have also been reported in the Model Lands area west of the Florida Power and Light Turkey Point Power Plant utilizing roads and Australian pine duff for thermal refugia (Mr. Bill Maus, Themis Consulting, telephone communication, February 5, 2009). However, information on indigo snake population numbers and density does not exist for this geographic area and dominant habitat type (mangroves).

In attempts to document the presence of eastern indigo snakes in the project area, surveys were conducted by Service biologists on January 26 and March 30, 2009. The first survey was conducted between 10:00 AM and 1:00 PM along approximately 8 mi of levees in the project area shortly after a cold front had moved through south Florida, which is the optimal time to observe eastern indigo snakes in open areas. No snakes were observed. The second survey was conducted between 11:15 AM and 3:45 PM on March 30, 2009. Approximately 11.5 mi of levees were surveyed three days after the passage of a cold front. No eastern indigo snakes were observed. The lead Service biologist on this project has been on numerous other site visits in the project area (e.g., February 21 and 22, 2006; March 28 through 30, 2006; June 28, 2006; November 30, 2006; March 8, 2007; November 11, 2007; March 24, 2008; April 30, 2008; and others) and has not observed eastern indigo snakes on any of these visits. Although indigo snakes have been observed in the project area, as noted above, the wetlands habitat that dominates the project area is sub-optimal habitat for indigo snakes, as they prefer drier upland habitats. Also, the wetlands in the project area are bordered by urban development and nursery tree farms to the north and west, respectively, which is also sub-optimal eastern indigo snake habitat.

Although indigo snakes were not observed during the Service's surveys and other field work in the project area, the anecdotal information described above indicates that indigo snakes likely occur in the project area. Thus, the Service assumes that these animals occur in the project area. Based on that assumption, the Service is concerned about potential project effects on indigo snakes. These concerns include: (1) construction of project features, (2) increased traffic during construction, and (3) exotic plant removal if it is by mechanical means.

The Service does not believe that loss of habitat due to installation of project features will appreciably impact indigo snakes. As previously noted, the levee habitat (presumably used by indigo snakes for sunning and resting) impacted by the installation of culverts, risers, pump stations is relatively small (4.5 ac) compared to the 720 ac of levee area available in the project area. Also, 5.5 ac of new berm area will be created which indigos could use for sunning, resting, and foraging. Construction of project features (primarily the spreader features) will impact 27.3 ac of native vegetation communities (most of which is mangrove wetland), 53.1 ac of non-native vegetation (Brazilian pepper and Australian pine), and 16.7 ac of native and non-native mixed communities (Table 1). These habitat types are sub-optimal for indigo snakes and comprise only 2 percent of the wetlands within project boundaries, thereby the risk to indigo snakes is considered unlikely.

The Service anticipates that implementing the BBCW Phase 1 Project will have some beneficial effects to the eastern indigo snake. Rehydration of the coastal wetlands by diverting water from conveyance canals may increase the forage base by improving the coastal wetlands habitat for the snake's major prey items, including fish, frogs, snakes, lizards, turtles, small alligators, birds, and small mammals. Also, as noted above, additional upland sunning and resting areas will be provided by the construction of berms associated with spreader features. Given the relatively small loss of sub-optimal habitat and anticipated increase in quality of remaining habitat

resulting from project implementation, the Service believes the displacement of indigo snake habitat by spreader features, culverts, and pump stations is discountable.

The Corps states in its October 29, 2008, BA that the standard construction precautions for the indigo snake (i.e., the *Draft Eastern Indigo Snake Standard Protection Measures*) will be included in the environmental protection plan when the Corps proceeds to the plans and specifications phase for this project. Those measures include: (1) providing indigo snake educational materials to construction employees prior to project initiation; (2) if a live indigo snake is found, construction activities will cease until the snake has left the project area on its' own accord and the location of sightings will be reported to the Service; and, (3) if a dead indigo snake is found, the snake will be frozen as soon as possible and the Service will be contacted immediately for further instructions. To further reduce the potential direct effect of project construction on indigos described above, the Service recommended the following additional measures be included as permit conditions to reduce risk to indigo snakes: (1) have a trained observer on site during construction, (2) in the project design phase the Service and Corps will coordinate to determine culvert locations on the L-31E Levee to avoid burrows as necessary, (3) examine any burrows in the footprint of pump stations, (4) avoid removal of invasive non-native vegetation by mechanical means, and (5) manage construction site to promptly remove debris so it doesn't create shelter sites for indigos. The Service also recommended that the Corps conduct a comprehensive survey for indigos in the construction areas of the project prior to beginning of project construction. Through email correspondence dated September 24, 2009, the Corps agreed to include the additional protection measures as permit conditions and has agreed to conduct the recommended survey when funding for such surveys becomes available after the project is authorized and appropriated by Congress. The Service and Corps will coordinate appropriate survey protocols at that time.

Based on the above information, the Corps has determined the project "may affect, but is not likely to adversely affect" the threatened eastern indigo snake. The Service concurs with this determination.

Sea Turtles

All five federally listed sea turtle species may be present in the nearshore bay waters in the project area. The green sea turtle may be present in the project area feeding on sea grasses. The leatherback may be present depending on the presence of jellyfish, and the loggerhead may be found foraging in the area for crustaceans or mollusks. The hawksbill sea turtle may also be found in the area as it feeds predominantly around coral reefs on sponges, which can be found on hardgrounds (limestone bottom colonized by sponges, small corals, and algae) located in the middle of Biscayne Bay. The Kemps Ridley sea turtle is the least likely to be found here due to its rare occurrence in Florida's coastal waters.

None of the sea turtle species would be present in the project area for nesting purposes since there is no suitable habitat for nesting in the project area. Because there is no nesting habitat for

sea turtles in or near the project area, the Corps determined the proposed project will have no effect on nesting habitat of sea turtles. The Service agrees with this determination.

Implementation of the project is anticipated to increase freshwater flow to the saltwater wetlands and nearshore bay areas which should result in lower salinity. This in turn may change seagrass species composition as described above, but no reduction in seagrass biomass is anticipated. Therefore, herbivores like the green sea turtle should not be affected. However, because suitable forage for sea turtles exists in the project area, the Corps is consulting with NOAA Fisheries for potential effects to sea turtles in the water. The Corps' October 29, 2008, BA was submitted to NOAA Fisheries as part of this consultation.

Schaus Swallowtail Butterfly

The present distribution of the Schaus swallowtail butterfly extends from southern Miami-Dade County south to Lower Matecumbe Key in the Middle Florida Keys. Schaus swallowtail butterfly distribution is limited to tropical hardwood hammocks and is concentrated in the insular portions of Miami-Dade and Monroe Counties, from Elliott Key in Biscayne National Park and associated smaller Keys to central Key Largo (Service 1999). Suitable habitat remaining from historical values for this species is estimated as 43 percent in Biscayne National Park and 17 percent for north Key Largo. The decline has been attributed primarily to habitat destruction (Service 1999).

Optimum habitat includes mature and well drained tropical hardwood hammocks with natural and manmade openings such as trails. In the project area, this habitat type is found only in the Deering Flow-way component. However, reintroductions of this species to the Deering Estate have not been successful. Rehydration of this project component area should assist in restoring and enhancing the natural vegetative communities associated with tropical hardwood hammocks, which might provide some benefits to the butterfly by enhancing hammock plant species that serve as cover and forage for both larvae and adult stages of this species. The Corps has determined that the proposed BBCW Phase 1 Project "may affect, but is not likely to adversely affect" the Schaus swallowtail butterfly. The Service concurs with this determination.

Crenulated Lead Plant, Garber's Spurge, Tiny Polygala, Deltoid Spurge, Small's Milkpea

Crenulated lead-plant, Garber's spurge, tiny polygala, deltoid spurge and Small's milkpea are associated with pine rocklands. In the project area, pine rocklands occur only at the Deering Estate in the northern extreme of the project area. There are 87 ac of pine rockland habitat on the Deering Estate.

The Deering Flow-way component is anticipated to restore hydrology through the Deering Glade with no changes in groundwater or surface water elevations anticipated in ecological communities at higher elevations than the hardwood hammock, such as pine rocklands. Therefore, any effect on pine rocklands should be insignificant and discountable. For these reasons, the Corps has determined the project "may affect, but is not likely to adversely affect"

the crenulated lead plant, Garber's spurge, tiny polygala, deltoid spurge, and Small's milkpea. The Service concurs with this determination.

Beach Jacquemontia

Beach jacquemontia is a coastal dune species. There is no habitat for this species within the project area or areas anticipated to be affected by the project. Therefore, the Corps has determined the project will have no effect on the beach jacquemontia. The Service agrees with this determination.

Everglade Snail Kite

The Everglade snail kite inhabits relatively open freshwater marshes which support adequate populations of Florida apple snails (*Pomacea paludosa*), the primary forage species for the kite. Favorable areas consist of extensive shallow open water such as sloughs and flats, vegetated by sawgrass (*Cladium jamaicense*) and spikerush (*Eleocharis cellulose*). The areas are often interspersed with tree islands or small groups of scattered shrubs and trees which serve as perching and nesting sites. Suitable snail kite habitat includes water levels that are sufficiently stable to prevent loss of the food supply through drying out of the surface. The Everglades snail kite is threatened primarily by habitat loss and destruction. Widespread drainage has permanently lowered the water table in some areas, including the BBCW project area. This drainage permitted development in areas that were once Everglade snail kite habitat.

Most wetlands affected by the project components are tidally influenced with salinities ranging from fresh to hypersaline (salinities greater than full strength sea water, *i.e.*, greater than 35 parts per thousand) conditions. The Florida apple snail is a freshwater species, so conditions in the project area are generally unsuitable for this forage animal. The exception is the freshwater wetland located west of L-31E between the C-103 and North Canal. Presently this part of the project area is dominated by hardwood trees and woody shrubs, and is generally unsuitable as apple snail habitat. Thus, the project area is currently unsuitable for the Everglade snail kite. However, the project objective for this part of the project area is to restore the wetland to graminoid marsh, which may be suitable to apple snails, and therefore, the Everglade snail kite.

Because of the currently unsuitable Everglade snail kite habitat in the project area and the potential restoration of foraging habitat in the freshwater wetlands west of L-31E, the Corps has determined the proposed BBCW Phase 1 Project would have no effect on the Everglade snail kite. The Service agrees with this determination.

Everglade Snail Kite Critical Habitat

There is no Everglade snail kite critical habitat in the project area, and because the project is located downstream of the nearest snail kite critical habitat the project will not affect it. The Corps has determined that the project will have no effect on critical habitat for the Everglade snail kite. The Service agrees with this determination.

Cape Sable Seaside Sparrow

The known distribution of the Cape Sable seaside sparrow is restricted to two areas of marl prairies east and west of Shark River Slough in the Everglades, and the edge of Taylor Slough along the southern boundary of the water preserve area project at the Bird Drive Basin in Miami-Dade County. The closest Cape Sable seaside sparrow sub-populations lie miles to the west or south of the project area. Sub-population F of the Cape Sable seaside sparrow is located approximately 16 mi west of the Cutler Flow-way component. Sub-population C lies approximately 15 mi west of the L-31E Culvert component and Sub-population D lies approximately 10 mi southwest of the freshwater wetlands between C-103 and North Canal. Because the habitat in the project area is not suitable for this species, the Corps has determined the project will have no effect on the Cape Sable seaside sparrow. The Service agrees with this determination.

Cape Sable Seaside Sparrow Critical Habitat

There is no Cape Sable seaside sparrow critical habitat in the project area. The Corps has determined that the project will have no effect on critical habitat for the Cape Sable seaside sparrow. The Service agrees with this determination.

Roseate Tern

The roseate tern forages in nearshore surf and nests on open sandy beaches. In southern Florida, the roseate tern normally nests on isolated islands, rubble islets, and dredge spoil. The only suitable nesting habitat for this species near the project area occurs on the Black Point jetty and shore of spoil islands located just off the mouths of the C-102 and C-103 Canals. The BBCW Phase 1 Project is not anticipated to affect these sub-optimal nesting areas. Therefore, the Corps has determined the project will have no effect on the roseate tern. The Service agrees with this determination.

This letter fulfills the concurrence requirements of section 7 of the ESA. If modifications are made to the project, if additional information involving potential effects to listed species becomes available, or if a new species is listed, reinitiation of consultation may be necessary.

FISH AND WILDLIFE RESOURCES

In addition to the federally listed species addressed above, the BBCW Phase 1 Project area also provides habitat for species listed by the State of Florida. These species are recognized as either endangered, threatened or as species of special concern, and are protected or otherwise given special consideration under Chapter 39-27.003, 39-27.004, and 39-27.005, Florida Administrative Code. Birds comprise the majority of the State-listed species associated with the project. Most of these are wading birds, which are generally dependent upon shallow open water for foraging on aquatic invertebrates and small fishes. The State does not list critical habitat for any of its species.

State-listed endangered species that may exist or potentially exist in the project area include the Arctic peregrine falcon (*Falco peregrinus tundrius*) and Florida mastiff bat (*Eumops glaucinus floridanus*). State-listed threatened species include the white-crowned pigeon (*Columba leucocephalus*), least tern (*Sterna antillarum*), piping plover (Charadrius melodus), rim rock crown snake (*Tantilla olitica*), and Everglades mink (*Mustela vison evergladensis*). State-listed species of special concern include the roseate spoonbill (*Ajaia ajaia*), limpkin (*Aramus guarauna*), little blue heron (*Egretta caerulea*), reddish egret (*Egretta rufescens*), snowy egret (*Egretta thula*), tricolored heron (*Egretta tricolor*), white ibis (*Eudocimus albus*), brown pelican (*Pelecanus occidentalis*), black skimmer (*Rynchops niger*), mangrove rivulus (*Rivulus marmoratus*), gopher tortoise (*Gopherus polyphemus*), American alligator (*Alligator mississippiensis*), and the Florida tree snail (*Liguus fasciatus*). The Service recommends that the Corps contact the Florida Fish and Wildlife Conservation Commission to solicit input for species under its jurisdiction that may occur in the BBCW study area or be affected by the project. We are particularly concerned about possible project impacts to the mangrove rivulus.

The Service supports the BBCW Phase 1 Project as it should provide meaningful hydrologic and ecologic improvements to the nearshore waters of southwestern Biscayne Bay and the adjacent coastal wetlands. Nearshore bay resources in the project area will be positively affected by the restoration of a more natural freshwater flow regime. Reduction of harmful point source discharges at major conveyance canals as a result of implementing the project will reduce the unnaturally large fluctuations in salinity near canal mouths, resulting in more stable salinity regimes in these areas, which will improve habitat for fish and invertebrates inhabiting the areas near the canal outlets. Reestablishing freshwater inflow to the bay across a broader front along the shoreline should lower salinities there resulting in more suitable estuarine habitat for eastern oyster (*Crassostrea virginica*), pink shrimp (*Farfantepenaeus duorarum*), blue crab (*Callinectes sapidus*), red drum (*Sciaenops ocellata*), common snook (*Centropomis undecimalis*), tarpon (*Megalops atlanticus*), and other fish and wildlife resources (Patillo et al. 1997). Lowering salinity along the shoreline should also result in the expansion of shoal grass (*Halodule wrightii*) and widgeon grass (*Ruppia maritima*) in these areas based on the preferred salinity ranges of these species (Fonseca et al. 1998), which increases benthic diversity and is a food source for the endangered West Indian manatee. However, salinity effects are not anticipated to extend more than a mile or so from the shoreline as indicated by the hydrodynamic model used during the planning process for the BBCW project area.

The combination of a restored hydrology, a more natural fire regime, and a non-native vegetation control program can be expected to evolve toward reestablishing to the extent possible the pre-drainage character of the BBCW wetland plant communities. Wetland habitat types found in the project area, particularly freshwater graminoid marsh and mangrove wetlands, supply plant biomass to the food web of Biscayne Bay. Both also serve as vital refuge and nursery grounds for a wide variety of freshwater and estuarine fish and invertebrate species, as well as foraging grounds for a variety of wading birds and reptiles, including the federally endangered American crocodile. Freshwater and oligohaline graminoid marshes foster the production of large numbers of mosquito fish (*Gambusia affinis*), sailfin mollies (*Poecilia latipinna*), and other small fishes that serve as the prey base for many of the region's wading birds and higher trophic level

predators. Restoring more natural salinities, hydroperiods, and water levels to these marshes, as planned in the BBCW Project, should serve to increase prey fish production and further enhance these habitats for amphibians, wading birds and other fish and wildlife resources.

While the Service supports the BBCW Phase 1 Project objectives, we have concerns about various aspects of the project and the benefits that will be provided by project features. These concerns and uncertainties were documented in detail in our draft Fish and Wildlife Coordination Act Report submitted to the Corps for this project on July 9, 2008. In that report we also provided recommendations intended to make the project more environmentally compatible and to further enhance the diversity and abundance of fish and wildlife resources in the project area, while assuring that the optimum ecological benefits are delivered to Biscayne Bay and adjacent coastal wetlands consistent with the basic project purpose.

In closing, the Service has reviewed available information related to federally listed species and habitat impacts and has no objection to the proposed project. Although uncertainties exist regarding water quality and water diversion effects to wetlands, the benefits to fish and wildlife resources that should be provided by the project are consistent with the Service's goals and objectives for habitat restoration and enhancement projects in south Florida.

Thank you for the opportunity to participate in restoring and conserving south Florida's ecosystems. If you have any questions, please contact Patrick Pitts at 772-562-3909, extension 250.

Sincerely yours,

for Paul Souza
Field Supervisor
South Florida Ecological Services Office

Enclosure

cc: w/enclosure (electronic copy only)
BNP, Homestead, Florida (Mark Lewis, Sarah Bellmund)
Corps, Jacksonville, Florida (Eunice Ford, William Gallagher, Brad Tarr)
Corps, West Palm Beach, Florida (Tori White)
DERM, Miami, Florida (Steve Blair, Craig Grossenbacker)
District, West Palm Beach, Florida (John Shaffer, Rick Alleman)
EPA, Jacksonville, Florida (Eric Hughes)
FDEP, West Palm Beach, Florida (Inger Hansen)
FWC, Tallahassee, Florida (Mary Ann Poole)
NOAA Fisheries, West Palm Beach, Florida (Audra Livergood)
Service, Jacksonville, Florida (Miles Meyer)

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Table 1. Spatial extent (in acres) of vegetation types displaced by project features within each of the 3 project geographic components.

Project Component	Land Use or Vegetation Type Impacted	Number of Acres Impacted
Deering Flow-way	Filled/Develop/Disturbed	6.10
	Tropical hardwood hammock	0.02
Cutler Flow-way	Brazilian pepper	48.19
	White mangrove/Buttonwood	23.51
	White mangrove/Brazilian pepper	12.00
	Filled / Developed/Disturbed	11.54
	Coastal Band Mangrove	2.25
	Native forested-shrub wetland /Australian pine	0.41
L-31E Culverts	Native forested-shrub wetland/Brazilian pepper	4.11
	Filled/Developed/Disturbed	4.58
	Cattail	0.10
	Open water	1.82
	Brazilian pepper	4.07
	Australian pine	0.73
	Coastal band mangrove	0.92
	Dwarf dense mangrove	0.09
	White mangrove/buttonwood	0.05
	Native forested-shrub wetland	0.10
	Native forested-shrub wetland/Australian pine	0.17
	Dwarf dense mangrove	0.11
	Dwarf dense mangrove/sawgrass	0.02
	Mixed wetland hardwoods	0.25
Totals	**Native vegetation communities**	**27.32**
	Non-native vegetation	**53.09**
	Native/non-native mixed communities	**16.69**
	Filled/Develop/Disturbed	**22.22**

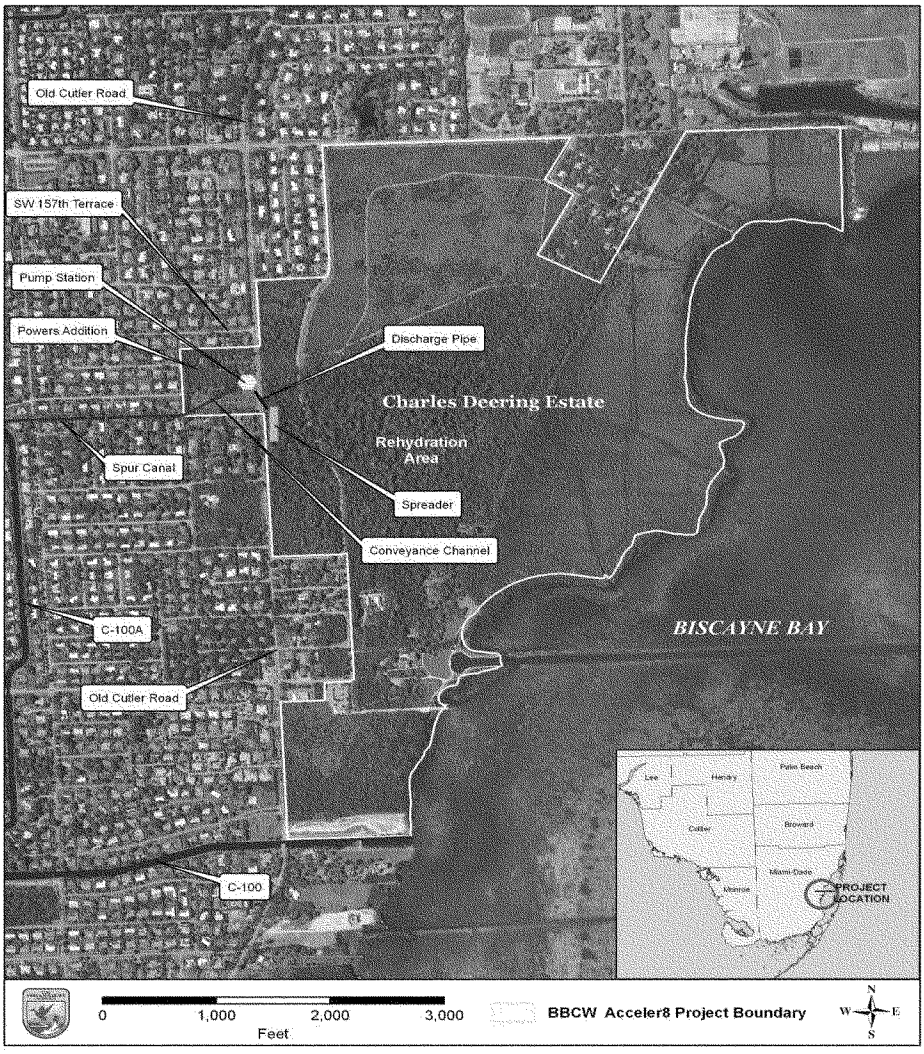

Figure 1. Map of the Deering Flow-way Component of the BBCW Phase 1 Project. The proposed Deering Flow-way is designed to restore freshwater flows through the Deering Estate by routing water from the Spur Canal (off C-100A) to the east side of Old Cutler Road and onto the Estate.

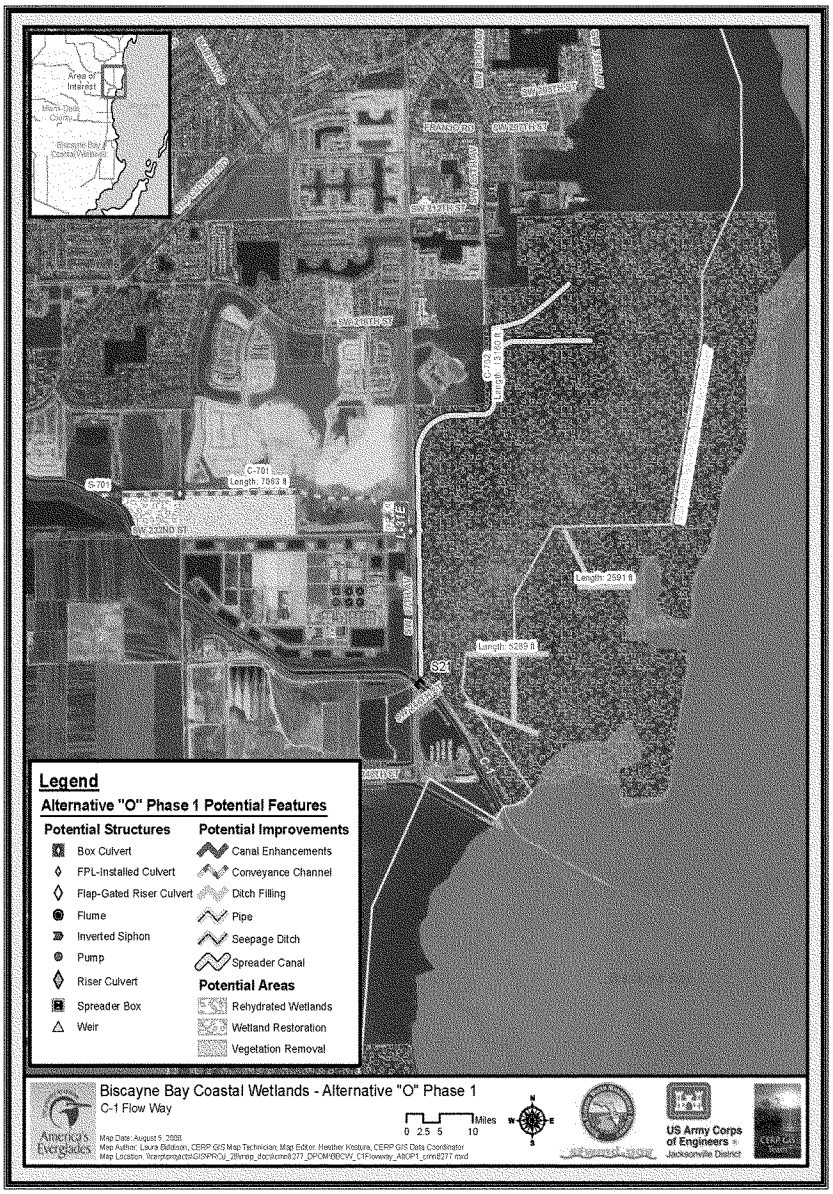

Figure 2. Map of the Cutler Wetlands component of the BBCW Phase 1 Project.

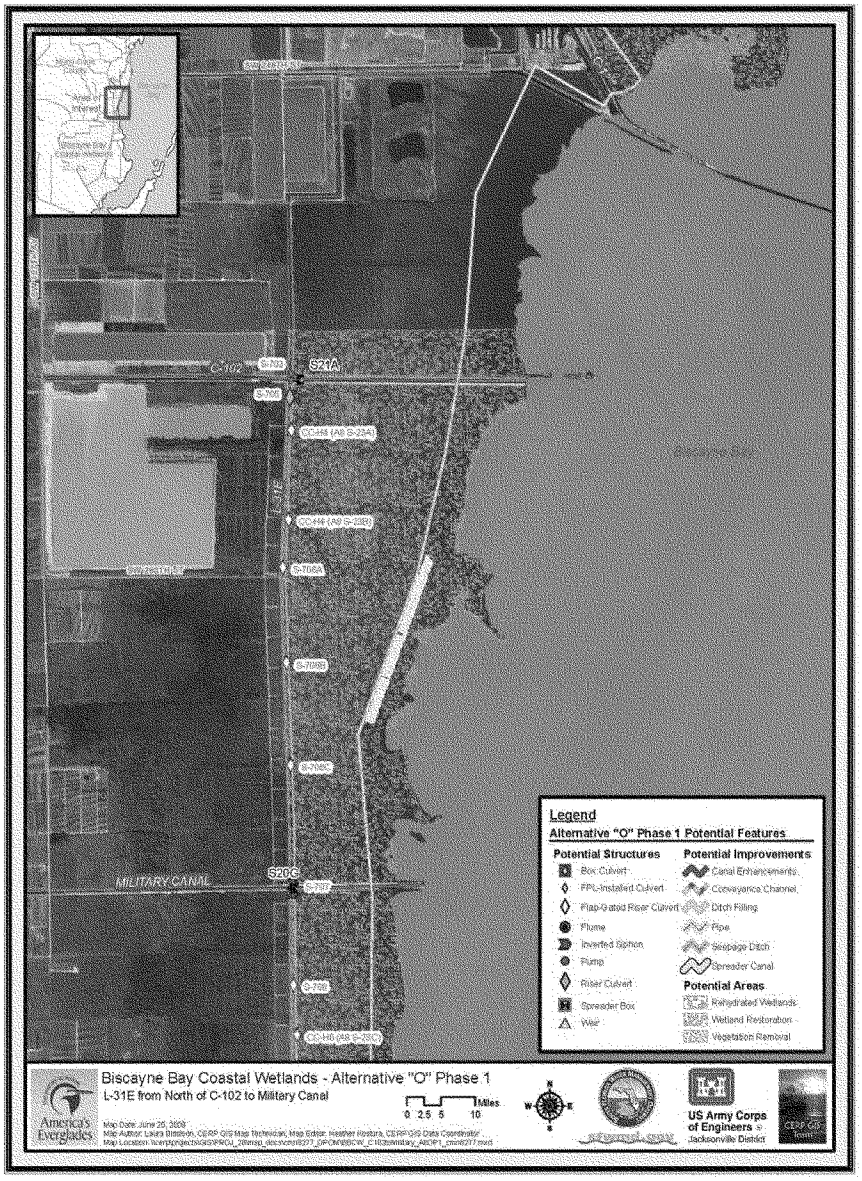

Figure 3. Map of the northern section of the L-31E Culverts component of the BBCW Phase 1 Project.

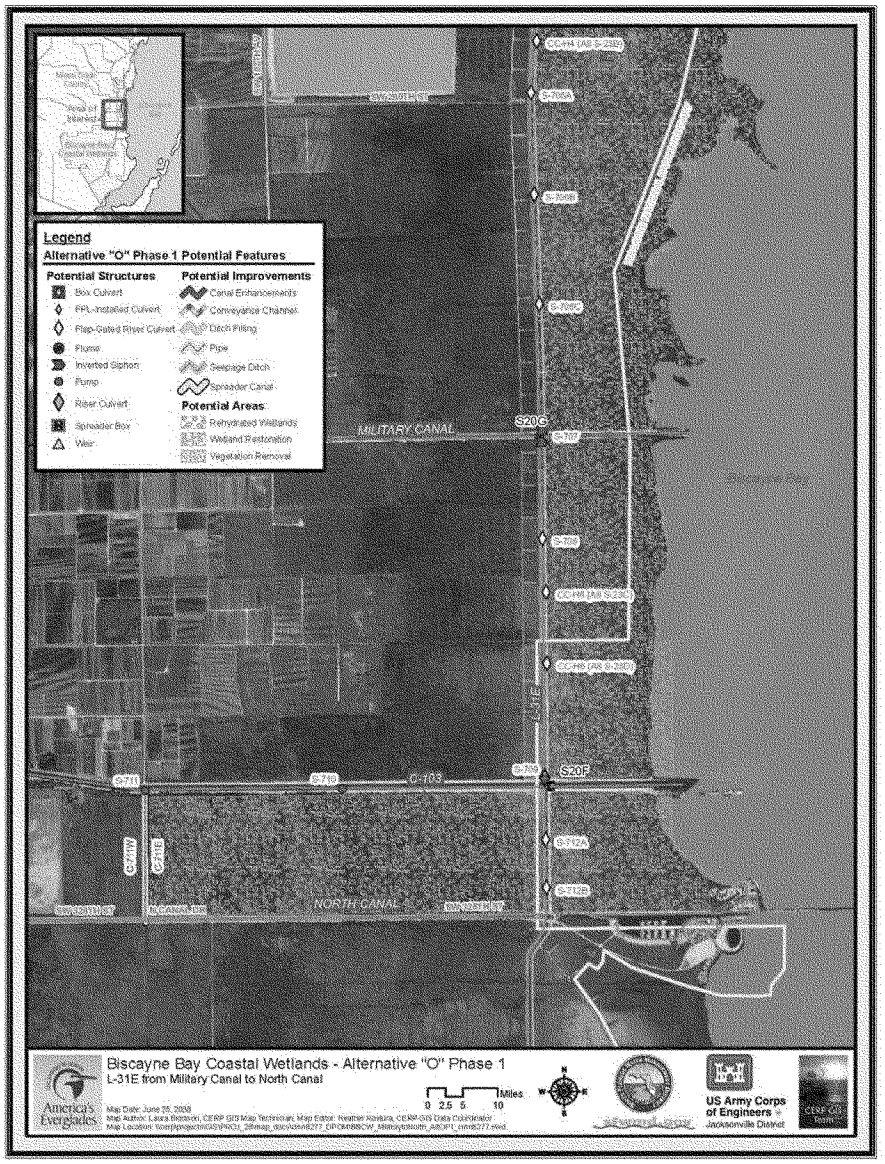

Figure 4. Map of the southern section of the L-31E Culverts component of the BBCW Phase 1 Project.

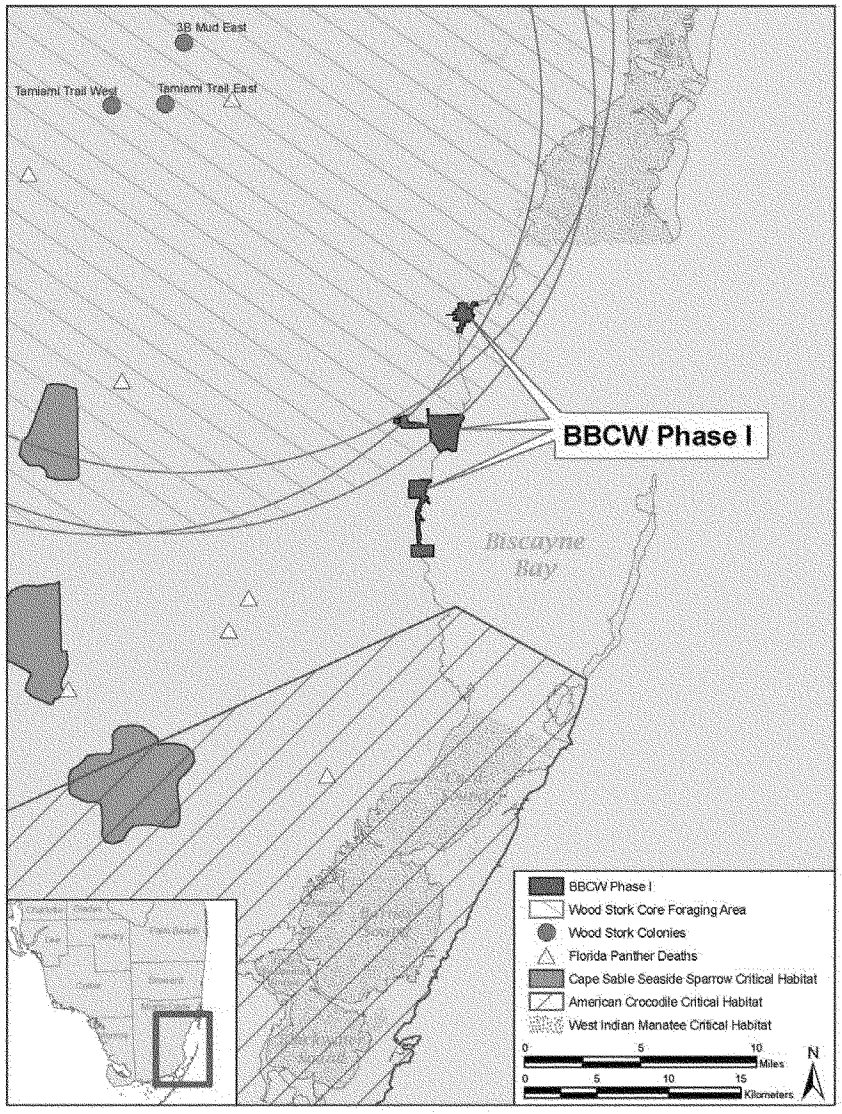

Figure 5. Map showing the location of designated critical habitat for the American crocodile, West Indian manatee, and Cape Sable seaside sparrow, the nearest wood stork colonies (including the colony foraging buffer), and nearest panther mortalities relative to the BBCW Phase 1 Project.

Enclosure

Biscayne Bay Coastal Wetlands Acceler8 Project:
Protection Measures for the American Crocodile
(June 12, 2007)

1. Prior to construction, an American crocodile (*Crocodylus acutus*) survey will be conducted by a person with experience in performing American crocodile surveys. The survey should be adequate to ensure a high likelihood of detecting American crocodiles that may be using the project area for shelter, feeding and sunning. If construction is planned during the nesting season (March through September), the project area should also be surveyed for nesting and breeding activities. If American crocodiles or nests are detected, a protection plan will be developed in coordination with the Fish and Wildlife Service (Service) and implemented prior to the initiation of construction.

2. The American crocodile survey report must be submitted to the Service prior to construction (using standard survey report format). The survey report shall be submitted whether or not a crocodile has been observed and shall contain information on any sightings of crocodiles or nests.

A.4.13 NMFS Concurrence Letter on the Biological Assessment

Tarr, Bradley A SAJ

From: Tarr, Bradley A SAJ
Sent: Wednesday, July 28, 2010 2:43 PM
To: 'Audra Livergood'
Subject: RE: BBCW Phase 1 Biological Assessment

Audra,

Thank you for the email regarding the effect determinations of threatened and endangered species related to the Biscayne Bay Coastal Wetlands project (BBCW). With the exception of a slightly larger footprint and subsequent impacts to wetland vegetation as a result of feature construction (impacted vegetation and quantities provided), the effect determinations contained in the Biological Assessment (BA) for Phase 1 of the BBCW project remain unchanged from the determinations of the BA prepared for the BBCW Acceler8 project. The Corps reiterates its determination that the proposed construction and operation of BBCW Phase 1 project will not adversely affect any listed species under NMFS purview.

Brad Tarr
US Army Corps of Engineers
Environmental Branch, Planning Division
701 San Marco Blvd.
Jacksonville, Florida 32232-0019
904-232-3582

-----Original Message-----
From: Audra Livergood [mailto:Audra.Livergood@noaa.gov]
Sent: Wednesday, July 28, 2010 2:25 PM
To: Tarr, Bradley A SAJ
Subject: BBCW Phase 1 Biological Assessment

Hi Brad,

As per our conversation today, I have not yet reviewed the October 2008 Biological Assessment (BA) provided by the COE for Phase 1 of the BBCW project. As you know, NMFS' previously concurred with the COE's determination of "may affect, but is not likely to adversely affect" smalltooth sawfish in regard to Phase 1 of the BBCW Acceler8 project (concurrence letter attached). At this time, it is unclear whether reinitiation is required. Hopefully, the BA will shed light on how the currently proposed project is different from the project upon which we previously consulted. Under the ESA, reinitiation is required if a take occurs or new information reveals effects of the action not previously considered, or the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat in a manner or to an extent not previously considered, or if a new species is listed or critical habitat designated that may be affected by the identified action.

What is the COE's position on this? Has the proposed action been modified in a manner that causes an effect to listed species or critical habitat that was not previously considered in the 2007 consultation?

Thanks,
Audra

1

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701
(727) 824-5312, FAX (727) 824-5309
http://sero.nmfs.noaa.gov

AUG 30 2007 F/SER31:AL

Mr. David Hobbie
Special Projects and Enforcement Branch
Palm Beach Gardens Regulatory Office
Jacksonville District Corps of Engineers
4400 PGA Boulevard, Suite 500
Palm Beach Gardens, FL 33410

Re: SAJ-1994-1327 (IP-AAZ)
SAJ-2006-7926 (IP-AAZ
SAJ-2007-139 (IP-AAZ)

Dear Mr. Hobbie:

This responds to your June 18, 2007, letter and biological assessment (BA) regarding the subject Corps of Engineers' (COE) permit application submitted by the South Florida Water Management District (SFWMD) for the Biscayne Bay Coastal Wetlands (BBCW) Phase 1 Acceler 8 project in Miami-Dade County, Florida. The purpose of the proposed work is to improve freshwater delivery to brackish and freshwater wetlands with the ultimate goal of providing an ecological benefit to Biscayne Bay. You determined that the proposed activity is not likely to adversely affect sea turtles, smalltooth sawfish, elkhorn coral, staghorn coral, and Johnson's seagrass and requested the National Marine Fisheries Service's (NMFS) concurrence, pursuant to section 7 of the Endangered Species Act (ESA). NMFS' determinations regarding the effects of the proposed action are based on the description of the action in this informal consultation. You are reminded that any changes to the proposed action may negate the findings of the present consultation and may require reinitiation of consultation with NMFS.

The project is located in coastal wetlands adjacent to and within Biscayne Bay and is comprised of three components: 1) the Deering Flowway (SAJ-2007-139), 2) the Cutler Flowway (SAJ-2006-7926), and 3) the L-31E Culverts (SAJ 1994-1327). The Deering Flowway is located in southeastern Miami-Dade County on the Charles Deering Estate property at Cutler, and includes the Deering Estate's Powers Addition Parcel, also known as the Cutler Glade Rehydration Area. The Cutler Flowway and the L-31E Culverts are also located in southeastern Miami-Dade County.

The Deering Flowway is designed to route water from the Spur Canal to the east side of Old Cutler Road. A pump station will be installed to pump water from the Spur Canal Extension through a series of pipes underneath Old Cutler Road. A concrete spreader box will be installed on the east side of Old Cutler Road to distribute water eastward through the Cutler Drain and overland through the coastal wetlands toward Biscayne Bay. A three-acre educational wetland area will be constructed on the Deering Estate Powers Addition Property. The BA describes the types of habitat that would be impacted by the proposed construction at the Deering Estate. According to the BA, this segment of the proposed project would impact the Spur Canal (proposed excavation) and an abandoned mango and avocado grove. The BA states the purpose of this segment is to disperse water across the mangrove wetlands to mimic a more natural historic flow of water into Biscayne Bay. No mangrove impacts as a result of excavation or fill are associated with this segment of the project.

The Cutler Flowway is designed to route water from the C-1 Canal in the vicinity west of SW 97th Avenue and SW 232nd Street to the Rehydration Area located east of SW 87th Avenue and south of the eastward extension of SW 232nd Street. A pump station will be installed on the C-1 Canal west of SW 97th Avenue and south of the western extension of SW 232nd Street. An open conveyance channel will extend from the pump station to the Rehydration Area. The conveyance channel will be routed underneath SW 97th Avenue and SW 87th Avenue. A spreader swale will be constructed south of the eastward extension of SW 232nd Street to distribute water across the Rehydration Area. This segment of the project involves removal of exotic vegetation from parcels north of SW 232nd Street located along the flowway and backfilling of select mosquito ditches located within the Rehydration Area. According to an e-mail received on July 27, 2007, from the Corps of Engineers Project Manager, Alisa Zarbo, this segment of the project proposes approximately 2.41 acres of mangrove impacts (1.86 acres of mangroves would be impacted via spreader swale excavation and 0.55 acre of mangroves would be impacted via backfilling of mosquito ditches). The habitat types within this segment include upland forested habitat dominated by exotic vegetation, the C-1 and L-31 Canals, a manmade freshwater marsh dominated by cattails, a forested wetland dominated by exotic vegetation, and a forested mangrove wetland.

The L-31E Culverts are designed to rehydrate coastal wetlands by moving water from the L-31E Canal to the coastal wetlands on the east side of the L-31E levee that runs parallel to the L-31E Canal. Four culverts will be installed under the levee road in select locations on publicly-owned property in the proximity of the C-102, Military, and C-103 Canals. The BA states habitat types within this segment include the L-31E Canal, an herbaceous wetland with sparse mangroves, and a forested mangrove wetland.

The BA states the project will adhere to the NMFS' March 23, 2006, Sea Turtle and Smalltooth Sawfish Construction Conditions (enclosed).

Five species of sea turtles (loggerhead, green, Kemp's ridley, hawksbill, and leatherback) and smalltooth sawfish, protected by the ESA and under NMFS' purview, are known to occur within or near the project site. NMFS believes the project would have no effect on sea turtles because the project does not have any elements with the potential to affect sea turtles. The project is not located within the range of Johnson's seagrass; therefore, NMFS believes the project would have

no effect on Johnson's seagrass. Two listed species of coral, *Acropora palmata* and *Acropora cervicornis*, are known to occur within the waters of Biscayne Bay and Biscayne National Park. However, NMFS believes there would be no effect on these species because they are not found within or near the project area. There is no designated critical habitat within the project area. NMFS believes smalltooth sawfish may be affected by the proposed work. Potential direct effects from the proposed action include injury or death from operating construction equipment in mangrove wetlands. Potential indirect effects include habitat loss.

NMFS believes that direct effects from the proposed action are extremely unlikely to occur and therefore discountable. Smalltooth sawfish are highly mobile and likely to move away from the work area during construction. In addition, the applicant has agreed to follow the enclosed construction conditions. NMFS believes smalltooth sawfish may be indirectly effected by habitat loss. The Cutler Flowway segment of the project proposes approximately 2.41 acres of mangrove impacts (1.86 acres of mangroves would be impacted via spreader swale excavation and 0.55 acre of mangroves would be impacted via backfilling of mosquito ditches). The purpose of the spreader swale and the backfilling of mosquito ditches is to retain water and create a slower sheet flow to the wetlands that are connected to Biscayne Bay. Ultimately, the project proposes an ecological benefit to Biscayne Bay. The BA states each segment of the project will be required to meet state water quality standards. The combined segments of the project propose rehydration of coastal mangrove wetlands. The Cutler Flowway segment also proposes the removal of exotic vegetation from the wetlands, which is anticipated to improve wetland function and value (BA, page 11). NMFS believes the project may be beneficial to smalltooth sawfish by improving nearshore water quality and coastal wetland function. We believe indirect effects due to habitat loss from the project are insignificant.

Based on our analysis, we concur with the COE's determination that the proposed action is not likely to adversely affect any listed species under our purview. This concludes your ESA consultation responsibilities with NMFS for the proposed project. Be advised that the consultation must be reinitiated if a take occurs or new information reveals effects of the action not previously considered, or the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat in a manner or to an extent not previously considered, or if a new species is listed or critical habitat designated that may be affected by the identified action.

We have enclosed additional information on other statutory requirements that may apply to this action, as well as information on NMFS' Public Consultation Tracking System (PCTS) that allows you to track the status of ESA consultations. We look forward to further cooperation with you on other projects to ensure the conservation of our threatened and endangered marine species

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and designated critical habitat. If you have any questions on this consultation or PCTS, please contact Audra Livergood, fishery biologist, at (305) 595-8352, or by e-mail at Audra.Livergood@noaa.gov.

Sincerely yours,

Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosures (2)

cc: Jocelyn Karazsia, HCD West Palm Beach

File: 1514-22.F.1.FL
Ref: I/SER/2007/01672

4

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701

SEA TURTLE AND SMALLTOOTH SAWFISH CONSTRUCTION CONDITIONS

The permittee shall comply with the following protected species construction conditions:

a. The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

g. Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the primary consultation.

Revised: March 23, 2006
O:\forms\Sea Turtle and Smalltooth Sawfish Construction Conditions.doc

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Additional Considerations for ESA Section 7 Consultations (Revised 12-6-2005)

Marine Mammal Protection Act (MMPA) Recommendations: The Endangered Species Act (ESA) section 7 process does not authorize incidental takes of listed or non-listed marine mammals. If such takes may occur an incidental take authorization under MMPA section 101 (a)(5) is necessary. Contact Ken Hollingshead of our NMFS Headquarters' Protected Resources staff at (301) 713-2323 for more information on MMPA permitting procedures.

Essential Fish Habitat (EFH) Recommendations: In addition to its protected species/critical habitat consultation requirements with NMFS' Protected Resources Division (PRD) pursuant to section 7 of the ESA, prior to proceeding with the proposed action the action agency must also consult with NMFS' Habitat Conservation Division (HCD) pursuant to the Magnuson-Stevens Fishery Conservation and Management Act's (MSA) requirements for essential fish habitat (EFH) consultation (16 U.S.C. 1855 (b)(2) and 50 CFR 600.905-930, subpart K). The action agency should also ensure that the applicant understands the ESA and EFH processes; that ESA and EFH consultations are separate, distinct, and guided by different statutes, goals, and time lines for responding to the action agency; and that the action agency will (and the applicant may) receive separate consultation correspondence on NMFS letterhead from HCD regarding their concerns and/or finalizing EFH consultation.

Public Consultation Tracking System (PCTS) Guidance: PCTS is an online query system allowing federal agencies and U.S. Army Corps of Engineers' (COE) permit applicants to track the status of NMFS consultations under ESA section 7 and under MSA sections 305(b)2 and 305(b)(4): Essential Fish Habitat. Access PCTS via: www.nmfs.noaa.gov/pcts. Federal agencies are required to enter an agency-specific username and password to query the Federal Agency Site. The Corps Permit Site allows COE permit applicants the ability to check on the current status of Clean Water Act section 404 permit actions for which NMFS has conducted an ESA section 7 consultation with the COE since the beginning of the 2001 fiscal year (no password needed).

For COE-permitted projects, click on "Enter Corps Permit Site." From the "Choose Agency Subdivision (Required)" list, pick the appropriate COE district. At "Enter Agency Permit Number" type in the COE district identifier, hyphen, year, hyphen, number. The COE is in the processing of converting its permit application database to PCTS-compatible "ORM." An example permit number is: SAJ-2005-000001234-IPS-1. For the Jacksonville District, which has already converted to ORM, permit application numbers should be entered as SAJ (hyphen), followed by 4-digit year (hyphen), followed by permit application numeric identifier with no preceding zeros. E.g., SAJ-2005-123, SAJ-2005-1234, SAJ-2005-12345.

For inquiries regarding applications processed by Corps districts that have not yet made the conversion to ORM (e.g., Mobile District), enter the 9-digit numeric identifier, or convert the existing COE-assigned application number to 9 numeric digits by deleting all letters, hyphens, and commas; converting the year to 4-digit format (e.g., -04 to 2004); and adding additional zeros in front of the numeric identifier to make a total of 9 numeric digits. E.g., AL05-982-F converts to 200500982; MS05-04401-A converts to 200504401. PCTS questions should be directed to Eric Hawk at Eric.Hawk@noaa.gov. Requests for username and password should be directed to April Wolstencroft (PCTSUsersupport@noaa.gov).

ANNEX B
NEPA INFORMATION

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B.0 NATIONAL ENVIRONMENTAL POLICY ACT INFORMATION

B.1 SUMMMARY OF ENVIRONMENTAL COMPLIANCE

TABLE B-1: ENVIRONMENTAL COMPLIANCE AND COORDINATION

Law, Regulation or Policy	Status *	Comments	Last Coordinated	Full Compliance Expected
Clean Air Act of 1972	PC	Project Implementation Report (PIR)/ Environmental Impact Statement (EIS) will be coordinated with public agencies. Air emissions permit may be required for large diesel pumps; normally applied for during Pre-Construction Engineering and Design (PED) phase.	Notice of Intent (NOI) 3/7/03; subsequent project workshops.	Compliance with Section 309 of Clean Air Act will occur with the coordination and review of the PIR/EIS by Environmental Protection Agency (EPA).
Clean Water Act of 1972	PC	A 404 (b) (1) evaluation has been prepared and is contained in Section B.2 of the Final; Water Quality Certification (WQC) will be required; (State permit); National Pollutant Discharge Elimination System (NPDES) permit will be required (State delegation); water quality is expected to improve with project.	Informal coordination with Florida Department of Environmental Protection (FDEP) through participation in Project Delivery Team (PDT) meetings.	Full compliance upon issuance of the WQC and NPDES permits by the state.
National Environmental Policy Act of 1969	PC	NOI published; scoping and stakeholder meetings held; no new issues have been identified; Draft PIR/EIS for Biscayne Bay Coastal Wetlands will be prepared after the	Central and Southern Florida (C&SF) Restudy 1999; NOI on 3/07/03; scoping letter sent on 3/01/03; with subsequent	Full compliance upon coordination of the Final PIR/EIS, public outreach activities completed and signing of the Record of Decision (ROD).

Law, Regulation or Policy	Status *	Comments	Last Coordinated	Full Compliance Expected
		Recommended Plan.	scoping meetings held on 10/29/02 and 10/28/03.	
Fish and Wildlife Coordination Act of 1958	PC	Funds transferred annually to U.S. Fish and Wildlife Service (FWS); Planning Aid Letters (PALs) received; FWS and NMFS have been active team participants and have provided information on fish and wildlife elements on project. An ongoing consultation process between USACE, FWS, the FWC, and the NMFS has involved regular communication and exchange of input between the agencies through monthly interagency coordination meetings, public scoping meetings, and official correspondence.	Ongoing. The FWS has participated in PDT meetings and creation of draft National Environmental Policy Act (NEPA) document. PALs and Planning Aid Reports (PARs) received dated 03/25/02, 06/21/02, 12/24/02, 06/05/03, 10/23/03, 05/13/04, 06/21/04, 01/27/05, 06/09/05, 11/21/05, 01/20/06, and 09/26/06. Final FWCA report was received May 21, 2010.	With receipt of the final Fish and Wildlife Coordination Act (FWCA) report, this project is in full compliance with this Act.
Endangered Species Act of 1973	PC	Initial letter sent to USFWS regarding Threatened and Endangered (T&E) species. A list of potentially affected Threatened and Endangered species has been confirmed by the FWS along with	Confirmation of T&E species by letter dated, January 24, 2005.	Full compliance expected by final PIR/EIS. Informal consultation with FWS, FWC and NMFS has resulted in agency concurrence with the Corps' "no affect", and "may

Law, Regulation or Policy	Status *	Comments	Last Coordinated	Full Compliance Expected
		listed species under the purview of the NMFS. Coordination with both FWS and NMFS is ongoing.		affect not likely to adversely affect" species determinations the formal letter of concurrence from the FWS is contained in Annex of the FPIR/EIS.
Magnuson-Stevens Fishery Mgt Act	PC	Overall project is expected to benefit Essential Fish Habitat (EFH); National Oceanic and Atmospheric Administration (NOAA) will accept Draft EIS as the EFH assessment.	Informal coordination has been conducted with NOAA. Agency representative has attended PDT meetings.	The project is in full compliance with this Act per NMFS concurrence letter dated April 23, 2010.
Fishery Conservation and Management Act	PC	The project is being coordinated with National Marine Fisheries Service (NMFS).	Informal coordination with NOAA representative at PDT meetings.	Full compliance after review of the Final PIR/EIS by NMFS.
Coastal Zone Management Act of 1972	PC	Based on a review of the March 2003 scoping notice and comments provided by state reviewing agencies, the state has determined that, at this stage, the project is consistent with the Florida Coastal Management Program.	March 2003	Additional consistency review by the state will occur during coordination of the Draft and Final PIR/EIS. Full compliance will occur with issuance of the WQC by the state.
Coastal Barrier Resources Act and Coastal Barrier Improvement Act	NA	There are no designated coastal barrier resources in the project area that will be affected by this project. These Acts do not apply.		
Marine Mammal Protection Act	PC	The West Indian Manatee does occur	March 2003 and coordination	Full compliance after review of the

Law, Regulation or Policy	Status *	Comments	Last Coordinated	Full Compliance Expected
		near some of the project sites. Incorporation of the safeguards used to protect T&E species during construction and operation will protect any marine mammals in the area. Coordination with the USFWS will continue as construction and operational guidelines are incorporated to avoid impacts to this species.	through PDT meetings.	Final PIR/EIS by NMFS.
Marine Protection, Research and Sanctuaries Act	NA	The term "dumping" as defined in the Act (3[33 U.S.C. 1402] (f)) does not apply to this project. Therefore the MPRSA does not apply.		
Estuary Protection Act of 1968	PC	It is anticipated that estuaries will be positively affected by this project.	March 2003 and coordination through PDT meetings.	Full compliance after review of the Final PIR/EIS by NMFS.
Anadromous Fish Conservation Act	PC	Anadromous fish species will not likely be adversely affected. The project is being coordinated with NMFS.	March 2003 and coordination through PDT meetings.	Full compliance after review of the Final PIR/EIS by NMFS.
Migratory Bird Treaty Act and Migratory Bird Conservation Act	PC	No migratory birds will likely be adversely affected by project activities. Opportunities exist to promote usage of additional foraging areas provided by the project.	Coordination through PDT meetings with FWS and FWC.	Full compliance after review of the Final PIR/EIS by FWS and FWC.
Wild and Scenic River Act of 1968	NA	No designated Wild and Scenic river		

Law, Regulation or Policy	Status*	Comments	Last Coordinated	Full Compliance Expected
		reaches will be affected by project related activities.		
Federal Water Project Recreation Act	C	The principles of this Act (PL 89-72) have been fulfilled by complying with the recreation cost sharing criteria.		
Submerged Lands Act of 1953	PC	The project will eliminate point source freshwater discharges and provide freshwater overland flow that will ultimately benefit the ecological habitats that occur on submerged lands of the State of Florida. No construction is expected on submerged lands; therefore, full compliance is anticipated.		Full compliance by completion of the Final PIR/EIS.
Rivers and Harbors Act of 1899	NA	The proposed work will not obstruct navigable waters of the United States.		
National Historic Preservation Act of 1966 and the Archaeology and Historic Preservation Act	C	Coordination with State Historic Preservation Officer (SHPO) has been completed. See SHPO letters: March 5, 2007 (DHR no. 2007-803), January 11, 2008 (DHR no. 2007-7384-B), July 16, 2008 (DHR no. 2009-3961)	Section 106 process is complete.	As a result of stated coordination, the project is in full compliance with this Act.
Resource Conservation and Recovery Act (RCRA),	PC	Phase II investigations are ongoing during land acquisition. Some site contamination has	FWS review is ongoing.	If significant site remediation is required, remediation and

Law, Regulation or Policy	Status *	Comments	Last Coordinated	Full Compliance Expected
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund Act)		been identified, and options are being addressed.		full compliance will be achieved during construction phase.
Farmland Protection Policy Act of 1981	C	Coordination with the Natural Resources Conservation Service (NRCS) was initiated through a letter dated 30 April 2008 providing project information regarding farmland conversion. Submittal of Form AD-1006 was sent to NRCS for their evaluation and a determination of no impact to unique farmland was provided by the NRCS through a letter on 9 May 2008 (***Annex B – Section B.5.1***). In the response from NRCS, they concurred no "prime and unique" farmland will be taken out of production due to the project.	Concurrence letter dated 9 May 2008	As a result of stated coordination, the project is in full compliance with this Act.
Executive Order (E.O.) 11988 Floodplain Management	PC	(Floodplain Development). The areas for proposed restoration in the project area are virtually all considered floodplain. The purpose of the EO is to discourage Federally induced development in	Ongoing.	Full compliance expected after completion of the Final PIR/EIS.

Law, Regulation or Policy	Status *	Comments	Last Coordinated	Full Compliance Expected
		floodplains. Commitment of lands to project restoration will preclude such development.		
E.O. 11990 Protection of Wetlands	PC	(Wetlands protection) The areas proposed for restoration are a combination of freshwater and coastal wetlands. A net functional "lift" is expected.	Ongoing habitat mapping and other analysis of wetlands.	The project is in full compliance with this Executive Order.
E.O. 12898 Environmental Justice	PC	The team is in compliance for this phase of the study, as no minority or economically disadvantaged population clusters have been identified in the immediate southern Miami-Dade County region where project features are proposed.	1999 Restudy	The project is in full compliance with this Executive Order.
E.O. 13089 Coral Reef Protection	PC	This project is expected to provide overall benefits to hard bottom communities and coral reef resources.	March 2003 and coordination through PDT meetings.	Full compliance after review of the Final PIR/EIS by NMFS.
E.O. 13112 Invasive Species	C	Project is expected to reduce the abundance and variety of invasive plant species in the project area.	Ongoing coordination with USFWS and Miami-Dade County Department of Environmental Resources Management (DERM).	The project is in full compliance with this Executive Order.
E.O. 13186 Migratory Birds	C	No migratory birds would be adversely	This coordination	This project is in compliance with

Law, Regulation or Policy	Status *	Comments	Last Coordinated	Full Compliance Expected
		affected by project activities.	has been on-going throughout the duration of the planning process.	this Executive Order.

* C: Complies fully; PC: partial compliance due to plan development; NC: non-compliant; NA: not applicable.

B.2 CLEAN WATER ACT SECTION 404(B)(1) EVALUATION

B.2.1 Project Description

B.2.1.1 Location

The Biscayne Bay Coastal Wetlands project area is located in southeast Miami-Dade County, south of Miami and east of Florida City and Homestead, within the South Florida Water Management District's (SFWMD's) Lower East Coast (LEC) water supply planning region. The study area is bounded by south-central Biscayne Bay and Biscayne National Park (BNP) to the south and east, and the Atlantic Coastal Ridge and agricultural and suburban development to the north and west. Florida Power & Light's (FPL's) Turkey Point nuclear power plant, Homestead Air Reserve Base and the South Dade Landfill are located in the project area.

The project area overlaps several drainage basins, including six which are named for the associated major east-west canals: Canal 100 (C-100), C-1, C-102, C-103, North Canal, and Florida City Canal. The canals are generally managed to discharge excess water from basins during flooding and maintain minimum water levels during droughts and incidentally redirect water from wetlands and discharge freshwater to Biscayne Bay. The north-south trending L-31E Levee and L-31E Canal cross the project area, and water control structures exist at its intersections with the major east-west canals.

B.2.1.2 Alternatives Considered and Rejected

The plan formulation process went through three iterations to arrive at a selected plan. Management measures were formulated based on prior planning efforts. The measures were then combined into an Initial Array of Alternatives. These alternatives were then screened based on factors derived from the objectives and constraints. After screening, some alternatives were combined due to redundant features that will not create discernible differences.

After the initial screening and consolidation described above, five alternatives remained as well as the future-without project condition. After hydrologic modeling of the alternatives, costs and habitat units were calculated and used to conduct the Cost Effectiveness/Incremental Cost Analysis (CE/ICA). As a result, the project development team (PDT) conducted a second screening process and three more of the alternatives were eliminated.

The two remaining alternatives (Alternative M and Alternative Q) were then analyzed. After completing their analysis, the project development team determined that a hybrid of the two plan alternatives should be formulated. The resulting plan, Alternative O was added to the final list of alternative plan candidates considered for the Biscayne Bay Coastal Wetlands project.

Cost and benefit units were then calculated for Alternative O, and the CE/ICA was calculated. Along with the CE/ICA for the final array comparison, the team also analyzed the Evaluation Accounts (i.e., National Economic Development [NED], National Ecosystem Restoration [NER] and Regional Economic Development [RED]) to determine the selected plan for the proposed Biscayne Bay Coastal Wetlands project.

B.2.1.2.1 Alternative O Phase 1 General Description

The selected plan for this study is the first increment of the Biscayne Bay Coastal Wetlands project, a subset of the NER plan Alternative O Phase 1. The first increment, Alternative O Phase 1, has been identified to provide benefits towards achieving the Biscayne Bay Coastal Wetlands project objectives. Additionally, acknowledging the risk and uncertainty inherent in this project, Alternative O Phase 1 incorporates the principles of adaptive management. The first increment contains most of the features of the Deering Estate subcomponent, including a 100 cubic feet per second (cfs) pump, spreader canal, culverts and improvements to a canal. In the Cutler Wetlands subcomponent, the selected plan includes a 400 cfs pump, culverts, a canal, and restoration of the Lennar Flow Way. In the L-31E Flow Way and North Canal Flow Way subcomponent, the Selected Plan includes pumps, a spreader canal, and several culvert structures to manage water flow between the C-102, L-31E Levee, L-31E Canal, Military Canal, C-103 Canal, and nearby wetland restoration areas. No construction activities are recommended in the first increment for the Barnes Sound subcomponent.

B.2.1.3 Authority and Purpose

The Comprehensive Everglades Restoration Plan (CERP) was approved in Section 601 of Water Resources Development Act (WRDA) of 2000. The authority for the preparation of the Biscayne Bay Coastal Wetlands Project Implementation Report (PIR), one of a number of site-specific projects, is

contained in Section 601(d) WRDA 2000. The U.S. Army Corps of Engineers (USACE) and the South Florida Water Management District (SFWMD) have executed a Design Agreement for the design of elements of the CERP and South Florida Ecosystem Restoration project (Design Agreement, May 2000). The direction and guidance for the development of the Biscayne Bay Coastal Wetlands project are contained within the CERP Master Program Management Plan (MPMP), which was developed and approved by the USACE and the SFWMD for the purposes of describing the framework and processes to be used for managing and monitoring implementation of the CERP.

The Central and Southern Florida (C&SF) Flood Control Project, as constructed, had unintended adverse impacts to Biscayne Bay and adjacent wetlands including BNP and Biscayne Bay Aquatic Preserve. Historically, freshwater flowed into Biscayne Bay from surface (sloughs, transverse glades, and overland from through wetlands) and groundwater sources and resulted in narrower salinity fluctuations than exist today. Now the nearshore bay experiences periods of low salinity during the wet season, when canal discharges are high, and periods of high salinity during the dry season, when canal discharges are absent. While historic estuarine conditions sustained healthy and extensive ecological communities (sawgrass prairies, mangrove communities, seagrass beds, and oyster bars) these communities have been degraded under the managed system. Page 9-24 of the CERP identified the purpose for the Biscayne Bay Coastal Wetlands project: *The purpose of this feature is to rehydrate wetlands and reduce point source discharge to Biscayne Bay. The proposed project will replace lost overland flow and partially compensate for the reduction in groundwater seepage by redistributing, through a spreader system, available surface water entering the area from regional canals.*

B.2.1.4 General Description of Dredged or Fill Material

B.2.1.4.1 General Characteristics of Material

As a generalization, material to be cut from spreader canals in undisturbed areas will be weakly cemented or highly solutioned limestone with a thin veneer of less than three feet of organic sediments overlying the limestone. The rock generally becomes harder with depth below approximately five feet. The canal spur at Deering Estates and some pump stations will be excavated deeper and encounter harder rock intervals.

B.2.1.4.2 Quantity of Material

The quantity of material to be excavated from the spreader canal paralleling SW 87th Avenue is approximately 90,000 cubic yards. This includes the State's Expedited Construction segments and Segment 4 that are planned as a USACE project. An additional quantity of approximately 45,000 cubic yards will be

excavated during construction of the canal between the C-1 Canal and the pump station, (between the pump station and SW 87th Ave). The spur canal at Deering Estate will have an excavation volume of approximately 4,400 cubic yards with an additional 8,100 cubic yards for the two acre educational wetlands that is part of this project.

B.2.1.4.3 Source of Material

The fill material will be material removed in situ during excavation of the canals.

B.2.1.5 Description of the Proposed Discharge Site

B.2.1.5.1 Location

Disposal of material will be onsite. Some material may be used for plugging existing mosquito ditches located east of L-31E Levee, depending on its quality. The remaining material will be stockpiled for use in Phase 2 of this project.

B.2.1.5.2 Size

An area of 1,260 acres will be used as flow way for the combined C-1, C-100, and Deering Estate components. Another 1,900 acres of rehydration will be constructed east of L-31E Levee between the North Canal and immediately north of the C-102 Canal, within the proposed area west of L-31E Levee between the C-103 Canal and North Canal.

B.2.1.5.3 Disposal Site

The disposal site for the project area consists of degraded wetlands which were formerly agricultural lands. A series of ditches, canals and paths are scattered throughout the site.

B.2.1.5.4 Habitat

The site currently consists of degraded wetlands with ditches, canals and paths scattered throughout. There are additional wetlands and agricultural land to the west, Biscayne Bay to the east, urban areas to the north, and wetlands and agricultural areas to the south.

B.2.2 Factual Determinations

B.2.2.1 Physical Substrate Determinations

B.2.2.1.1 Sediment Type

B.2.2.1.1.1 Deering Estates (CC-D3)

The soil material is a gray, stony loam consisting of fill material used to construct building lots for residences. This is not native material. The surficial material is up to 50 inches thick and underlain by hard limestone.

B.2.2.1.1.2 Cutler Wetlands (C-702)

The soil material at this location is Perrine marl which (in this case a silt loam, more silt than clay and sand) reaches a depth of up to two feet and is underlain by soft limestone.

B.2.2.1.1.3 C-711E and C-711W

Perrine marl and minor Biscayne marl are present at the spreader canal location. The Perrine is the major soil type in this area as described above. The Biscayne marl is gray to light gray silt loam up to 15 inches thick with occasional layers of organic material up to eight inches thick. The Biscayne marl and Perrine marl in this area are underlain by hard porous limestone at a depth from 15 inches to two feet.

B.2.2.1.2 Substrate Elevation and Slope

The natural topography of the area is nearly flat with slopes less than two percent, with the exception of the unnatural features (canals and levee).

B.2.2.1.3 Dredge/Fill Material Movement

Once the culverts are installed and the channels excavated and stabilized with riprap, movement of fill and surface soils is not expected. Some minor erosion may occur in specific areas if high rain events induce flooding during, or immediately, after construction.

B.2.2.1.4 Physical Effects on Benthos

No adverse impacts to benthic organisms are anticipated other than displacement of those organisms in the construction footprint of the proposed spreader channels.

B.2.2.1.5 Water Circulation, Fluctuation, and Salinity Determination

Currently, surface waters east of the L-31E Levee drain toward Biscayne Bay via ditches and canals with no sheet-flow to the coastal wetlands. This has resulted in hypersaline conditions within these tidal wetlands and in the nearshore waters not directly adjacent to canal mouths. The proposed project will pump available water from the C-102 and C-103 canals which currently discharge to tide at Structures S-21A and S-20F. The pumped water will be diverted to freshwater and saltwater wetlands and ultimately Biscayne Bay. With implementation of the project, freshwater deliveries to the coastal wetlands will vary by location due to the variation in the wetland topography. In some locations, freshwater deliveries may not occur due to elevated topography. On average, the volume diverted to wetlands from C-102 and C-103 is 109,000 acre-feet per year (acre-feet/year). This is approximately 51 percent of the total available average annual flow (214,000 acre-feet/year). An ecological monitoring plan has been developed to monitor the effectiveness of the culverts.

B.2.2.1.6 Water Column Effects

During construction of spreader canals and installation of culverts and pump stations, the water column in the immediate area may become temporarily more turbid. No long term effects on the water column are expected.

B.2.2.1.6.1 Current Patterns and Circulation

Construction of the project features is not expected to affect current patterns or circulation.

B.2.2.1.6.2 Normal Water Level Fluctuations and Salinity Gradients

Construction activities will not affect normal water level fluctuations or salinity gradients. Implementation of the project will help to modify the salinity released to Biscayne Bay. The salinity gradient will be somewhat modified to a more ecologically appropriate level.

B.2.2.2 Suspended Particulate/Turbidity Determinations

B.2.2.2.1 Expected Changes in Suspended Particulates and Turbidity Levels in the Vicinity of the Disposal Site

Suspended particulate/turbidity will be limited to the construction footprint during construction period. There should be no turbidity in canals or downstream wetlands as a result of the project. Best management practices will be used to minimize the suspension and transport of soils, levee materials, and

roadway materials into water adjacent to or downstream of the construction area including use of sediment controls for adjacent wetlands.

B.2.2.2.2 Effects on Chemical and Physical Properties of the Water Column

In general, any short-term impacts to water quality associated with construction of the project will be ameliorated by construction sequencing, best management practices for erosion and sedimentation control and monitoring during construction. Longer-term impacts to water quality associated with the operation of project features will be addressed through operational monitoring and adaptive management actions, if potentially adverse affects are observed or predicted.

B.2.2.2.3 Light Penetration

During construction operations there will be a temporary reduction in light penetration in the canals in the immediate vicinity of the activity. Once construction is complete, light penetration is expected to return to pre-construction levels.

B.2.2.2.4 Dissolved Oxygen

During construction operations there will be a temporary reduction in the dissolved oxygen content in the water column in the immediate vicinity of the activity. Once construction is complete, dissolved oxygen is expected to return to pre-construction levels.

B.2.2.2.5 Toxic Metals, Organics, and Pathogens

No toxic metals, organics, or pathogens will be released by project construction.

B.2.2.2.6 Aesthetics

During construction, visual aesthetics will be negatively impacted. After completion, aesthetics will improve due to a reduction in exotic species.

B.2.2.2.7 Effects on Biota

B.2.2.2.7.1 Primary Productivity and Photosynthesis

Disposal of excavated materials will adversely affect wetlands in the immediate vicinity of construction by destroying vegetation and smothering biota. However, project operation will improve the primary productivity and photosynthesis due to an increase in quality of wetland habitat.

B.2.2.2.7.2 Suspension/Filter Feeders

During construction operations there will be a temporary increase in turbidity and possibly a decrease in suspension/filter feeders due to construction activities. This temporary increase in turbidity will be short-term and should not have any long-term negative impact on these highly fecund organisms. The implantation of the project should benefit these organisms by creating a better quality wetland habitat.

B.2.2.2.7.3 Sight Feeders

During construction operations there will be a temporary increase in turbidity and possibly a decrease in sight feeders due to construction activities. No significant impacts on these organisms are expected as the majority of sight feeders are highly mobile and can move outside the affected area. When the project is operational, sight feeders will benefit from the better quality wetland habitat.

B.2.2.3 Contamination Determinations

From the 1920s through the 1960s, most of the land parcels incorporated in the project footprint were cultivated for agricultural use. A few parcels continue to be farmed; however, crops and cultivation practices have changed dramatically. Residual pesticide contamination associated with past and present crop production can be detected in the soils on many of the parcels. For parcels that are frequently inundated under present hydrologic conditions, the project is not likely to significantly increase the risk of environmental harm associated with the fate and transport of the residual contamination. For parcels that are not frequently inundated under present hydrologic conditions, the project may increase the risk of environmental harm associated with the fate and transport of residual contamination. Additional hazardous, toxic and radioactive waste (HTRW) investigations will be conducted to determine what project top-soils require isolation (by encapsulating in levee berms) to minimize the risk of contaminant bioaccumulation or mobilization.

B.2.2.4 Aquatic Ecosystem and Organism Determinations

B.2.2.4.1 Effects on Plankton

No adverse impacts to plankton are anticipated. Concentration of freshwater diatoms should increase at a minimum in a narrow zone associated with water delivery at each culvert location.

B.2.2.4.2 Effects on Benthos

No adverse impacts to benthic organisms are anticipated other than displacement of those organisms in the construction footprint of the proposed spreader channels.

B.2.2.4.3 Effects on Nekton

The waters of Biscayne Bay and the adjacent coastline provide a variety of habitat for a range of fish. Estuarine fish species most likely to occur in the mouths of the tidal creeks include the small forage species such as killifish (*Cyprinodon* spp. and *Fundulus* spp.), mosquito fish (*Gambusia affinish*), juvenile sciaenids (*Leiostomus* spp.), silversides (*Atherinidae*) and mullets (*Mugil* spp.). Larger secondary consumers include gray snapper (*Lutjanus griseus*), tarpon (*Megalops atlanticus*), snook (*Centopomus* spp.), red drum (*Sciaenops ocellatus*) and spotted seatrout (*Cynoscion nebulosus*).

No adverse impacts to the fish in the project area are anticipated during construction activities. Fish are able to move in and out of the area. An, installation of the culverts in locations of remnant freshwater creeks will provide water delivery and re-creation of tidal creeks connecting coastal wetlands to the bay, improving habitat and nursery opportunities for fish.

B.2.2.4.4 Effects on the Aquatic Food Web

Periphyton forms the base of the food web within the project area. Implementation of the project is expected to increase periphyton mat biomass and productivity throughout the site as well as freshwater diatoms. No adverse impacts to the aquatic food web are anticipated, other than minor temporary impacts within the construction footprint of the proposed spreader channels.

B.2.2.5 Effects on Special Aquatic Sites

B.2.2.5.1 Hardground and Coral Reef Communities

There are no hardground or coral reef communities located within the proposed project site or the nearshore waters affected by the project. Corals found within the waters of Biscayne Bay are outside of the area of potential effect.

B.2.2.5.2 Sanctuaries and Refuges

BNP is immediately adjacent to the site and recognized as a tropical marine environment of national significance well known for its productive reef ecosystems that play a critical role in the dynamics of the larger Florida Keys reef ecosystem. The landward boundary of BNP captures the "coastal band mangroves" where the mangrove fringe is well developed, tidally flushed daily,

and dominated by large red mangroves. Although the landward boundary does not extend all the way to the L-31E Levee, the project will have a positive impact on BNP by reducing freshwater point source discharges through the C-1, C-100, C-102, C-103, and Military canals thereby decreasing the typical amplitude and frequency of extreme salinity excursions at canal mouths.

B.2.2.5.3 Wetlands

Vegetation in the project area is comprised of saltwater wetlands to the east. Mangrove is the dominant vegetation class with mangrove wetlands at the project site from west to east consisting of dwarf, transitional and fringing (at the shoreline). There is some remnant salt marsh present immediately east of the L-31E Levee generally along and in the vicinity of the C-102 Canal. Additionally, in the northwest corner of the L-31 project site there are wetlands identified as exotic wetland hardwoods dominated by Brazilian pepper (*Schinus terebinthifolius*) and leather fern (*Acrostichum* spp.).

As a result of the project, approximately 101 acres of wetlands will be removed by construction activities (culvert installation, excavation, and stabilization with riprap). This loss is considered minimal and is not anticipated to have any adverse effects. Historically, the wetlands at the project site were a graminoid community dominated by sawgrass. The proposed project is anticipated to provide positive ecological benefits to the mangrove wetlands particularly with respect to diatom and periphyton production. Without implementation of other features and operational changes, the project is not anticipated to cause transition of mangrove wetlands back to graminoid marsh. Water delivery as a result of the project, however, is anticipated to benefit the remnant creeks in the vicinity of the culverts particularly through improvements to salinity concentrations, water stages, wetland vegetation, and algal composition.

B.2.2.5.4 Mud Flats

There are no mud flats within the construction footprint or areas impacted by the project.

B.2.2.5.5 Vegetated Shallows

Submerged aquatic vegetation (SAV) is present throughout the nearshore waters. The trend shows the following species in order from the shoreline to the deeper waters: widgeon grass (*Ruppia maritime*), shoal grass, turtle grass. Without operational changes and/or active pumping the project is not anticipated to have any effect on SAV.

B.2.2.5.6 Riffle and Pool Complexes

There are none within the project footprint and none should be impacted by the project.

B.2.2.5.7 Threatened and Endangered Species

There are 25 Federally listed threatened and endangered species potentially present in the project area. That number includes the American alligator which is categorized as a species of similar appearance to the American crocodile. The USACE and U.S. Fish and Wildlife Service (FWS) are presently consulting on a determination of 'no effect' or 'not likely to adversely effect' decision for all Federally listed species within the project area.

B.2.2.6 Proposed Disposal Site Determinations

B.2.2.6.1 Mixing Zone Determination

The dredged material will not cause unacceptable changes in the mixing zone water quality requirements as specified by the State of Florida's Water Quality Certification permit procedures. No adverse impacts related to depth, current velocity, direction and variability, degree of turbulence, stratification, or ambient concentrations of constituents are expected from implementation of the project.

B.2.2.6.2 Determination of Compliance with Applicable Water Quality Standards

The project will comply with Federal and state water quality standards.

B.2.2.7 Potential Effects on Human Use Characteristics:

B.2.2.7.1 Municipal and Private Water Supply

No municipal or private water supplies will be adversely impacted by the implementation of the project.

B.2.2.7.2 Recreational and Commercial Fisheries

Biscayne Bay provides critical nursery habitats and food web links for many important commercial and recreational fishery species, including bonefish, snook, tarpon, permit, pink shrimp, spotted seatrout, oysters, clams, blue crabs and stone crabs, baitfishes, and numerous coral reef fishes that include snappers, groupers, grunts, barracuda, spadefish, spiny lobster, parrotfish and triggerfish. Recreational and commercial fishers will not be adversely affected by the implementation of the project. The project may provide a positive benefit by reconnection of remnant tidal creeks to the bay and thereby providing habitat (i.e: foraging and nursery opportunities for recreational and commercial fish).

B.2.2.7.3 Water Related Recreation

Presently, BNP provides opportunities for fishing, kayaking/canoeing, motorized boating (in areas of adequate water depth) and wildlife viewing. Water related recreation will not be affected as a result of project implementation.

B.2.2.7.4 Aesthetics:

The existing environmental setting will not be changed. Some exotic plant control may enhance the aesthetics of the area.

B.2.2.7.5 Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves

See Paragraphs ("Sanctuaries and Refuges") above.

B.2.2.8 Essential Fish Habitat

B.2.2.8.1 Essential Fish Habitat in the Area

The project is located in areas designated as essential fish habitat (EFH) for corals, coral reef and live bottom habitat, red drum (*Sciaenops ocellatus*), shrimp, spiny lobster (*Panulirus argus*), other coastal migratory pelagic species and the snapper-grouper complex. Species generally present in the Florida region include brown shrimp, pink shrimp, white shrimp, spiny lobster, stone crab, gulf stone crab, red drum, Spanish mackerel, gray snapper (juvenile and adult). Specifically, EFH in Biscayne Bay is comprised of seagrasses, estuarine mangroves, intertidal flats, estuarine water column, live/hard bottoms, and coral reefs.

The features constructed for the Deering Estate Flow-way component (spur canal extension, pump station, conveyance pipe, and spreader feature) are anticipated to displace 6.1 acres of filled, developed, or disturbed habitat and 0.02 acre of tropical hardwood hammock (***Table B-2***). Features constructed for the Cutler Flow-way Component of the project (pump station, conveyance channel, and spreader canal) will displace 48.2 acres of non-native vegetation (almost exclusively Brazilian pepper), 25.8 acres of native vegetation (mostly mangroves), and 12.4 acres of native and non-native mixed vegetation communities. Also, approximately 2,500 linear feet of material will be used to plug existing mosquito ditches, the intent of which is to discourage the channelization of the water delivered to the area by the spreader canals. Features constructed for the L-31E Culverts component of the project (pump stations, spreader ditch, seepage canal, culverts, and risers) will displace 4,6 acres of filled, developed, or disturbed habitat, 1.5 acres native vegetation, 4.9 acres of non-native vegetation (Brazilian pepper and Australian pine), and 4.3 acres of native and non-native mixed vegetation communities.

TABLE B-2: SPATIAL EXTENT (IN ACRES) OF VEGETATION TYPES DISPLACED BY PROJECT FEATURES WITHIN EACH OF THE 3 PROJECT GEOGRAPHIC COMPONENTS

Project Component	Land Use or Vegetation Type Impacted	Number of Acres Impacted
Deering Flow-way	Filled/Develop/Disturbed	6.10
	Tropical hardwood hammock	0.02
Cutler Flow-way	Brazilian pepper	48.19
	White mangrove/Buttonwood	23.51
	White mangrove/Brazilian pepper	12.00
	Filled / Developed/Disturbed	11.54
	Coastal Band Mangrove	2.25
	Native forested-shrub wetland /Australian pine	0.41
L-31E Culverts	Native forested-shrub wetland/Brazilian pepper	4.11
	Filled/Developed/Disturbed	4.58
	Cattail	0.10
	Open water	1.82
	Brazilian pepper	4.07
	Australian pine	0.73
	Coastal band mangrove	0.92
	Dwarf dense mangrove	0.09
	White mangrove/buttonwood	0.05
	Native forested-shrub wetland	0.10
	Native forested-shrub wetland/Australian pine	0.17
	Dwarf dense mangrove	0.11
	Dwarf dense mangrove/sawgrass	0.02
	Mixed wetland hardwoods	0.25
Totals	**Native vegetation communities**	**27.32**
	Non-native vegetation	**53.09**
	Native/non-native mixed communities	**16.69**
	Filled/Develop/Disturbed	**22.22**

B.2.2.8.1.1 Assessment of Effects on Hardground and Coral Reef Communities

There are no hardground or coral reef communities located within the proposed project site or the nearshore waters affected by the project. Corals found within the waters of Biscayne Bay outside of the area of potential effect.

B.2.2.8.1.2 Assessment of Effects on Sanctuaries and Refuges

BNP is immediately adjacent to the site and recognized as a tropical marine environment of national significance well known for its productive reef

ecosystems that play a critical role in the dynamics of the larger Florida Keys reef ecosystem. The landward boundary of BNP captures the "coastal band mangroves" where the mangrove fringe is well developed, tidally flushed daily, and dominated by large reds. Although the landward boundary does not extend all the way to the L-31E Levee, the project will have a positive impact on BNP by reducing freshwater point source discharges through the C-102, C-103, and Military Canals thereby decreasing the typical amplitude and frequency of extreme salinity excursions at canal mouths.

B.2.2.8.1.3 Assessment of Effects on Wetlands

Vegetation in the project area is comprised of saltwater wetlands to the east. Mangrove is the dominant vegetation class with mangrove wetlands at the project site from west to east consisting of dwarf, transitional, and fringing (at the shoreline). There is some remnant salt marsh present immediately east of the L-31E Levee generally along and in the vicinity of the C-102 Canal. Additionally, in the northwest corner of the L-31 project site there are wetlands identified as exotic wetland hardwoods dominated by Brazilian pepper (*Schinus terebinthifolius*) and leather fern (*Acrostichum* spp.).

As a result of the project approximately 101 acres of wetlands will be removed by construction activities (culvert installation, excavation, and stabilization with riprap). This loss is considered minimal and is not anticipated to have any adverse effects. Historically the wetlands at the project site were a graminoid community dominated by sawgrass. The proposed project is anticipated to provide positive ecological benefits to the mangrove wetlands particularly with respect to diatom and periphyton production. Without implementation of other features and operational changes, the project is not anticipated to cause transition of mangrove wetlands back to graminoid marsh. Water delivery as a result of the project, however, is anticipated to benefit the remnant creeks in the vicinity of the culverts particularly through improvements to salinity concentrations, water stages, wetland vegetation, and algal composition.

B.2.2.8.1.4 Assessment of Effects on Mud Flats

There are no mud flats within the construction footprint or areas impacted by the project.

B.2.2.8.1.5 Assessment of Effects on Vegetated Shallows

SAV is present throughout the nearshore waters. The trend shows the following species in order from the shoreline to the deeper waters: widgeon grass (Ruppia maritime), shoal grass, turtle grass. Without operational changes and/or active pumping the project is not anticipated to have any effect on SAV.

B.2.2.8.1.6 Assessment of Effects on Riffle and Pool Complexes

There are none within the project footprint and none should be impacted by the project.

B.2.2.8.1.7 Assessment of Effects on Plankton

No adverse impacts to plankton are anticipated. Concentration of freshwater diatoms should increase at a minimum in a narrow zone associated with water delivery at each culvert location.

B.2.2.8.1.8 Assessment of Effects on Benthos

No adverse impacts to benthic organisms are anticipated other than displacement of those organisms in the construction footprint of the proposed spreader channels.

B.2.2.8.1.9 Assessment of Effects on Nekton

The waters of Biscayne Bay and the adjacent coastline provide a variety of habitat for a range of fish. Estuarine fish species most likely to occur in the mouths of the tidal creeks include the small forage species such as killifish (*Cyprinodon* spp. and *Fundulus* spp.), mosquito fish (*Gambusia affinish*), juvenile sciaenids (*Leiostomus* spp.), silversides (*Atherinidae*), and mullets (*Mugil* spp.). Larger secondary consumers include gray snapper (*Lutjanus griesus*), tarpon (*Megalops atlantica*), snook (*Centopomus* spp.), red drum (*Sciaenops ocellatus*) and spotted seatrout (*Cynoscion nebulosus*).

There should be no adverse impacts during the construction due to the ability of fish to move out of the area. Installation of the culverts in locations of remnant freshwater creeks will provide improved habitat and nursery opportunities for fish with water delivery and recreation of tidal creeks connecting coastal wetlands to the bay.

B.2.2.8.2 Determination of Effects on Essential Fish Habitat

The overall benefit to the regional system is expected to be far greater than the localized adverse effects. The restoration of hydrology of the greater Everglades ecosystem and the increase in spatial extent of protected wetland acreage in the region will produce extensive cumulative beneficial effects. These beneficial effects are expected to substantially outweigh the cumulative adverse effects produced by the aquatic ecosystem alterations that may be necessary to construct some of the project components.

There will be no adverse secondary impacts on the aquatic ecosystem as a result of the construction. During construction, the sites will be contained with sedimentation barriers. Erosion will be controlled by appropriate erosion control techniques. Sedimentation will be controlled during construction. An ecological and water quality monitoring plan would be implemented during and after construction and specific environmental commitments, engineering and design commitments, and operational commitments will be incorporated to avoid, minimize, and/or mitigate for adverse effects.

B.2.2.9 Determination of Cumulative Effects on the Aquatic Ecosystem

The overall benefit to the regional system is expected to be far greater than the localized adverse effects. The hydrologic restoration of the greater Everglades ecosystem and the increase in spatial extent of protected wetland acreage in the region will produce extensive cumulative beneficial effects. These beneficial effects are expected to substantially outweigh the cumulative adverse effects produced by the aquatic ecosystem alterations that may be necessary to construct some of the project components.

B.2.2.10 Determination of Secondary Effects on the Aquatic Ecosystem

No adverse secondary impacts on the aquatic ecosystem will occur as a result of the construction. During construction the sites will be contained with sedimentation barriers. Erosion will be controlled by appropriate erosion control techniques. Sedimentation will be controlled during construction. An ecological and water quality monitoring plan will be implemented during and after construction and specific environmental commitments, engineering and design commitments, and operational commitments will be incorporated to avoid, minimize, and/or mitigate for adverse effects.

B.2.3 Findings of Compliance or Non-Compliance with the Restrictions on Discharge

a. No significant adaptations of the guidelines were made relative to this evaluation.
b. At the time of the project planning phase no practicable alternatives exist which meet the study objectives involving discharge of fill into waters of the United States.
c. At this time, no practicable alternatives exist which have less adverse impact on the aquatic ecosystem without presenting other significant adverse environmental consequences.
d. The discharge of fill materials is not anticipated to cause or contribute to violations of any applicable state water quality standards for Class III waters. The discharge operation is not anticipated to violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

e. The placement of fill materials in the project area is not anticipated to jeopardize the continued existence of any species listed as threatened and endangered or result in the likelihood of destruction or adverse modification of any critical habitat as specified by the Endangered Species Act of 1973, as amended.
f. The placement of fill material is not anticipated to result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife and special aquatic sites. The life stages of aquatic species and other wildlife is not anticipated to be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic and economic values are not anticipated.
g. Based on the guidelines, the proposed discharge site for the discharge of fill and/or dredged material is specified as complying with the requirements of these guidelines.

B.3 COASTAL ZONE CONSISTENCY EVALUATION

FLORIDA COASTAL ZONE MANAGEMENT PROGRAM FEDERAL

Chapter 161, Beach and Shore Preservation

The intent of the Coastal Construction Permit Program established by Chapter 161 is to regulate construction projects located seaward of the line of mean high water and which might have an effect on natural shoreline processes.

Response: The proposed plans and information will be submitted to the state in compliance with this chapter. No work is proposed seaward of the mean high water line in beach areas.

Chapters 186 and 187, State and Regional Planning

These chapters establish the State Comprehensive Plan that sets goals that articulate a strategic vision of the state's future. The purpose is to define, in a broad sense, goals and policies that provide decision-makers directions for the future and provide long-range guidance for an orderly social, economic and physical growth.

Response: The proposed project has been coordinated with various Federal, state and local agencies during the planning process. The proposed project will achieve the goals of these chapters by contributing to a long-range master plan for south Florida's water resources, which will support the continued orderly social, economic and physical growth of the region.

Chapter 252, Disaster Preparation, Response and Mitigation

This chapter creates a state emergency management agency, with the authority to provide for the common defense; to protect the public peace, health and safety; and to preserve the lives and property of the people of the State of Florida.

Response: This statute is not applicable to this project.

Chapter 253, State Lands

Chapter 253 governs the management of submerged state lands and resources within state lands. This includes archeological and historical resources; water resources; fish and wildlife resources; nearshore reefs; beaches and dunes; submerged grass beds and other benthic communities; swamps, marshes and other wetlands; mineral resources; unique natural features; submerged lands; spoil islands; and artificial reefs.

Response: The proposed project will make a positive contribution to preserving cultural, water, fish and wildlife, wetland and estuarine resources. The proposed project will comply with the intent of Chapter 253.

Chapters 253, 259, 260, and 375, Land Acquisition

Chapters 253, 259, 260, and 375 authorize the State of Florida to acquire land to protect environmentally sensitive areas.

Response: Much of the property proposed for this project is already in public ownership. The proposed project will comply with the intent of this chapter.

Chapter 258, State Parks and Aquatic Preserves

Chapter 258 authorizes the state to manage state parks and preserves. Consistency with this statute will include consideration of projects that will directly or indirectly adversely impact park property, natural resources, park programs, management or operations.

Response: BNP is at the head of historic creeks and productive estuarine and marine ecosystems, including aquatic preserves, along with local parks and recreation areas. The aquatic preserves are Outstanding Florida Waters. The proposed project will improve the timing and delivery of water to Biscayne Bay which will have a positive effect on these areas. The proposed project will comply with the intent of Chapter 258.

Chapter 267, Historic Preservation

Chapter 267 establishes the procedures for implementing the:

- Florida Historic Resources Act responsibilities
- Section 106 of the National Historic Preservation Act of 1966, as amended
- National Environmental Policy Act of 1969, as amended

Response: Phase 1 cultural resource surveys have been completed for the State's Expedited Construction (formally known as Acceler8) features of the Biscayne Bay Coastal Wetlands project. Upon completion of repairs to the Deering Estate Bridge (8DA2815C) and channel maintenance, the State Historic Preservation Officer concurs with the determination by Janus Research that the proposed project will have no effect on cultural resources (any prehistoric or historic district, site, building, structure, or object) listed or eligible for listing in the National Register of Historic Places. Coordination for the additional features to be constructed by the USACE is ongoing.

Chapter 288, Economic Development and Tourism

Chapter 288 directs the State of Florida to provide guidance and promotion of beneficial development through encouraging economic diversification and promoting tourism.

Response: The proposed project will achieve the goals of Chapter 288 by contributing to a long-range master plan for south Florida's water resources, which will support economic diversification and tourism.

Chapters 334 (Transportation Administration), 335 (State Highway System), 338 (Intrastate Highway System and Toll Facilities) and 339 (Public Transportation)

Chapters 334, 335, 338 and 339 authorize the planning and development of a safe, balanced and efficient transportation system.

Response: No public transportation systems will be impacted by this project.

Chapter 370, Saltwater Living Resources

Chapter 370 directs the state to preserve, manage and protect the marine, crustacean, shell and anadromous fishery resources in state waters; to protect and enhance the marine and estuarine environment; to regulate fishermen and vessels of the state engaged in the taking of such resources within or without state waters; to issue licenses for the taking and processing products of fisheries;

to secure and maintain statistical records of the catch of each such species; and to conduct scientific, economic, and other studies and research.

Response: The proposed project is consistent with the goals of Chapter 370. Implementation of the project will provide direct positive impacts on saltwater resources within Biscayne Bay and adjacent estuaries by redistributing freshwater runoff from the watershed away from the existing canal discharges to provide a more natural and historic overland flow through transverse glades and existing coastal wetlands that will reduce hyper-saline conditions and improve the overall salinity balance. This course of action will benefit seagrass, oysters, fisheries and wildlife.

Chapter 372, Living Land and Freshwater Resources

Chapter 372 establishes the Florida Fish and Wildlife Conservation Commission (FWC) and directs it to manage freshwater aquatic life and wild animal life and their habitat to perpetuate a diversity of species with densities and distributions that provide sustained ecological, recreational, scientific, educational, aesthetic and economic benefits.

Response: The project will have a long-term beneficial effect on freshwater aquatic life and wild animal life within the freshwater wetlands adjacent to Biscayne Bay through redistribution of freshwater flow, through a spreader system, and available surface water entering the wetlands from regional canals. The proposed project is consistent with the intent of this chapter.

Chapter 373, Water Resources

Chapter 373 provides the authority to regulate the withdrawal, diversion, storage and consumption of water.

Response: The non-Federal sponsor for this project is the SFWMD, which is the state agency responsible for implementing this statute. The USACE and the SFWMD have coordinated planning efforts to ensure compatibility with established policies. The project is consistent with the goals of Chapter 373.

Chapter 376, Pollutant Spill Prevention and Control

Chapter 376 regulates the transfer, storage, and transportation of pollutants and the cleanup of pollutant discharges.

Response: The contract specifications will prohibit the contractor from dumping oil, fuel, or hazardous wastes in the work area and will require that the

contractor adopt safe and sanitary measures for the disposal of solid wastes. A spill prevention plan is required.

Chapter 377, Oil and Gas Exploration and Production

Chapter 377 authorizes the regulation of all phases of exploration, drilling and production of oil, gas and other petroleum products.

Response: This project does not involve the exploration, drilling, or production of gas, oil or petroleum product. Therefore, Chapter 377 does not apply to this project.

Chapter 380, Environmental Land and Water Management

Chapter 380 establishes criteria and procedures to assure that local land development decisions consider the regional impact of proposed large-scale development on natural systems.

Response: The proposed project incorporates restoration components primarily intended to benefit estuarine resources in three geographical regions that include the Deering Estate, the Cutler Flow Way, and the L-31E culverts. Specifically, this includes the installation/construction of pump stations, spreader swales, stormwater treatment areas (STAs), flow ways, levees, culverts and backfilling canals. The primary project functions will minimize the number and severity of events of point source canal water discharges where harmful amounts of freshwater are discharged into the nearshore marine communities. These primary project functions help to moderate unnatural changes in salinity which is extremely detrimental to estuarine communities. The project is consistent with the intent of Chapter 380.

Chapter 388, Arthropod Control

Chapter 388 provides for a comprehensive approach for abatement or suppression of mosquitoes and other pest arthropods within the State of Florida.

Response: The project will not further the propagation of mosquitoes or other pest arthropods.

Chapter 403, Environmental Control

Chapter 403 authorizes the regulation of pollution of the air and waters of the State of Florida by the Florida Department of Environmental Regulation (now a part of the Florida Department of Environmental Protection [FDEP]).

Response: An Environmental Impact Statement (EIS) addressing project impacts has been prepared and will be reviewed by the appropriate resource agencies including the FDEP. Environmental protection measures will be implemented to ensure that no lasting adverse effects on water quality, air quality or other environmental resources will occur. Prior to construction, Water Quality Certification will be sought from the State of Florida. The project complies with the intent of Chapter 403.

Chapter 582, Soil and Water Conservation

Chapter 582 establishes policy for the conservation of state soil and water through the U.S. Department of Agriculture. Land use policies will be evaluated in terms of their tendency to cause or contribute to soil erosion; or to conserve, develop, and utilize soil and water resources both onsite or in adjoining properties affected by the project. Particular attention will be given to projects on or near agricultural lands.

Response: Project construction and implementation will include appropriate erosion control plans and measures to ensure compliance with the intent of the chapter.

B.4 CULTURAL RESOURCES COMPLIANCE

Phase 1 cultural resources coordination with the State Historic Preservation Officer for Alternative O Phase 1 is complete. The State Historic Preservation Officer concurred on March 5, 2007 (DHR no. 2007-803) that the installation of four culverts along the L-31E Canal will have no effect on historic properties. In a letter dated January 11, 2008 (DHR no. 2007-7384-B) the State Historic Preservation Officer concurred with Janus Research's determination that the State Expedited Construction project will have no effect on historical sites 8DA2815 (Deering Estate historic district), 8DA2815D (historic wall), 8DA6518 (historic road), or 8DA11247 (historic road). The proposed repairs to the Deering Estate Bridge (8DA2815C) and channel maintenance will prevent the rise in water levels from having an adverse effect on the bridge. In a letter dated July 16, 2008 (DHR no. 2009-3961) the State Historic Preservation Officer concurred with the Corps' USACE's determination that additional Alternative O Phase I features along the C-103 and L-31E canal and levee will no effect on historic properties.

B.5 PERTINENT CORRESPONDENCE

B.5.1 Scoping Correspondence

Audubon OF FLORIDA

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January 3, 2005

Colonel Robert M. Carpenter
District Engineer, U.S. Army Corps of Engineers
P. O. Box 4970
Jacksonville, Florida 32207
Via email: robert.m.carpenter@saj02.usace.army.mil

Subject: Biscayne Bay Coastal Wetlands Comprehensive Everglades Restoration Project

Dear Colonel Carpenter:

Audubon of Florida is concerned that the development of the Biscayne Bay Coastal Wetlands (BBCW) project is not adequately addressing several critical hydrological issues facing the Comprehensive Everglades Restoration Plan (CERP) and Biscayne Bay. Full implementation of the CERP is expected to diminish water supply to Biscayne Bay, a potential problem in satisfying the savings clause (114.2680, Section 601, F.S.). Additional water is needed to achieve restoration goals in the bay; this is above the quantity of water that must be delivered to meet the savings clause. Further, sea level rise is expected to significantly effect hydrology and salinities along the coast. It is necessary to address these issues in the current phase of project formulation.

As discussed in the *Additional Water for Everglades National Park and Biscayne Bay Feasibility Study*, the formulation of additional project features or operational changes is necessary to offset reductions in freshwater flow to the bay from existing legal sources. As stated in the 1999 *Central and Southern Florida Project Comprehensive Review Study, Final Integrated Feasibility Report and Programmatic Environmental Impact Statement*, "The subsequent detailed design phase of individual components will address the outstanding performance issues associated with the recommended Comprehensive Plan including . . . ecological performance in Biscayne Bay by restoring more natural freshwater inflows." The BBCW project should include features that help address these issues either directly, by capturing and supplying additional water for the bay, or indirectly, by designing the project to accommodate additional deliveries of water that will be made possible through the detailed design of other CERP projects.

It is critical that the scope of the BBCW project is expanded to ensure water is available to satisfy the savings clause and to restore Biscayne Bay. The fact that the additional sources of water have not been identified is indeed a problem, but one that must be solved. It should not be used as a reason to "under design" the features of the BBCW project assuming lesser quantities of water. Alternatives also should account for sea level rise and demonstrate the ability to meet project goals given the continued intrusion of saltwater along the coast.

January 3, 2005
Page Two

Audubon of Florida is dedicated to supporting the U.S. Army Corps of Engineers (Corps) efforts to implement the CERP. In light of the accelerated pace of the project, Audubon requests that the Corps immediately expand the scope of the Biscayne Bay Coastal Wetlands CERP project to address these issues and maximize benefits for Biscayne Bay. Additionally, Audubon requests that all permit applications within CERP project areas to given strict scrutiny to ensure compatibility with restoration.

Thank you for this opportunity to share our concerns and recommendations. We look forward to your response.

Sincerely,

April H. Gromnicki, Esq.

C: Linda Canzanelli, BISC_superintendent@nps.gov
Dennis Duke, dennis.r.duke@usace.army.mil
Jorge Marban, jmarban@sfwmd.gov
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JUL-19-05 10:22 AM AUDUBON OF FLORIDA 3053716398 P.02

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July 19, 2005

COL. Robert Carpenter
Jacksonville District Engineer
US Army Corps of Engineers
PO Box 4970
Jacksonville, FL 32232-0019
Via Facsimile: 904-232-2200

Subject: Biscayne Bay Coastal Wetlands Comprehensive Everglades Restoration Project

Dear COL. Carpenter:

Audubon of Florida strongly encourages the Army Corps of Engineers to expand the Biscayne Bay Coastal Wetlands Project ("BBCW") in order to ensure that Biscayne Bay will receive the amount of freshwater it requires. Audubon is concerned that the BBCW project will not address several critical hydrological issues facing Biscayne Bay if the Comprehensive Everglades Restoration Plan ("CERP") projects are implemented as currently planned. As recognized in the June 2003 *Additional Water for Everglades National Park and Biscayne Bay Final Reconnaissance Study Report* ("*Additional Water Study*"), Everglades National Park and Biscayne Bay are "in need of additional water compared to the amount currently received by those areas and the amount to be provided in the future through implementation of the CERP." Chapter 9 of the CERP calls for the BBCW project to identify "potential sources of water for providing freshwater flows to Biscayne Bay." It is essential that this issue be addressed in the BBCW project formulation.

The CERP Savings Clause forbids any elimination or transfer of an existing source of water, including those for fish and wildlife, "[u]ntil a new source of water supply of comparable quantity and quality as that available on the date of enactment of [the Water Resources Development Act of 2000 (WRDA 2000)] is available to replace the water to be lost as a result of implementation of the Plan…" *See* 106 P.L. 541, Section VI, 114 Stat. 2680 (2000). As discussed in the *Additional Water Study*, the formulation of additional project features or operational changes is necessary to offset reductions in freshwater flow to the bay from existing sources and for "consisten[cy] with the Savings Clause requirements of WRDA 2000." *Id.* at 5. Therefore, more water for Biscayne Bay should be identified and delivered through the BBCW project.

JUL-19-05 10:23 AM AUDUBON OF FLORIDA 3053716398 P.03

July 19, 2005
COL. Robert Carpenter
Page Two

The Master Implementation Sequencing Plan (MISP) for each project affecting Biscayne Bay illustrates the current situation. According to the *Comparison of Restudy and MISP Construction Completion Dates*, the L-31N Seepage Management Pilot and the Biscayne Bay Coastal Wetlands (Phase 1) projects are scheduled for completion in 2008, and the Everglades National Park Seepage Management project is scheduled for completion in 2009. The South Miami Dade Reuse Pilot project and the South Miami-Dade County Reuse project, the only projects intended to provide more water for the bay, will not begin until 2015 and 2020. Decreased flows to Biscayne Bay will occur years before compensating sources of water are developed, illustrating the need for additional water supply development in the BBCW project.

In addition, development proposals within and around the BBCW project area have potential to diminish beneficial quantities of water to Biscayne Bay. Audubon requests close review of all permit applications within CERP project areas to guarantee compatibility with system-wide restoration objectives.

In continuing support of the U.S. Army Corps of Engineers and the South Florida Water Management District's implementation of the CERP, Audubon maintains that expansion of the BBCW project is imperative to ensure the health of Biscayne Bay. Thank you for this opportunity to share our concerns and recommendations, and we look forward to your response.

Sincerely,

David E. Anderson
Executive Director
Audubon of Florida

C: Carol Ann Wehle, Executive Director, SFWMD, 561.682.6200
Dennis Duke, Restoration Program Division Chief, USACE, 904.232.1251
Vice-Chairwoman Irela Bagué, SFWMD Governing Board, 305.381.9889
Michael Collins, SFWMD Governing Board Member, 305.852.5428
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Safe Neighborhood Parks
Seaport
Solid Waste Management
Strategic Business Management
Team Metro
Transit
Urban Revitalization Task Force
Vizcaya Museum and Gardens
Water and Sewer

February 6, 2006

Mr. Jorge Jaramillo
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33416

Re: Comments on 15% BODR for Phase I of Biscayne Bay Coastal Wetlands Project

Dear Mr. Jaramillo:

DERM has reviewed the draft BODR for the Acceler8 (A8) portion of the BBCW project. We would first like to express our general support and acknowledge the importance of Acceler8's aggressive construction schedule toward achievement of the BBCW project's overall goals under the larger, second phase of the project. Moving forward as soon as possible with all construction elements feasible under the Phase I project is critical to this task. We are therefore encouraged that the SFWMD has selected phases of the BBCW project for the Acceler8 Program, and we appreciate being included as members of the design review team. With the goals of assuring that the A8 project is advanced as rapidly as possible and its effectiveness is optimized, we offer the following comments and suggestions regarding the consultant's recommended alternative.

SCOPE OF CONSULTANT'S RECOMMENDED PROJECT

The recommended alternative does not make use of the Lennar Flowway component or the Shoma Flowway component, two key areas necessary to maximize benefits and opportunities for both this A8 component and the later PIR component. Within the entire Cutler Wetlands project component area of A8, the recommended spreader would directly hydrate only one property (TA500-030) outside of Biscayne National Park (BNP), and if the proposed spreader extension were built (shown as a dashed line on Figure 1-10), only one other additional property landward of BNP (GZ300-015). Furthermore, since the entire portion of the BBCW study area located north of the C-1 canal was initially incorporated into the Acceler8 program primarily because of the presence of the Lennar Flowway parcels, we believe the recommended alternative is fundamentally inconsistent with the main reason this portion of the BBCW study area was chosen for A8.

The timetables of the overall BBCW PIR project would likely not allow for construction of the phase two portion of BBCW before the Lennar Flowway parcels are scheduled to revert to Lennar; in such a case, the ability to incorporate the Lennar Flowway into even the subsequent BBCW PIR project could be lost if the SFWMD were to adopt the consultant's recommended alternative. This would be inconsistent with the PIR and present unacceptable (and avoidable) constraints on the overall BBCW project.

Mr. Jorge Jaramillo
South Florida Water Management District
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WASTEWATER REUSE

Without the construction of the Lennar Flowway under A8, we are concerned that the ability to later utilize reclaimed wastewater from the South Dade Wastewater Treatment Plant in any portion of the BBCW project north of C-1 canal will be compromised, if not entirely eliminated. There are no other undeveloped lands remaining north of the C-1 canal and west of L31-E for introduction of reclaimed water other than the Lennar Flowway. The CERP Wastewater Reuse Pilot Project PDT had previously determined that wastewater treated to a water quality level high enough for hydration of wetlands within the BBCW study area should, after the treatment train, first flow through constructed or previously degraded non-tidal wetlands prior to discharging directly into the high quality wetlands within or directly adjacent to BNP. Such an approach is recommended to reduce ecological risk represented by long-term exposure to contaminants that could be present even in highly treated wastewater, provide an opportunity for additional "polishing" or improvements in timing and distribution, and avoid regulatory issues associated with discharge to Outstanding Florida Water bodies. Since the consultant's recommended pump and spreader site for the C-1 would be the only remaining location (without the Lennar Flowway) to introduce reuse water to the Cutler Wetlands in this area, our conclusion is that reuse water will not be able to be used for BBCW north of C-1 without the Lennar Flowway. This would be inconsistent with the PIR, which requires formulation of the BBCW alternatives based on an assumed reuse water scenario only. Furthermore, the independent findings of the consultant including their own modeling are in agreement with the PIR team's findings to date that the amount of water currently available from C-100 and C-1 systems needed for restoration of the Cutler Wetlands, creeks, and adjacent near shore areas is inadequate to meet nearshore estuarine targets for the area and therefore reuse water or other additional water is required. Therefore, exclusion of the Lennar Flowway during construction of the A8 project poses constraints and limitations to the overall BBCW project that are inconsistent with the PIR and which otherwise are avoidable. We strongly recommend that the Lennar Flowway remain part of the Acceler8 component of the BBCW project, as a site for implementation of the reuse pilot project or perhaps as a water storage area.

SALTWATER INTRUSION AND WATER QUALITY

The analysis in the BODR of saltwater intrusion issues and operation of the recommended alternative is overly simplistic in that it assumes that the C-1 stage will be maintained at all times. We acknowledge the importance of maintaining higher canal stages at and upgradient of the L31-E in order to prevent further salt intrusion. However, we are concerned that pumping into the proposed spreader at 400 cubic feet/second (cfs) from a feeder canal that draws water just upstream of the S-21 may cause saltwater intrusion issues during some conditions. Past modeling has indicated the relationship between canal stage and migration of the salt front. Unlike most canals, the proposed (unlined) feeder canal and pump would be located parallel and directly over the salt front, and therefore the dynamic equilibrium of the front beneath the entire feeder canal would likely be sensitive to stage changes. Improvements proposed to this feeder canal including deepening would result in increased connectivity to the surficial aquifer and therefore sensitivity to the salt front immediately below, particularly when stages are lowered in the canal by discretionary operations including but not limited to prestorm drawdowns at S-21, even when the 400 cfs pumps are not operating. Current operations including prestorm drawdowns and other discretionary departures from the stage triggers at S-21 and S-123 are important factors effecting both flood protection and saltwater intrusion.

It is also important to note that canal discharges and operation of water control structures in the vicinity of S-21 may affect movement and fate of ammonia-contaminated groundwater plumes and surface water at or downstream of old dumps and active landfills. The existing stormwater management systems, leachate collection infrastructure, and groundwater remediation systems in place at these facilities are designed and

Mr. Jorge Jaramillo
South Florida Water Management District
Page 3

operated based upon prevailing conditions and plume dynamics. Changes in the effectiveness of these systems as a consequence of effects on groundwater and surface water movements may result in exceedances of surface water quality criteria or other regulatory requirements affecting these facilities. Location of the C-1 canal pumps in the BBCW PIR formulation of alternatives avoided these types of issues by pumping water out of C-1 well upgradient of these facilities and the leachate plume associated with the South Dade Landfill. Additionally, although existing surface water quality monitoring documents that canal water quality is generally degraded and more variable than surface water quality in the Bay itself, these monitoring programs are indicative of large-scale patterns and temporal trends, and cannot be used to predict future conditions resulting from altered water management practices or infrastructure. The observational data does not include, nor take into account, groundwater interactions or pollutant loading. Miami-Dade County requests that detailed modeling of groundwater-surface water interactions and water quality in this area be completed prior to finalization of construction and operation plans if the SFWMD adopts the consultant's recommended alternative in the C-1 canal/Lennar Flowway area. In addition to canal stages based on published operational triggers of structures such as S-21 as well as all discretionary operations, the modeling should capture other important operational factors related to ammonia in the groundwater in this area such as operation of the leachate collection system at the South Dade Landfill. The plume is dynamic and related to regional ground water stages, flows and events affecting these factors (e.g., storm events).

Any analyses involving comparison of water quality data to regulatory criteria should include evaluation of narrative standards for nutrients and antidegradation, as well as numerical criteria for Class III waters and Miami-Dade County standards (including the Chapter 24, Environmental Protection Ordinance ground and surface water standard of 0.5 mg/l total ammonia, etc.). The Waste Water Reuse Pilot Project PDT prepared a water quality summary report that was to be used to assess needed water quality for waters entering Biscayne Bay necessary to meet antidegradation standards. The recommendations in this report with respect to water quality objectives are relevant to any discharges contemplated to high quality, tidally connected wetlands east of SW 87th Avenue.

DEERING ESTATE

The recommended discharge into the Deering Estate of up to 200 cubic feet/second (cfs) from the C-100 system essentially represents the majority of water that is potentially available from this system at most times. We are concerned that direction of all of the 200 cfs flows through the Deering Estate slough may be too high. As a measure of comparison, formulation of BBCW PIR alternatives included flows in the 20 to 50 cfs range for Deering. Preliminary model runs by DERM of the 100-year storm event indicate a series of short, peak discharges into the slough during such storms that would not be consistent with wetland habitat restoration goals at Deering.

It should be noted that the rehydration project at Deering as developed by Miami-Dade County (the latter phases of which would be implemented by the SFWMD rather than the County under Accerler8) was not intended to achieve the desired BBCW salinity targets within Biscayne Bay; rather it was intended to rehydrate sensitive, unique wetland features and habitats within the Deering slough. As the design criteria used for the BODR analysis was apparently based in part on projected nearshore salinity targets (and did not include any wetland hydration or impact criteria which are included in the PIR), an alternative that appeared to meet the salinity targets could score high, even if the flow volumes or velocities were sufficient to damage or destroy the Deering wetlands. We believe that an emphasis on nearshore salinity targets for design of the Deering Estate components is therefore inappropriate.

Mr. Jorge Jaramillo
South Florida Water Management District
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We recommend utilization of hydroperiod and flow velocity targets for the Deering Estate slough. Peak, downstream flow velocities of surface water during maximum pumpage at the Powers Addition should be comparable to those pre-drainage flow velocities that were typical in these transverse glade connections between the Everglades and Biscayne Bay. We also continue to recommend, prior to detailed design, a one or two day pump test (with portable pumps) to move water from the spur canal to a point just east of Old Cutler Road. This type of field test could be used to address a number of remaining uncertainties for this component including projected seepage in the Cutler slough as well as estimation of surface water flow roughness coefficients (due to the large amount of topographic variation and also vegetation present). In addition, the model output (both the consultant and ERDC modeling) could be further refined and validated in this area with such information and design issues related to important cultural resources such as the 'Chinese Bridge' could be better addressed. Without information pertaining to these issues, we remain concerned that it will be difficult to obtain the needed consistency determinations and certificates of appropriateness for cultural resources at multiple levels of government in a timely manner necessary to insure that the aggressive schedule of Acceler8 is preserved.

We note that the recommended alternative does not include plugs or filling of the mosquito ditches in the mangrove wetlands of the Deering Estate. In order to keep Phase I project costs as low as possible and to insure that unneeded features are not constructed at Deering, we agree that such should not be constructed under Acceler8. However, we recommend monitoring as part of A8 for this issue. If monitoring reveals that enough flow is being delivered to the weir presently being constructed by Miami-Dade County, we recommend that plugs (at a minimum) only be constructed as part of the later BBCW PIR project to prevent short circuiting of flows in these downstream mosquito ditches at Deering.

NORTHERN CUTLER WETLANDS

The consultant's recommended alternative provides no means of redirecting flows from the C-100 system to the northern Cutler Wetlands. We are also concerned that there would be no way to balance flow distribution under A8 between the only two areas that could be served by the C-100 system. We believe that such may also be inconsistent with the PIR in this regard since none of the formulated alternatives propose the use of most or all available water at Deering; rather every PIR alternative, including the most minimal ones, reserve some or the majority of the water during larger flow events for the northern Cutler Wetlands.

A more balanced approach that would be protective of the Deering Estate wetlands, prevent future constraints and maintain consistency with the PIR would be to direct roughly 75% of the C-100 available flows to the northern Cutler Wetlands in the Acceler8 project. The most cost effective delivery of these flows would likely involve construction of an underground pipe through the four privately owned residential parcels south of the 'Haas' parcel (now in public ownership). This pipe could culminate in an open spreader either on the BNP owned lands just east of the former Burger King Headquarters site or on the large wetland tract immediately south of this site.

In order to reduce costs associated with the central portion of the project and to insure available flows are distributed over an appropriately sized area, the C-100 spreader should probably not extend south past the Shoma Flowway site under the Acceler8 project. An incremental benefits analysis for those wetlands that would be rehydrated at and north of Shoma could be performed to document the cost competitiveness of this option in comparison with other C-100 system costs. Although the Consultant expressed concerns regarding seepage (loss of redistributed water to groundwater), the PIR team has recognized that groundwater levels and flows play important roles in support and benefits to coastal wetlands and the bay. Although the amount of 'overland' flow may be significantly reduced due to seepage, the area can still see benefits in the wetland and bay through the potential increase in groundwater flow and stages from the redirected waters.

Mr. Jorge Jaramillo
South Florida Water Management District
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In addition, options to more effectively redistribute existing C-1 and C-100 canal flows to the Cutler Wetlands using the S-122 connector and also other canal improvements should be explored. These options should consider the possibility of operational changes and also additional flows including but not limited to reclaimed wastewater. The Cutler Wetlands spreader(s) could be extended further at a later date under the overall BBCW project to accommodate additional flows needed to fully restore this area.

NEEDED PROJECT ASSURANCES

We acknowledge that modeling for Savings Clause analysis for flood protection, salt water intrusion, and water supply will be conducted at a later date for this project. We believe the above recommendations will be of assistance to your consultants in this regard as the BODR is further refined and finalized.

Thank you for the opportunity to comment on this document. My staff will be providing additional, more detailed, recommendations to help refine the draft 15% design prior to finalization of the BODR. Please contact Craig Grossenbacher at (305) 372-6522 if you have any questions regarding these matters.

Sincerely,

Carlos Espinosa, P.E.
Acting Director

CC: Miami-Dade Water & Sewer Department
Miami-Dade Park & Recreation Department
Village of Palmetto Bay
SFWMD Miami Field Office
SFWMD West Palm Beach
FDEP
Biscayne National Park
Everglades National Park
U.S. Fish and Wildlife Service
U.S. Army Corps of Engineers

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Solid Waste Management
Strategic Business Management
Team Metro
Transit
Urban Revitalization Task Force
Vizcaya Museum and Gardens
Water and Sewer

April 27, 2006

Col. Robert Carpenter, District Commander
U.S. Army Corps of Engineers
Jacksonville District
701 San Marco Blvd.
Jacksonville, FL 32208

Dear Colonel Carpenter:

The Miami-Dade County Department of Environmental Resources Management (DERM) is providing this letter in support of the Biscayne Bay Coastal Wetlands (BBCW) Alternative Q. As members of the PDT, we assisted in the alternatives evaluation process and were informed at the last meeting that the Army Corps analysis has indicated Q to be both the National Environmental Restoration (NER) and National Interest Plan alternative. We acknowledge the estimated cost differences between Q and the minimal alternative, M, are significant and that Q costs are projected at this time to exceed the planning cost containment cap for this project. However, alternative M would impose avoidable constraints that significantly reduce project benefits as well as opportunities. Furthermore, we are concerned with the limited adaptive management potential of alternative M in comparison with Q, particularly in the core area of the BBCW project.

- Alternative Q provides approximately twice the "habitat" benefits of M. In particular, Q addresses project objectives identified in the Yellow Book and the PMP related to restoration and enhancement of nearshore estuarine environments freshwater wetlands, hydrologic connectivity coastal wetlands and sloughs, and more natural water delivery throughout the project footprint. In contrast, M does not address the full range of project objectives or benefits of the Yellow Book alternative. M provides few features or benefits south of the C-1 canal, even though this is the area where most freshwater delivery to Biscayne National Park currently occurs and where the potential for environmental benefits and integration with other CERP projects is greatest.

- Miami-Dade County is committed to reuse of reclaimed water, and believes that Q provides flexibility and maximum opportunity for conveyance and distribution of additional water to degraded freshwater and transitional wetlands, an approach that offers water quality, aquifer recharge, and passive storage benefits. M does not provide similar opportunity, and would compel discharge of treated wastewater directly to sensitive tidal waters and wetlands of Biscayne National Park an Outstanding Florida Water body.

- M would direct significant levels of nutrients from the C102 and C103 canals directly onto sensitive tidal wetlands without polishing or treatment. These wetlands are designated as Outstanding Florida Waters and located in and adjacent to Biscayne National Park.

We believe that optimization of Q in conjunction with further partnering between the County and the state and federal sponsor could go a long way towards reducing future funding needs for Q and at the same time create additional restoration opportunities. Preserving all opportunities for wastewater reuse and more strategic partnering between the county and district land acquisition programs are just two mechanisms that could allow greater restoration via this project. Thank you for the opportunity to comment on this issue. Please contact me at 305 372-6754 if you have any questions regarding this matter.

Sincerely,

Carlos Espinosa, P.E.
Acting Director

Delivering Excellence Every Day

Preliminary Recommendations for the Biscayne Bay Coastal Wetlands Project

Prepared by the
Everglades Foundation

Betty Grizzle, D.Env.

Thomas Van Lent, Ph.D., P.E.

July 2006

Biscayne Bay Coastal Wetlands Restoration Project

General Concepts for Restoration

The overarching goal for the Biscayne Bay Coastal Wetlands (BBCW) Project should be restoration of the coastal gradient, both hydrologically and ecologically. For this to occur, the design of the project must incorporate the functional components of the historic, underlying drainage pattern, soils, and topography.

Restoring the coastal gradient in the study area centers on the timing of surface and ground water flows that historically occurred through the transverse glades to the coastal wetlands (see Figures 1 and 2). Most of this flow has been replaced by water management structures (e.g., canals, ditching) that have simultaneously created a net loss in storage and increased the occurrence large peak flows to tide, draining the watershed over a shorter time period.

Restoration Objectives

For the Biscayne Bay coastal wetlands, three key objectives (adapted from Gaiser and Ross 2004) for correcting the ecological consequences of the adverse timing and drainage effects are identified:

1. **Restore flows to tidal creeks** by reconnecting with natural flow paths and eliminating flow barriers (this will also help control the displacement of native communities by exotic vegetation)

2. **Alleviate drainage of freshwater marshes** by removing drainage features and re-hydrating existing and remnant wetlands

3. **Restore the natural mixing of fresh- and saltwater** by eliminating the barriers created by the north-south water management structures

The design features for implementing these objectives must be carefully planned in order to ensure that benefits will be achieved without creating potentially worse conditions in these currently altered systems. Additionally, this project must define long-term management options for this area to control and manage, for example, exotic invasive vegetation and adverse human-use impacts. Potential water sources for rehydration are likely to be rich in nutrients and other constituents, highlighting the need for monitoring of system responses.

Recommended Project Features

[Note – Deering Estate component for the BBCW Project was not evaluated.]

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Section 1: C-100 Canal to Black Point Marina

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Related to topographic considerations, Hull and Meyer (1973) also described the defining soil characteristics in this region, which have implications for project features and expected benefits relative to the restoration of water flows as well. Soils in the western edge of the coastal areas (primarily Perrine marl) are noted for their very low hydraulic conductivity and high water retentivity, and thus are poorly drained. These soils also exhibit high capillary conductivity that results in upward movement of water through the water table during dry conditions, adding to the soil salinity (Hull and Meyer 1973). These alkaline soils are also low in organic matter and minerals.

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importantly, this alternative provides no storage in the upstream communities, which is an important consideration during the dry season.

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We also recommend that the L-31E levee be degraded and the L-31E canal be infilled in as much as practicable within this stretch of the project area and further south. The removal of this obstruction is essential for restoring the natural mixing of fresh water and salt water in these coastal wetlands. The connection of this canal with east-west drainage canals has not only resulted in the elimination of the historic freshwater flow to the east and has caused remnant tidal creeks to silt-in and eventually overgrown with invasive woody vegetation (Meeder et al. 2000). Freshwater conditions are now entirely restricted *west* of the L-31E drainage with higher salinities developing in interior basins where circulation is limited because of higher elevation mangrove berms to the east and forest vegetation lining former drainages to the south and north (Gaiser and Ross 2004). If necessary, a new levee and, if necessary, a seepage canal could be co-located adjacent to the proposed spreader canal located further west.

Ruiz and Ross (2004) also recommended modifications to the Campbell Drive Canal area, including plugging the mouth of this canal and backfilling to a location so as to allow for re-connecting to a tributary that historically emptied into Biscayne Bay. As we have recommended in other parts of the project area, modifications (to prevent hydrologic conveyance) to east-west drainage ditches and mosquito ditches both east and west of the L-31E canal should also be incorporated as project features for this section of the study area.

We understand that the State has also raised concerns regarding potential contaminants in this section of the project study area (i.e., DDT in soils on properties to the east of the Homestead Air Reserve Base and south of the rock pit). Though farming in southeastern Miami-Dade County has historically been problematic as a result of the poor soil drainage, low nutrients, and susceptibility to saline intrusion as a result of drainage in the watershed (Hull and Meyer 1973), the current vegetation map prepared by the Fish and Wildlife Service does indicate the presence of Brazilian pepper in limited areas, which can be an indication of previous cleared and farmed areas. We recommend that site investigations be focused within those sections, but detected levels of contaminants of concern should be evaluated for potential risks relative to background levels within south Florida. Elsewhere, the presence of more contemporary pesticides, in addition to DDT and its derivatives, represents an element of concern for proposed rehydration

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components and further highlight the need to provide retention components and rigorous monitoring (P. Gardinali personal communication 2006).

Section 3: C-103 Canal south to the Northern Model Lands

As above, location of a proposed spreader canal south of the C-103 canal should be as far west as possible in order to maximize the restoration of freshwater flows to the impacted communities to the west of the L-31E canal and to provide flows to the coastal marshes to the east of this canal. Restoring wetter, freshwater conditions further west will also assist in reducing the rapid expansion of exotic woody vegetation communities (primarily Australian pine and Brazilian pepper) into former freshwater marsh communities (Gaiser and Ross 2004).

We recommend a location of a spreader canal similar to what was proposed in Alternative Q and modified Alternative J, but which also follows the same topographic contour to the north (see Figure 4). By contrast, Alternative O presents an eastward jog of a proposed spreader canal and then moves the canal back to the west, though available maps do not indicate this excluded section as privately-owned land.

This more westerly location of a spreader canal should continue along a topographic alignment (between 2 and 3 foot) below the North Canal and Florida City Canal so that it more closely aligns with our previously proposed topographically-aligned contours for the C-111 spreader canal.

As above, we recommend that the L-31E Levee be degraded and the canal infilled as practicable to restore the natural gradation of vegetative communities. This is especially important for the lower reach of the L-31E, where we have observed the dramatic separation of the encroaching mangrove community to the south versus the freshwater wetlands to the north. Coincident with the removal of the L-31E levee, is the plugging of mosquito ditches (at north-south intersection locations with the east-west drainage ditches) south of the North Canal, but *west* of L-31E (see Figure 3).

Recommendations for restoration efforts for this lower reach of the Biscayne Bay coastal wetlands also provide much needed hydrologic restoration for the Model Lands region. The wetland communities located within the C-111 Basin and the Model Lands (also called the Coastal Everglades or Southeastern Everglades) have been recognized as the only significant remaining area of short hydroperiod wetlands east of Everglades National Park, and which fulfill a "critical function for wading birds and other wildlife" (National Audubon Society 1997; p. 22). The restoration of natural flow patterns to both Biscayne and Florida Bays is essential to restoring the high intrinsic value of these wetland communities.

Recommendations for the Planning Process

Scientists from the Everglades Foundation have been unable to participate in the PDT planning process for this project. This elimination of public input in the technical planning process, which runs counter to the requirements defined in the CERP Programmatic Regulations, has once again created a proposed project design (Alternative O) that is not only provides incomplete environmental benefits, but also runs a high risk that other alternatives have been not been adequately evaluated in the NEPA process.

As an example, the method used for ranking alternatives based on performance measure scoring has resulted in a "double counting," a technique that has not been used for other CERP projects. This method also results in a type of weighting of the alternatives that may or may not be appropriate. Evaluation with and without this double-counting should have been used to determine the effect of this type of weighting relative to the calculation of Habitat Units (HUs). We conducted our own assessment of the HUs documented in the two Cost Effectiveness/Incremental Cost Analysis (CE/ICA) reports prepared for the BBCW Project (dated April 10 and May 12, 2006). We used the planning team's original scoring of the performance measures, but without double-counting the performance measures. Thus, we summarized the nearshore zone performance measures together with only the unique performance measures found in the saltwater and freshwater zones, effectively adding all of the unique performance measures together and then calculated the Total HUs made available based on the planning team's scoring. These results are summarized in the table below.

Alternative	Total Habitat Units – April	Total Habitat Units – May
Yellow Book	45,471	46,272
Alternative O	N/A	34,723*
Alternative M	32,022	12,794*
Alternative Q	37,107	37,996
Alternative E	51,589	N/A
Alternative J	44,235	N/A
Existing Conditions	11,780	11,841
Future Without Project	14,271	14,349

*see comments below

When we looked more closely at why the alternatives scored higher or lower relative to each other, we found that certain performance measures were key for increasing (or decreasing) the habitat unit scores for the alternatives. For example, for the April CE/ICA report, the unique *freshwater* zone performance measures (primarily PM IV.A.1) produced the largest significant difference between the Yellow Book and other alternatives. The unique *saltwater* zone performance measures (primarily PM V.A.1) produced the key difference, and higher score, for Alternative J versus the other alternatives. Conversely, the HUs calculated for Alternative M was lowered by the poor scoring relative to the nearshore performance measure PM VI.C.

When we evaluated the May CE/ICA report, we noticed similar results, but also discovered a significant change to the previous calculation of HUs for Alternative M. The planning team appears to have recalculated the score for performance measure PM IV.C, for this alternative,

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which resulted in a much lower score than the April report. Thus, the HUs dropped from 32,022 to 12,794. This performance measure, acres of existing public wetlands improved, also resulted in the high scoring of the new Alternative O as well, such that this performance measure received the same score as Alternative Q. However, when you look at the two proposed alternatives (O and Q), it seems unlikely that this equivalent scoring is appropriate. First, Alternative O has a much reduced linear extent of proposed spreader canal compared to Alternative Q. Second, there are significant differences between rehydration benefits with the implementation of the proposed spreader canal in Alternative Q versus the pumps located on existing canals proposed in Alternative O. The scoring of performance measure PM IV.C should be re-examined so that the scoring more accurately reflects the benefits achieved in the proposed alternatives.

What this illustrates is that project components for proposed alternatives should have been evaluated in total and in a way that evaluates the performance of each performance measure separately. It appears that original alternatives were designed with little integration with one another so that the planning team was unable to fully evaluate an alternative that incorporated the "best" features of all of the alternatives. The recent effort to produce Alternative O should have evaluated *all* of the previously proposed alternatives, not just M and Q, in order to determine which performance measures and thus which project features provide the "optimal" environmental performance relative to costs and benefits.

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Figure 1. Transverse Glades and Major Canals
(Source Meeder et al. 2002)

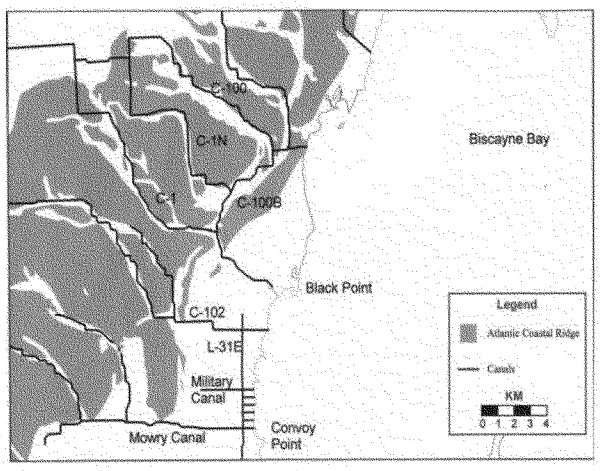

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Figure 2. Transverse Glade Flow Dynamics
(Source: Meeder et al. 2002)

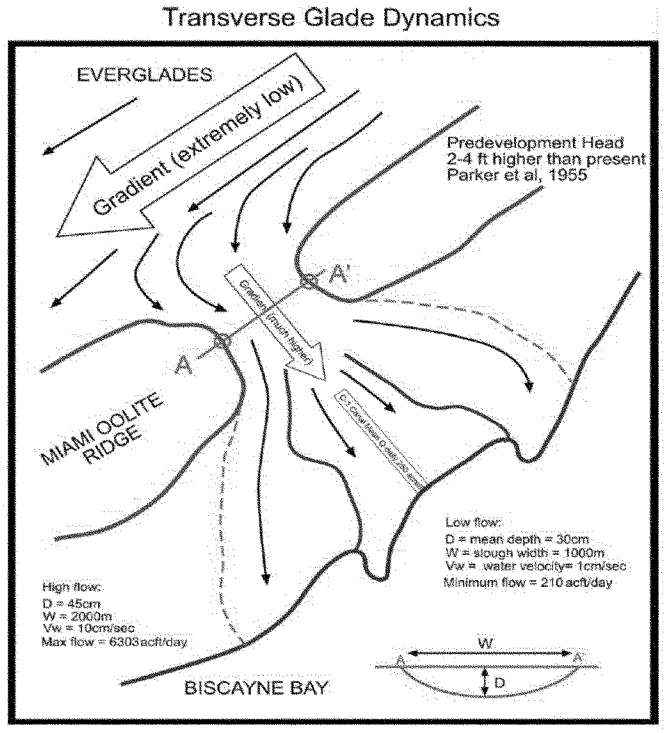

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Figure 3. Distribution of Mosquito and Drainage Ditches for the Biscayne Bay Coastal Wetlands Region. (Source: Ruiz and Ross, 2004)

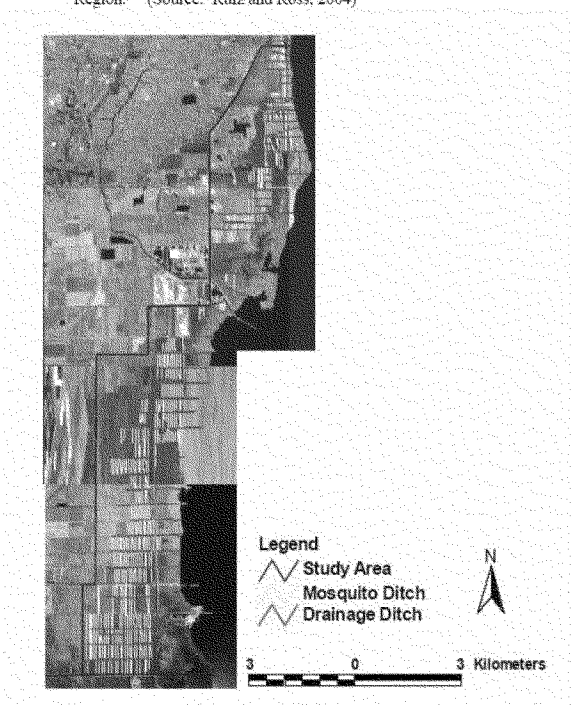

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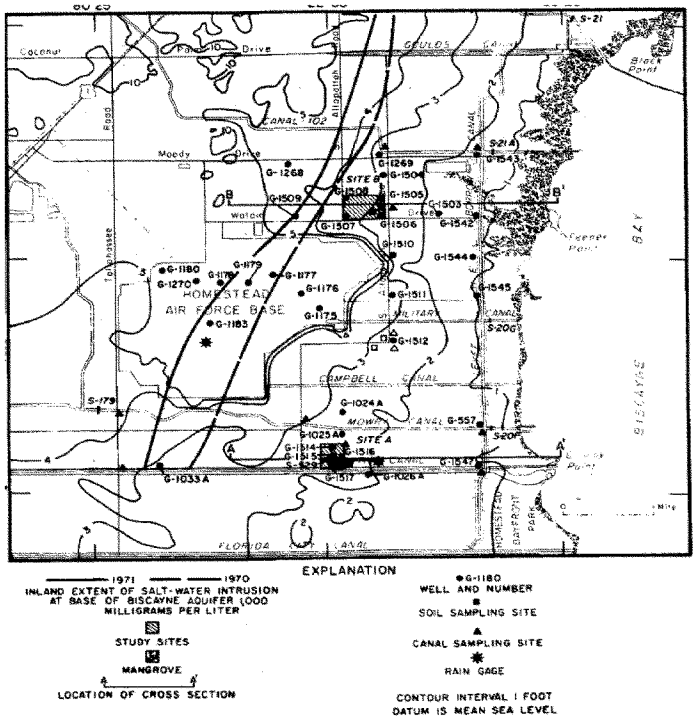
Figure 4. Biscayne Bay Coastal Wetlands Map including Topography
(Source: Hull and Meyer 1973)



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December 13, 2006

Carol Wehle
Executive Director
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33406

Re: ***Preliminary Design Report - Cutler Wetlands C-1 Flow Way and L-31E Culverts, Biscayne Bay Coastal Wetlands – Phase 1 Project***

Dear Ms. Wehle:

On behalf of the Everglades Foundation, a non-profit organization dedicated to the restoration of America's Everglades, I would like to offer comments on the Preliminary Design Report for Phase 1 of the Biscayne Bay Coastal Wetlands (BBCW) Project, Cutler Wetlands C-1 Flowway and L-31E Culverts (Preliminary Design Report), developed under the direction of the South Florida Water Management District's (District) Acceler8 Program.

As stated in the BBCW Project Management Plan (2002), *"[t]he primary purpose of the BBCW project is to redistribute freshwater runoff from the watershed into Biscayne Bay…and provide a more natural and historic overland flow through existing or improved coastal wetlands."* Two key objectives in achieving this goal are: 1) providing for dry season flows to the coastal wetlands and 2) providing for redistribution of wet season flows within the coastal wetlands. Fulfillment of both of these objectives is expected to result in restoring nearshore bay habitat through the improvement of coastal salinity regimes.

Our review of the Preliminary Design Report indicates that the proposed features make little progress toward those stated objectives. For example, results of culvert flow analyses for the proposed L-31E culvert system indicate that, at best, 49 cfs of seasonal flow is provided to the coastal wetlands east of L-31E during wet years, and *no flows* for dry year conditions. The average peak flow is 29 cfs, an insignificant quantity, yet the executive summary contains an unsubstantiated claim of "significant improvements in nearshore salinities." We believe this result illustrates a fundamental shortcoming with the proposed project - the current recommended Tentatively Selected Plan (Alternative O) contains almost no storage features. To make matters worse, we understand that the planning process for the next phase of the BBCW CERP Project has shifted from designing/locating elements for storing peak wet season flows (both within existing wetlands and within artificial impoundments) in the watershed to finding ways to augment dry season flows with treated wastewater.

Additionally, we were unable to determine from our review of the Preliminary Design Report the flows (rates or volumes) that would be delivered to the proposed spreader canal located to the east of the proposed Cutler Flowway. The report's analyses provided substantial discussion of the design process related to flow velocities to address the distribution of the pumped flow, but we were unable to find the actual flows that would be delivered to the proposed spreader canal east of SW 87th Ave. Thus, it is impossible for us to verify the conclusions that this element of the project provides environmental enhancement.

The Everglades Foundation recognizes that the Acceler8 program is a major economic undertaking on the part of the State and was intended to address projected increased costs in labor and construction materials, and also increases in land values by acquiring lands necessary for Everglades restoration early in the planning process. In its commitment to accelerate the completion of important CERP projects, the State reaffirmed and strengthened the state and federal partnership to restore America's Everglades. Over the past year, the Everglades Foundation has provided public and written comment[1] on two key Acceler8 projects, the BBCW and C-111 Spreader Canal Projects, whose objectives are to restore and improve the quantity, quality, timing, and distribution of flows to both Biscayne and Florida Bays.

Given the disappointing conclusions contained within the BBCW-Phase 1 Preliminary Design Report, we believe that our concerns voiced previously for the BBCW CERP Project continue to be valid ones, and, in this context, we ask that the fundamental shortcomings to expected restoration benefits identified in this letter regarding the proposed Acceler8 features be addressed.

Thank you for the opportunity to provide comment. Should you have any questions regarding our concerns, please contact me at (305) 251-0301.

Sincerely,

/signed/

Betty Grizzle, D.Env.
Everglades Foundation
18001 Old Cutler Road, Suite 625
Palmetto Bay, Florida 33157

cc: Jorge Jaramillo, P.E., South Florida Water Management District

[1] For example, the Everglades Foundation formally submitted a preliminary recommendation report for the BBCW CERP Project to the South Florida Ecosystem Restoration Working Group on July 20, 2006 (see attachment).

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Preliminary Recommendations for the Biscayne Bay Coastal Wetlands Project

Prepared by the
Everglades Foundation

Betty Grizzle, D.Env.

Thomas Van Lent, Ph.D., P.E.

July 2006

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Biscayne Bay Coastal Wetlands Restoration Project

General Concepts for Restoration

The overarching goal for the Biscayne Bay Coastal Wetlands (BBCW) Project should be restoration of the coastal gradient, both hydrologically and ecologically. For this to occur, the design of the project must incorporate the functional components of the historic, underlying drainage pattern, soils, and topography.

Restoring the coastal gradient in the study area centers on the timing of surface and ground water flows that historically occurred through the transverse glades to the coastal wetlands (see Figures 1 and 2). Most of this flow has been replaced by water management structures (e.g., canals, ditching) that have simultaneously created a net loss in storage and increased the occurrence large peak flows to tide, draining the watershed over a shorter time period.

Restoration Objectives

For the Biscayne Bay coastal wetlands, three key objectives (adapted from Gaiser and Ross 2004) for correcting the ecological consequences of the adverse timing and drainage effects are identified:

1. **Restore flows to tidal creeks** by reconnecting with natural flow paths and eliminating flow barriers (this will also help control the displacement of native communities by exotic vegetation)

2. **Alleviate drainage of freshwater marshes** by removing drainage features and re-hydrating existing and remnant wetlands

3. **Restore the natural mixing of fresh- and saltwater** by eliminating the barriers created by the north-south water management structures

The design features for implementing these objectives must be carefully planned in order to ensure that benefits will be achieved without creating potentially worse conditions in these currently altered systems. Additionally, this project must define long-term management options for this area to control and manage, for example, exotic invasive vegetation and adverse human-use impacts. Potential water sources for rehydration are likely to be rich in nutrients and other constituents, highlighting the need for monitoring of system responses.

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Recommended Project Features

[Note – Deering Estate component for the BBCW Project was not evaluated.]

Section 1: C-100 Canal to Black Point Marina

North Cutler Wetlands: Previous alternatives and the new Alternative O include a feature to provide conveyance of flows from the C-100 canal into a proposed spreader canal system at the extreme north end of the Cutler Wetlands. This feature may prove difficult to implement given the restrictions imposed by current land uses in this area and the low flow volumes within the C-100 canal itself. Additionally, there is little topographic relief in this narrow wetland area and any water placed in this region is likely to flow through existing north-south mosquito ditches and/or routed quickly out to tide by connecting to larger east-west drainage ditches. (Ruiz and Ross documented 93 mosquito and 21 drainage ditches from the Saga Bay area to Eureka Drive, with respective mean depths of 60 cm and 120 cm, see Figure 3) Removing this feature from the alternatives would provide significant cost savings that could be used to implement more effective project components.

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We recommend that the proposed spreader system be sited as far west as possible in this region of the BBCW so that the previous identified polishing wetlands components (PW-H1 and PW-H2) are incorporated into the project design. This will provide the opportunity to better distribute flows through a larger area. Location of a pump at the C-102 canal, northwest of the rock pit, *not to the northeast* as proposed in Alternative O, would provide source water for the proposed spreader. Additionally, because of the potential hydrologic impoundment that will likely occur to the area just south of the current rock pit with the operation of the spreader system, we recommend that the northern portion of the previous characterized "polishing wetland" (or PW-H1) be consider for use as an STA to provide watershed storage (thus re-establishing timing of flows during the wet and dry seasons) as well as water quality treatment functions.

We also recommend that the L-31E levee be degraded and the L-31E canal be infilled in as much as practicable within this stretch of the project area and further south. The removal of this obstruction is essential for restoring the natural mixing of fresh water and salt water in these coastal wetlands. The connection of this canal with east-west drainage canals has not only resulted in the elimination of the historic freshwater flow to the east and has caused remnant tidal creeks to silt-in and eventually overgrown with invasive woody vegetation (Meeder et al. 2000). Freshwater conditions are now entirely restricted *west* of the L-31E drainage with higher salinities developing in interior basins where circulation is limited because of higher elevation mangrove berms to the east and forest vegetation lining former drainages to the south and north (Gaiser and Ross 2004). If necessary, a new levee and, if necessary, a seepage canal could be co-located adjacent to the proposed spreader canal located further west.

Ruiz and Ross (2004) also recommended modifications to the Campbell Drive Canal area, including plugging the mouth of this canal and backfilling to a location so as to allow for re-connecting to a tributary that historically emptied into Biscayne Bay. As we have recommended in other parts of the project area, modifications (to prevent hydrologic conveyance) to east-west drainage ditches and mosquito ditches both east and west of the L-31E canal should also be incorporated as project features for this section of the study area.

We understand that the State has also raised concerns regarding potential contaminants in this section of the project study area (i.e., DDT in soils on properties to the east of the

7

Homestead Air Reserve Base and south of the rock pit). Though farming in southeastern Miami-Dade County has historically been problematic as a result of the poor soil drainage, low nutrients, and susceptibility to saline intrusion as a result of drainage in the watershed (Hull and Meyer 1973), the current vegetation map prepared by the Fish and Wildlife Service does indicate the presence of Brazilian pepper in limited areas, which can be an indication of previous cleared and farmed areas. We recommend that site investigations be focused within those sections, but detected levels of contaminants of concern should be evaluated for potential risks relative to background levels within south Florida. Elsewhere, the presence of more contemporary pesticides, in addition to DDT and its derivatives, represents an element of concern for proposed rehydration components and further highlight the need to provide retention components and rigorous monitoring (P. Gardinali personal communication 2006).

Section 3: C-103 Canal south to the Northern Model Lands

As above, location of a proposed spreader canal south of the C-103 canal should be as far west as possible in order to maximize the restoration of freshwater flows to the impacted communities to the west of the L-31E canal and to provide flows to the coastal marshes to the east of this canal.
Restoring wetter, freshwater conditions further west will also assist in reducing the rapid expansion of exotic woody vegetation communities (primarily Australian pine and Brazilian pepper) into former freshwater marsh communities (Gaiser and Ross 2004).

We recommend a location of a spreader canal similar to what was proposed in Alternative Q and modified Alternative J, but which also follows the same topographic contour to the north (see Figure 4). By contrast, Alternative O presents an eastward jog of a proposed spreader canal and then moves the canal back to the west, though available maps do not indicate this excluded section as privately-owned land.

This more westerly location of a spreader canal should continue along a topographic alignment (between 2 and 3 foot) below the North Canal and Florida City Canal so that it more closely aligns with our previously proposed topographically-aligned contours for the C-111 spreader canal.

As above, we recommend that the L-31E Levee be degraded and the canal infilled as practicable to restore the natural gradation of vegetative communities. This is especially important for the lower reach of the L-31E, where we have observed the dramatic separation of the encroaching mangrove community to the south versus the freshwater wetlands to the north. Coincident with the removal of the L-31E levee, is the plugging of mosquito ditches (at north-south intersection locations with the east-west drainage ditches) south of the North Canal, but *west* of L-31E (see Figure 3).

Recommendations for restoration efforts for this lower reach of the Biscayne Bay coastal wetlands also provide much needed hydrologic restoration for the Model Lands region. The wetland communities located within the C-111 Basin and the Model Lands (also

called the Coastal Everglades or Southeastern Everglades) have been recognized as the only significant remaining area of short hydroperiod wetlands east of Everglades National Park, and which fulfill a "critical function for wading birds and other wildlife" (National Audubon Society 1997; p. 22). The restoration of natural flow patterns to both Biscayne and Florida Bays is essential to restoring the high intrinsic value of these wetland communities.

Recommendations for the Planning Process

Scientists from the Everglades Foundation have been unable to participate in the PDT planning process for this project. This elimination of public input in the technical planning process, which runs counter to the requirements defined in the CERP Programmatic Regulations, has once again created a proposed project design (Alternative O) that not only provides incomplete environmental benefits, but also runs a high risk that other alternatives have been not been adequately evaluated in the NEPA process.

As an example, the method used for ranking alternatives based on performance measure scoring has resulted in a "double counting," a technique that has not been used for other CERP projects. This method also results in a type of weighting of the alternatives that may or may not be appropriate. Evaluation with and without this double-counting should have been used to determine the effect of this type of weighting relative to the calculation of Habitat Units (HUs). We conducted our own assessment of the HUs documented in the two Cost Effectiveness/Incremental Cost Analysis (CE/ICA) reports prepared for the BBCW Project (dated April 10 and May 12, 2006). We used the planning team's original scoring of the performance measures, but without double-counting the performance measures. Thus, we summarized the nearshore zone performance measures together with only the unique performance measures found in the saltwater and freshwater zones, effectively adding all of the unique performance measures together and then calculated the Total HUs made available based on the planning team's scoring. These results are summarized in the table below.

Alternative	Total Habitat Units – April	Total Habitat Units – May
Yellow Book	45,471	46,272
Alternative O	N/A	34,723*
Alternative M	32,022	12,794*
Alternative Q	37,107	37,996
Alternative E	51,589	N/A
Alternative J	44,235	N/A
Existing Conditions	11,780	11,841
Future Without Project	14,271	14,349

*see comments below

When we looked more closely at why the alternatives scored higher or lower relative to each other, we found that certain performance measures were key for increasing (or decreasing) the habitat unit scores for the alternatives. For example, for the April

CE/ICA report, the unique *freshwater* zone performance measures (primarily PM IV.A.1) produced the largest significant difference between the Yellow Book and other alternatives. The unique *saltwater* zone performance measures (primarily PM V.A.1) produced the key difference, and higher score, for Alternative J versus the other alternatives. Conversely, the HUs calculated for Alternative M was lowered by the poor scoring relative to the nearshore performance measure PM VI.C.

When we evaluated the May CE/ICA report, we noticed similar results, but also discovered a significant change to the previous calculation of HUs for Alternative M. The planning team appears to have recalculated the score for performance measure PM IV.C, for this alternative, which resulted in a much lower score than the April report. Thus, the HUs dropped from 32,022 to 12,794. This performance measure, acres of existing public wetlands improved, also resulted in the high scoring of the new Alternative O as well, such that this performance measure received the same score as Alternative Q. However, when you look at the two proposed alternatives (O and Q), it seems unlikely that this equivalent scoring is appropriate. First, Alternative O has a much reduced linear extent of proposed spreader canal compared to Alternative Q. Second, there are significant differences between rehydration benefits with the implementation of the proposed spreader canal in Alternative Q versus the pumps located on existing canals proposed in Alternative O. The scoring of performance measure PM IV.C should be re-examined so that the scoring more accurately reflects the benefits achieved in the proposed alternatives.

What this illustrates is that project components for proposed alternatives should have been evaluated in total and in a way that evaluates the performance of each performance measure separately. It appears that original alternatives were designed with little integration with one another so that the planning team was unable to fully evaluate an alternative that incorporated the "best" features of all of the alternatives. The recent effort to produce Alternative O should have evaluated *all* of the previously proposed alternatives, not just M and Q, in order to determine which performance measures and thus which project features provide the "optimal" environmental performance relative to costs and benefits.

References

Gaiser, E.E. and M.S. Ross. 2004. Water flow through coastal wetlands. Annual Report 2004. Final Report to Biscayne National Park.

Hull, J.E. and F.W. Meyer. 1973. Salinity studies in East Glades Agricultural Area, Southeastern Dade County, Florida. USGS Open File Report No. 73005.

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Meeder, J., P. Harlem, and A. Renshaw. 2002. Historic Freshwater Flows to Biscayne Bay and Coastal Salinity Regime. Powerpoint presentation. Florida International University, Southeast Environmental Research Center.

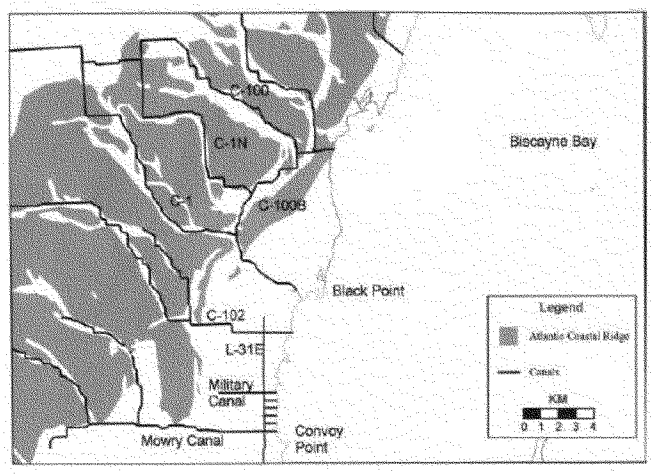
Meeder, J. F., P. W. Harlem, M. S. Ross, E. E. Gaiser and R. Jaffe. 2000. Southern Biscayne
Bay Watershed Historic Creek Characterization. Final Report to the South Florida Water Management District.

National Audubon Society. 1997. Water Preserve Areas: Defining Biological Functions and Spatial Extent. A Workshop Held September 19-20, 1996. National Audubon Society; Miami, Florida.

Ruiz, P.L. and M.S. Ross. 2004. Hydrologic restoration of the Biscayne Bay Coastal Wetlands: mosquito and drainage ditch inventory and recommendations. URL: http://www.fiu.edu/~serp1/project/131e/mdr.pdf. [accessed May 10, 2006]

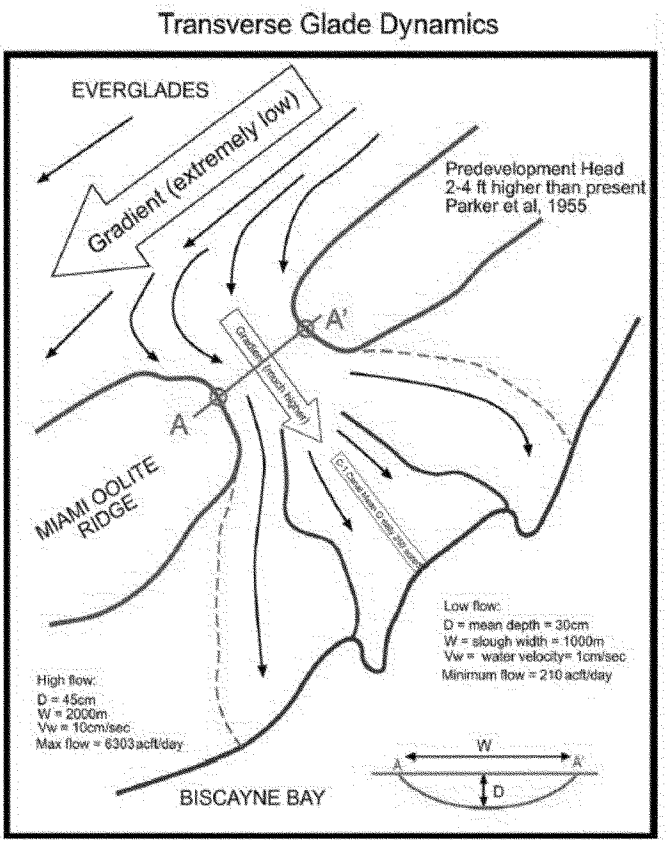
U.S. Department of Interior [DOI]. 1973. Resource and land information for South Dade County, Florida. Geological Survey Investigation I-850.

Figure 1. Transverse Glades and Major Canals
(Source Meeder et al. 2002)



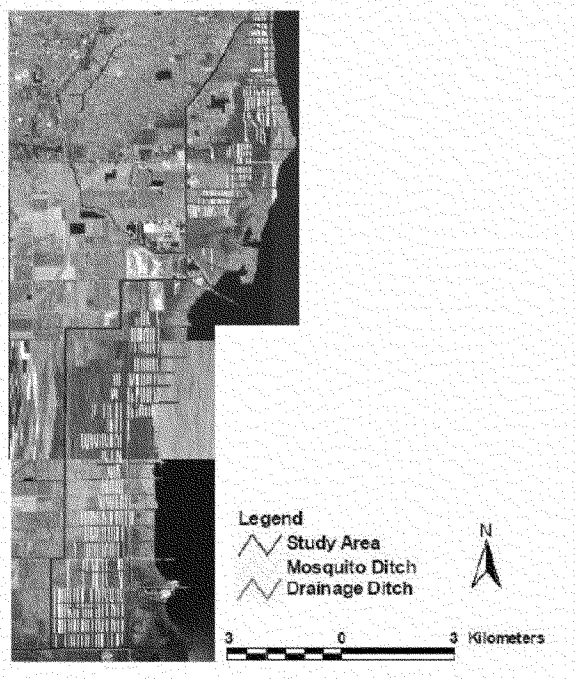
12

Figure 2. Transverse Glade Flow Dynamics
(Source: Meeder et al. 2002)



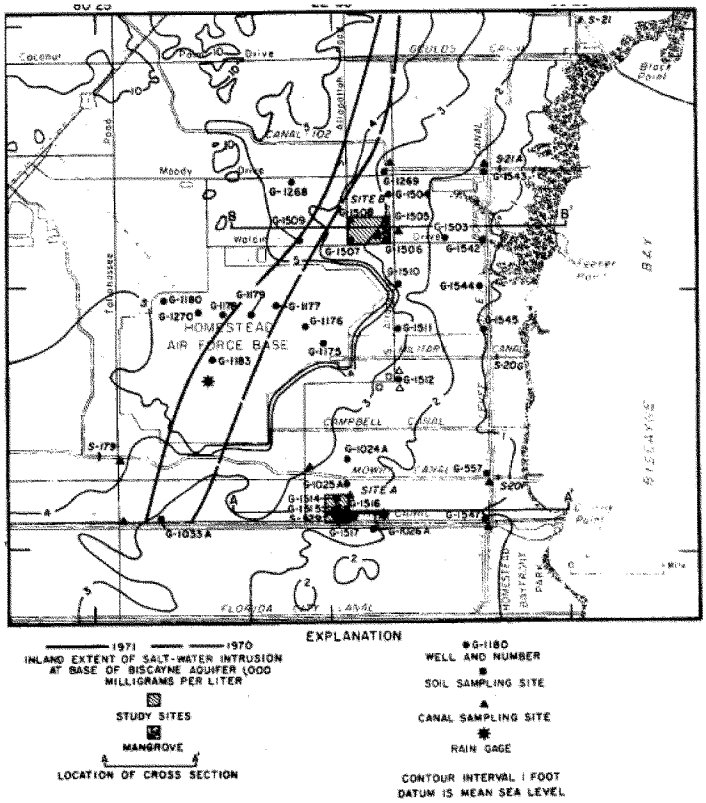
13

Figure 3. Distribution of Mosquito and Drainage Ditches for the Biscayne Bay Coastal Wetlands Region. (Source: Ruiz and Ross, 2004)



14

Figure 4. Biscayne Bay Coastal Wetlands Map including Topography
(Source: Hull and Meyer 1973)



15

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

RECEIVED
26 July 2007

July 23, 2007

Mr. Stuart J. Appelbaum
Chief, Planning Division
Environmental Branch
U.S. Army Corps of Engineers – Jacksonville
P.O. Box 4970
Jacksonville, FL 32232-0019

SUBJ: U.S. Army Corps of Engineers' (COE) Cooperating Agency Request for Biscayne Bay Coastal Wetlands EIS; Biscayne Bay, FL

Dear Mr. Appelbaum:

The U.S. Environmental Protection Agency (EPA) has received your letter dated June 28, 2007, offering this Agency an opportunity to be a cooperating agency for the subject EIS. The goal of this proposed project "…is to redistribute freshwater runoff from the watershed into Biscayne Bay, away from the canal discharges that exist today and provide a more natural and historic flow through existing and/or improved coastal wetlands."

As you know, EPA is strongly supportive of Everglades restoration efforts and has been a cooperating agency for a number of the Jacksonville District's CERP EISs. In an effort to continue such cooperation, EPA accepts the COE's offer to be a cooperating agency for the proposed EIS. However, our acceptance for this effort is conditioned in terms of our level of involvement. Due to staff and travel resource limitations, EPA does not expect to have the same level of involvement as on previous endeavors. However, to the extent feasible, we can offer NEPA scoping comments and our early review/technical expertise for water quality/wetland sections, and we can also participate in teleconferences and meetings with stakeholders to discuss important milestones.

It should also be noted that our status as a cooperating agency has no effect on our review responsibilities under Section 102(2)(C) of the National Environmental Policy Act (NEPA) or Section 309 of the Clean Air Act. Similarly, although we continue to support Everglades restoration, our being a cooperating agency should not imply that EPA will necessarily concur with all aspects of the COE EIS.

Internet Address (URL) • http://www.epa.gov
Recycled/Recyclable • Printed with Vegetable Oil Based Inks on Recycled Paper (Minimum 30% Postconsumer)

2

We appreciate your coordination with us. The EPA technical contact will be Eric Hughes (904/232-2464) located in your Jacksonville District office, while our NEPA contact will be Chris Hoberg (404/562-9619) of my staff in the EPA Atlanta regional office.

Sincerely,

Heinz J. Mueller, Chief
NEPA Program Office
Office of Policy and Management

October 19, 2007

Via Email

Mr. Ernest Clarke
U.S. Army Corps of Engineers
Jacksonville District
P.O. Box 4970
Jacksonville, Florida 32232

Re: Plan Formulation for Biscayne Bay Coastal Wetlands Project

Dear Mr. Clarke:

On behalf of the Everglades Foundation, I write to provide comment on the Biscayne Bay Coastal Wetlands (BBCW) Alternative Formulation Briefing (AFB) Package, September 2007, which outlines the plan formulation and evaluation process and the tentatively selected plan for the BBCW component of the Comprehensive Everglades Restoration Plan (CERP).

We believe there are serious process and technical issues with the alternative formulation for this important restoration project, which were underscored at the recent BBCW Project PDT meeting. For example, the Cost Effective/Incremental Cost Analysis (CE/ICA) presented in the AFB package, which provides an estimate of the total benefits expected from the various alternatives, relies on matrices of performance measures that have been changed, sometimes drastically, from previous matrices presented in earlier CE/ICA reports (April and May 2006). These earlier analyses were used to evaluate the preliminary set of alternatives that were subsequently screened out from further consideration, but do not represent the same basis of evaluation (and thus project performance) for the current suite of alternatives. The current performance measures came under question again at the October 12, 2007, PDT meeting, which only serves to highlight the potential errors in the estimation of project benefits, and, more importantly, whether the current performance measures still conform to original restoration objectives defined for this project. Our concern is that the current process in selecting (and scoring) these performance measures will produce an alternative that represents a foregone conclusion based on a dubious choice of performance measures rather than an alternative that has been carefully weighed and whose underlying logic of selection is retrievable.

It is important that as this project proceeds to formal NEPA documentation that the Corps of Engineers not only clearly document justifiable measures of natural system benefits for this restoration project, but provide documentation that a "reasoned decision" has been made based on an analysis that adequately considers and discloses the impact and benefits expected with project implementation.

The Everglades Foundation has followed this project in great detail for nearly two years and has provided formal written comments and oral comments within various public

venues expressing our expectations and issues that need to be resolved in order for this project to achieve its anticipated environmental benefits. Therefore, we were very surprised that our concerns as well as those of our environmental community partners were not included within this briefing package. In fact, Table 5-1 – Environmental Compliance and Coordination states "no new issues have been identified" relative to scoping and stakeholder meetings. Relatedly, recent interactions with agency managers seem to confirm a lack of knowledge of our issues with the plan formulation for this project. Indeed, they seem surprised as to our expressions of concern.

We ask that our previous letters, technical analysis, and comments be, at minimum, summarized and submitted in the Corps briefing process to ensure that the public's concerns have been faithfully and accurately presented

Sincerely,

/signature waived to expedite delivery/

Betty Grizzle, D.Env
Everglades Foundation
18001 Old Cutler Road, Suite 625
Palmetto Bay, Florida 33157
bgrizzle@evergladesfoundation.org

cc: Tiphanie Jinks, USACE
Matt Morrison, SFWMD

2

B.5.2 NRCS Response

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P.O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO ATTENTION OF

Planning Division
Environmental Branch

APR 25 2008

Ms. Deanna Peterson
Natural Resources Conservation Service
Soils Section
2614 NW 43rd Street
Gainesville, Florida 32606-6611

Dear Ms. Peterson:

The U.S. Army Corps of Engineers (Corps), Jacksonville District, is submitting the Farmland Conversion Impact Rating form (Form AD-1006) for the Biscayne Bay Coastal Wetlands Phase I project. In order to initiate consultation and ensure compliance under the Farmland Protection Policy Act, the Corps is requesting an evaluation from the Soil Conservation Service on farmland impacts within the proposed project area.

Enclosed is the Farmland Conversion Impact Rating form (Form AD-1006) with Parts I and III completed by the Corps and a study map. We are asking your agency to provide information on the remaining portion of the form. If you have any questions or need further information, please contact Mr. Brad Tarr at 904-232-3582.

Sincerely,

Rebecca S. Griffith

Rebecca S. Griffith, Ph.D, PMP
Chief, Planning Division

Enclosure

Planning Division
Environmental Branch

APR 25 2008

Ms. Deanna Peterson
Natural Resources Conservation Service
Soils Section
2614 NW 43rd Street
Gainesville, Florida 32606-6611

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Sincerely,

Rebecca S. Griffith, Ph.D, PMP
Chief, Planning Division

Enclosure

Tarr/CESAJ-PD-ES/3582/
EC Clarke/CESAJ-PD-PN
Hourican/CESAJ-DR-S
Schwichtenberg/CESAJ-PD-P
Bivens/CESAJ-PD
Griffith/CESAJ-PD

L: group/PDES/Tarr/Data/Corps/Projects/CERP/Biscayne Bay Coastal Wetlands/Farmland

B-31

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
2614 NW 43 Street
Gainesville, FL 32606

http://www.fl.nrcs.usda.gov/

State Office
P.O. Box 141510
Gainesville, FL 32614-1510

Phone: 352-338-9500
FAX: 352-338-9574

May 9th, 2008

Rebecca S. Griffith, Ph. D., PMP
Chief, Planning Division
Department of the Army
Jacksonville, District Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

Dear Ms. Griffith,

Enclosed is the completed AD-1006 for the Biscayne Bay Coastal Wetlands (Alternative "O" Phase 1) in Miami-Dade County.

The review of the Prime Farmland Maps and Prime Farmland Lists for Miami-Dade indicates that there are no Prime Farmland soils present within the defined Project Area. However, the USDA-NRCS considers any agricultural land that is used in the production of commodity row crops (peanuts, corn, citrus, etc.) as qualifying within the category of Unique Farmland.

Since it was difficult to ascertain using available digital orthoimagery for aerial photographic interpretation, I contacted Mr. Brad Tarr via phone. According to Mr. Tarr, there were no commodity row crops within the Project Area. In addition, there is little chance that there will be any crop production within the Project Area in the foreseeable future. Based on these findings, we have determined that there are no Unique Farmlands within the Project Area, hence, no impact on Unique Farmland.

However, if there has been any recent cultivation of any adjacent lands for the production of commodity row crops, there is a chance that this absence of Unique Farmland designation could change. If that is the case, please provide supplemental information and documentation to inform us otherwise.

Additional maps, interpretations, and ratings can be obtained at the USDA-NRCS Web Soil Survey at: http://websoilsurvey.nrcs.usda.gov/app/.

Sincerely,

Rick

Rick Robbins
USDA-NRCS
Soil Scientist
Gainesville, Florida

The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

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B.5.3 Cultural Resources

RECEIVED
9 May 05

FLORIDA DEPARTMENT OF STATE
Glenda E. Hood
Secretary of State
DIVISION OF HISTORICAL RESOURCES

Mr. David W. Barnett
Planning Division, Environmental Branch
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

April 29, 2005

RE: DHR No. 2005-2443 / Date Received by DHR: March 10, 2005
Comprehensive Everglades Restoration Plan (CERP)
Biscayne Bay Coastal Wetlands Project, Alternative E

Dear Mr. Barnett:

Our office received and reviewed the above referenced project in accordance with Section 106 of the *National Historic Preservation Act* of 1966, as amended, and 36 *C.F.R.*, Part 800: *Protection of Historic Properties*. The State Historic Preservation Officer is to advise and assist federal agencies when identifying historic properties (archaeological, architectural, and historical resources) listed, or eligible for listing, in the *National Register of Historic Places* (NRHP), assessing the project's effects, and considering alternatives to avoid or minimize adverse effects.

We have reviewed the referenced project, and note that pre-field research by the Corps identified several recorded sites within the area of potential effect, including the NRHP-listed Charles Deering Estate (8DA2815), and other sites recorded in the Florida Master Site File (8DA7, 8DA1031, 8DA5202-8DA5205, 8DA5198-8DA5199, 8DA6518-8DA6519, 8DA6792, and 8DA2001). In addition, the Old Cutler Road, a designated State Historic Highway, was identified along the western edge of the project area. We further note that Corps proposes to conduct the following variety of survey strategies to identify all of the cultural resources within the project's area of potential effect: Systematic shovel testing on a thirty-meter (or smaller) grid in the uplands; pedestrian survey in the wetlands focused on ground-disturbing activities such as ditch removal and grading; and shovel testing in areas of high probability. Based on the information provided, we concur with the identification of the enumerated recorded sites and with the specified survey strategies, and look forward to coordinating with the Jacksonville District Corps of Engineers and the South Florida Water Management District.

If you have any questions concerning our comments, please contact Janice Maddox, Historic Sites Specialist, by electronic mail at jmaddox@mail.dos.state.fl.us, or by phone at 850/245-6333. Your interest in protecting Florida's historic properties is appreciated.

Sincerely,
Barbara E. Mattick
Deputy SHPO for Survey & Registration
for Frederick Gaske, Director, and
State Historic Preservation Officer

500 S. Bronough Street • Tallahassee, FL 32399-0250 • http://www.flheritage.com

☐ Director's Office (850) 245-6300 • FAX: 245-6436
☐ Archaeological Research (850) 245-6444 • FAX: 245-6436
☑ Historic Preservation (850) 245-6333 • FAX: 245-6437
☐ Historical Museums (850) 245-6400 • FAX: 245-6433
☐ Southeast Regional Office (954) 467-4990 • FAX: 467-4991
☐ Northeast Regional Office (904) 825-5045 • FAX: 825-5044
☐ Central Florida Regional Office (813) 272-3843 • FAX: 272-2340

MARCH 8, 2005

Planning Division
Environmental Branch

Mr. Frederic Gaske, Director
Division of Historical Resources
State Historic Preservation Officer
500 South Bronough Street
Tallahassee, Florida 32399-0250

Dear Mr. Gaske:

The U.S. Army Corps of Engineers (Corps), Jacksonville District and the South Florida Water Management District are evaluating the potential effects of the proposed Biscayne Bay Coastal Wetlands Restoration Project. This project is a component of the Comprehensive Everglades Restoration Plan (CERP) and components of the project are part of the State's Acceler8 actions associated with the CERP plan. The project is located in southeastern Dade County from the Deering Estates Historic Site to just south of the Turkey Point Power generation plant. Enclosed is a copy of Alternative E of the plan along with its associated maps. This alternative includes all of the actions proposed at this time. The final project may include all or part of this proposal. The Acceler8 component includes "Sub-Region 1 and 2" (Deering Estate and the Cutler and Black Point Wetlands). The project includes a variety of actions including, but not limited to, construction of reservoirs, large stormwater treatment areas (STA), excavating new canals and spreader ditches, backfilling or plugging old canals and ditches and grading of land to control water flow. The overall purpose of the project is to alter the coastal hydrology by increasing the amount and depth of fresh water in the coastal wetlands and to provide a more consistent flow of fresh water thereby reducing shocks to the estuary system.

Pre-field research by the Corps identified the National Register of Historic Places (NRHP) listing of the Deering Estate (8DA2815NR), as well as, the number of historic and prehistoric sites (8DA5202, 8DA5203, 8DA5204, 8DA5205, 8DA7, 8DA5198, 8DA5199, 8DA6518 8DA6519, and 8DA2001) within or adjacent to the Deering Estate. The Corps also identified that the "Old Cutler Road" (8DA405) along the western edge of the project area is a designated State Historic Highway. Also, prehistoric sites (8DA1031 and 8DA6792) have been identified near one of the proposed reservoirs/STAs. The Corps has determined that the

-2-

project has the potential to affect historic properties eligible for listing on the National Register of Historic Places. Also, even though there have been some prior surveys, they do not appear to be sufficient to have identified all of the historic properties within the area of potential affects of the project, additional surveys to locate and evaluate the NRHP eligibility and the project effects are needed. Because of the differences in potential for sites, a variety of survey strategies will be used. In the uplands, systematic shovel testing on a 30-meter (or smaller) grid will be used. In the wetlands, a pedestrian survey will be conducted and shovel testing will be conducted in areas identified in the field as high probability. The wetland surveys will be focused on the ground disturbing activities, ditch removal and grading.

I request your concurrence with the Corps' determination of potential effect and the proposed survey strategy. If there are any questions, please contact Mr. Grady Caulk at 904-232-1786 or e-mail at grady.h.caulk@saj02.usace.army.mil.

Sincerely,

Dennis W. Barnett, P.E.
Acting Chief, Planning Division

Enclosures

Caulk/CESAJ-PD-EA/1786/
Cintron/CESAJ-PD-ES
Mason/CESAJ-PD-E
Trulock/CESAJ-DP-E
Barnett/CESAJ-PD

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FLORIDA DEPARTMENT OF STATE
Kurt S. Browning
Secretary of State
DIVISION OF HISTORICAL RESOURCES

Ms. Tori White
Jacksonville Corps of Engineers
Restoration Program – Regulatory Division
1400 Centrepark, Suite 750
West Palm Beach, Florida 33401-7402

March 5, 2007

Re: DHR Project File No.: 2007-803 / Received: February 2, 2007
Permit Application No.: 1994-1327 (IP-TW)
Applicant: South Florida Water Management District
Project: Biscayne Bay Coastal Wetlands Phase I Acceler8 Project
Miami-Dade County

Dear Ms. White:

Our office received and reviewed the above referenced Public Notice in accordance with Section 106 of the *National Historic Preservation Act* of 1966, as amended, and 36 *C.F.R.*, Part 800. The State Historic Preservation Officer is to advise and assist federal agencies when identifying historic properties (archaeological, architectural, and historical resources) listed, or eligible for listing, in the *National Register of Historic Places*, assessing the project's effects, and considering alternatives to avoid or minimize adverse effects.

Our review of the application and the Florida Master Site File data indicates that no significant archaeological or historical resources are recorded within the project area of potential effect. Furthermore, because of the nature of the project, the installation of four culverts along the L-31E Canal, it is the opinion of this office that the project will have no effect on historic properties.

If there are any questions concerning our comments, please contact Laura Kammerer, Deputy State Historic Preservation Officer, by phone at (850) 245-6333, or by electronic mail using lkammerer at dos.state.fl.us. We appreciate your continued interest in protecting Florida's historic properties.

Sincerely,

Frederick P. Gaske, Director, and
State Historic Preservation Officer

500 S. Bronough Street • Tallahassee, FL 32399-0250 • http://www.flheritage.com

☐ Director's Office (850) 245-6300 • FAX: 245-6436
☐ Archaeological Research (850) 245-6444 • FAX: 245-6452
☑ Historic Preservation (850) 245-6333 • FAX: 245-6437
☐ Historical Museums (850) 245-6400 • FAX: 245-6433
☐ Southeast Regional Office (561) 416-2115 • FAX: 415-2149
☐ Northeast Regional Office (904) 825-5045 • FAX: 825-5044
☐ Central Florida Regional Office (813) 272-3843 • FAX: 272-2340

FLORIDA DEPARTMENT OF STATE
Kurt S. Browning
Secretary of State
DIVISION OF HISTORICAL RESOURCES

Mr. David S. Hobbie, Chief
Jacksonville District Corps of Engineers
Restoration Program Office
1400 Centrepark, Suite 750
West Palm Beach, Florida 33401-7402

January 11, 2008

Re: DHR Project File No. 2007-7384-B / Received by DHR: September 24, 2007
Additional Information Received: December 24, 2007
Corps Project Nos.: SAJ-2006-7926 (IP-TKW), SAJ-2007-139 (IP-TKW)
Cultural Resource Assessment Survey of the Deering Estate and Cutler Flow-Way Projects, Miami-Dade County, Florida

Dear Mr. Hobbie:

Our office received and reviewed the above referenced survey report in accordance with Section 106 of the *National Historic Preservation Act of 1966* (Public Law 89-665), as amended in 1992; *36 C.F.R., Part 800: Protection of Historic Properties*; and Chapter 267, *Florida Statutes*, for assessment of possible adverse impact to cultural resources (any prehistoric or historic district, site, building, structure, or object) listed, or eligible for listing, in the National Register of Historic Places (NRHP).

In April 2007, Janus Research (Janus) conducted an archaeological and historical Phase I survey of the Deering Estate and Cutler Flowway Projects on behalf of the South Florida Water Management District. Janus identified the Deering Estate historic district (8DA2815), a historic bridge (8DA2815C), a historic wall (8DA2515D), and two historic roads (8DA6518 and 8DA11247) within the project area during the investigation.

The Charles Deering Estate (8DA2815) is listed on the NRHP and includes the Deering Estate Wall (8DA2815D) and the Deering Estate Bridge (8DA2815C) as contributing resources. The Deering Estate Bridge (8DA2815) is also considered individually eligible for listing on the NRHP under Criterion C as a distinctive and unique example of early twentieth century bridge design in Florida.

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■ Historic Preservation (850) 245-6333 • FAX: 245-6437
❒ Historical Museums (850) 245-6400 • FAX: 245-6433
❒ Southeast Regional Office (561) 416-2115 • FAX: 416-2149
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Mr. Hobbie
January 11, 2008
Page 2

Janus Research determined that the SW 72nd Avenue Road Segment (8DA6518) is also potentially eligible for listing on the NRHP as a contributing resource to 8DA2815, but is ineligible for listing individually. Janus Research determined that the Old Cutler Road (8DA11247), as it is expressed within the project area, does not appear to be eligible for listing on the NRHP although it is designated as a State Historic Highway.

Janus Research determined that the proposed project will have no effect on 8DA2815, 8DA2815D, 8DA6518, or 8DA11247. Furthermore, the proposed project includes repairs to the Deering Estate Bridge (8DA2815C) and channel maintenance so that the rise in water level will have no adverse effect on the bridge.

Based on the information provided, our office concurs with these determinations and finds the submitted report complete and sufficient in accordance with Chapter 1A-46, *Florida Administrative Code.*

For any questions concerning our comments, please contact April Westerman, Historic Preservationist, by electronic mail at amwesterman@dos.state.fl.us, or by phone at (850) 245-6333. Your continued interest in protecting Florida's historic properties is appreciated.

Sincerely,

Frederick P. Gaske, Director, and
State Historic Preservation Officer

Xc: Kathleen Hoffman, Janus Research

Planning Division
Environmental Branch

JUN 1 1 2008

Mr. Frederic P. Gaske, Director
Division of Historical Resources
State Historic Preservation Officer
500 South Bronough Street
Tallahassee, Florida 32399-0250

Dear Mr. Gaske:

The U.S. Army Corps of Engineers (Corps), Jacksonville District and the South Florida Water Management District (SFWMD) propose to construct the Biscayne Bay Coastal Wetlands Project (BBCW) with features extending along approximately 8 miles of the Biscayne Bay coast line. Portions of the BBCW Project Area are located in the following 7.5-minute Quads: Perrine (1988) and Arsenicker Keys (1997), Sections 10, 15, and 33, T56S/R40E; and Sections 4, 9, 16, and 18, T57S/R40E.

This project has separate phases of construction to be handled by the Corps and the SFWMD. Phase 1 of the BBCW Project includes features to be constructed by Acceler8 and reviewed by the State Historic Preservation Officer under DHR Project File No. 2007-7384. The continuation of Phase 1 includes features to be constructed by the Corps in the same project areas.

These features include a northeastward extension of the spreader canal to be built by Acceler8 and additional mosquito ditch plugging in the wetlands to the east in the Cutler Flow Way (Figure 1); six additional culverts, two gated riser structures, four pump stations, and a spreader canal with a small berm and seepage ditch between C-103 to the North Canal in the L-31 E area (Figure 2).

The spreader canal and the ditch plug features in the Cutler Flow Way are in low-lying areas of mangroves and mangrove muck soils over marl, an area previously deemed low probability for cultural resources.

Most of the structural elements in the L-31E area will be constructed within the existing canals. A previous literature review of this area performed by Janus Research determined that the project area had low potential for undetected cultural resources. Although the spreader canal and associated berm and seepage ditch between C-103 and the North Canal are in an area outside of the literature reviewed area, they are still in the low-lying disturbed area.

-2-

Pre-field research by the Corps did not identify any sites within the project's area of potential effect. The Corps has determined that the project does not have the potential to affect historic properties eligible for listing on the National Register of Historic Places.

I request your concurrence with the Corps' determination of no potential effect. If there are any questions, please contact Ms. Natalie Garrett at 904-232-1250 or e-mail at Natalie.s.garrett@usace.army.mil.

Sincerely,

Rebecca S. Griffith
Chief, Planning Division, Ph.D, PMP

Enclosures

Garrett/CESAJ-PD-ES/1250/ 10 June 08
Cintron/CESAJ-PD-ES
Clarke/CESAJ-PD-PN
Hourican/CESAJ-DR-PE
Schwichtenberg/CESAJ-PD-P
Bivens/CESAJ-PD
Griffith/CESAJ-PD

L:\GROUP\PDEC\N Garrett\BBCW\BBCW alt O shpo.doc

FLORIDA DEPARTMENT OF STATE
Kurt S. Browning
Secretary of State
DIVISION OF HISTORICAL RESOURCES

July 16, 2008

Ms. Rebecca S. Griffith, Ph.D.
Chief, Planning Division
Jacksonville Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Re: SHPO/DHR Project File No.: 2009-3961 / Received: June 13, 2008ry 2, 2007
Biscayne Bay Coastal Wetlands (BBCW) Phase I Continuation
C-103 and L-31E structural elements
Miami-Dade County

Dear Dr. Griffith:

Our office received and reviewed the project in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended and 36 CFR Part 800. The State Historic Preservation Officer is to advise and assist federal agencies when identifying historic properties (archaeological, architectural, and historical resources) listed, or eligible for listing, in the National Register of Historic Places, assessing the project's effects, and considering alternatives to avoid or minimize adverse effects.

Because of the nature of the BBCW proposed construction features involving the C-103 and L-31E canal and levee, this office concurs that no historic properties eligible for listing in the National Register will be affected.

If there are any questions concerning our comments, please contact Laura Kammerer, Deputy State Historic Preservation Officer, by phone at (850) 245-6333 or via e-mail at lkammerer@dos.state.fl.us. We appreciate your continued interest in protecting Florida's historic properties.

Sincerely,

Frederick P. Gaske, Director, and
State Historic Preservation Officer

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B.5.4 Miami-Dade County Resolution – February 2009

MEMORANDUM

Agenda Item No. 11(A)(7)

TO:	Honorable Chairman Dennis C. Moss and Members, Board of County Commissioners	**DATE:**	February 17, 2009
FROM:	R. A. Cuevas, Jr. County Attorney	**SUBJECT:**	Resolution urging U.S. Congress and the Florida Legislature to fully fund Biscayne Bay Coastal Wetlands Projects

The accompanying resolution was prepared and placed on the agenda at the request of Prime Sponsor Commissioner Katy Sorenson, and Co-Sponsors Commissioner Sally A. Heyman and Commissioner Rebeca Sosa.

R. A. Cuevas, Jr.
County Attorney

RAC/up

MEMORANDUM

(Revised)

TO: Honorable Chairman Dennis C. Moss and Members, Board of County Commissioners

DATE: February 17, 2009

FROM: R. A. Cuevas, Jr. County Attorney

SUBJECT: Agenda Item No. 11(A)(7)

Please note any items checked.

_____ **"4-Day Rule" ("3-Day Rule" for committees) applicable if raised**

_____ **6 weeks required between first reading and public hearing**

_____ **4 weeks notification to municipal officials required prior to public hearing**

_____ **Decreases revenues or increases expenditures without balancing budget**

_____ **Budget required**

_____ **Statement of fiscal impact required**

_____ **Bid waiver requiring County Mayor's written recommendation**

_____ **Ordinance creating a new board requires detailed County Manager's report for public hearing**

_____ **Housekeeping item (no policy decision required)**

_____ **No committee review**

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Approved _____ Mayor
Veto _____
Override _____

Agenda Item No. 11(A)(7)
2-17-09

RESOLUTION NO. _____

RESOLUTION URGING THE U.S. CONGRESS AND THE FLORIDA LEGISLATURE TO FULLY FUND BISCAYNE BAY COASTAL WETLANDS PROJECTS

WHEREAS, the Greater Everglades Ecosystem is a globally imperiled habitat and the primary source of drinking water for Miami-Dade County; and

WHEREAS, the Comprehensive Everglades Restoration Project (CERP) is the largest ecosystem restoration effort in the United States; and

WHEREAS, the CERP is intended to restore fresh water sheet flows to Everglades National Park and Biscayne National Park; and

WHEREAS, two projects on the list of 68 identified in CERP, the C-111 spreader canal and the Biscayne Bay Coastal Wetlands rehydration projects, are the only elements of the restoration plan that rehydrate wetlands and restore the estuaries within Biscayne National Park; and

WHEREAS, full funding for all phases of both of these projects are critical to the restoration of Biscayne National Park; and

WHEREAS, these two projects are also critical to Miami-Dade County's efforts to adapt to the projected impact of sea level rise that will cause additional saltwater intrusion in areas that are already experiencing significant saltwater migration several miles inland; and

WHEREAS, restoration of freshwater sheet flow feeding into southern Biscayne Bay will help hold back saltwater intrusion and improve the County's resilience to potential climate impacts; and

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Agenda Item No. 11(A)(7)
Page No. 2

WHEREAS, these projects are also both "shovel-ready" and "green," making them consistent with early goals for federal economic stimulus funding,

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF COUNTY COMMISSIONERS OF MIAMI-DADE COUNTY, FLORIDA, that this Board:

Section 1. Urges the U.S. Congress and the Florida Legislature to fully fund Biscayne Bay Coastal Wetlands projects, in particular the two projects critical to Biscayne Bay and Biscayne National Park: (i) both phases of the C-111 spreader canal and (ii) the Biscayne Bay Coastal Wetland rehydration project.

Section 2. Urges the U.S. Congress and the Florida Legislature to prioritize funding for Everglades restoration projects in any economic stimulus package passed.

Section 3. Directs the Clerk of the Board to transmit a certified copy of this resolution to the members of the Florida Congressional Delegation, the Governor of Florida, the President of the Florida Senate, the Speaker of the Florida House of Representatives, and the Chair and Members of the Miami-Dade State Legislative Delegation.

Section 4. Directs the County's federal and state lobbyists to advocate for the passage of the legislation set forth in Sections 1 and 2 above, and directs the Office of Intergovernmental Affairs to include this item in the 2009 Federal and State Legislative Packages.

The Prime Sponsor of the foregoing resolution is Commissioner Katy Sorenson, and the Co-Sponsors are Commissioner Sally A. Heyman and Commissioner Rebeca Sosa. It was offered by Commissioner , who moved its adoption. The motion was seconded by Commissioner and upon being put to a vote, the vote was as follows:

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Agenda Item No. 11(A)(7)
Page No. 3

Dennis C. Moss, Chairman
Jose "Pepe" Diaz, Vice-Chairman

Bruno A. Barreiro	Audrey M. Edmonson
Carlos A. Gimenez	Sally A. Heyman
Barbara J. Jordan	Joe A. Martinez
Dorrin D. Rolle	Natacha Seijas
Katy Sorenson	Rebeca Sosa
Sen. Javier D. Souto	

The Chairman thereupon declared the resolution duly passed and adopted this 17th day of February, 2009. This resolution shall become effective ten (10) days after the date of its adoption unless vetoed by the Mayor, and if vetoed, shall become effective only upon an override by this Board.

MIAMI-DADE COUNTY, FLORIDA
BY ITS BOARD OF
COUNTY COMMISSIONERS

HARVEY RUVIN, CLERK

By:_____
Deputy Clerk

Approved by County Attorney as
to form and legal sufficiency. JMM

Jess M. McCarty

5

B.5.5 Essential Fish Habitat – April 2010

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
(727) 824-5317; FAX (727) 824-5300
http://sero.nmfs.noaa.gov/

April 23, 2010 F/SER4:JK/pw

(Sent via Electronic Mail)

Colonel Alfred Pantano
District Engineer, Jacksonville District
Department of the Army Corps of Engineers, Planning Division
PO Box 4970
Jacksonville, Florida 32232

Attention: Mr. Brad Tarr

Dear Colonel Pantano:

NOAA's National Marine Fisheries Service (NMFS) reviewed the Jacksonville District's Draft Environmental Impact Statement (EIS) dated March 2010 and titled *Biscayne Bay Coastal Wetlands (BBCW) Draft Integrated Project Implementation Report and EIS.* The Draft EIS identifies the BBCW project's primary purpose is to restore a more natural water flow pattern to Biscayne Bay by redirecting freshwater that is currently discharged directly to the Bay through man-made canals into coastal wetlands that are adjacent to the Bay. By rehydrating coastal wetlands and reducing harmful point source freshwater discharges, the Draft EIS concludes that the tentatively selected plan would help restore freshwater and saltwater wetlands, re-establish more natural salinity regimes, and provide a more productive nearshore nursery habitat. The focus of our review is the Essential Fish Habitat (EFH) assessment, which is located in Annex B, section B.2.2.8 or the Draft EIS. The Jacksonville District's initial determination is that the proposed activity would result in a net benefit to EFH and that the loss of wetlands associated with construction of the project would be minimal. As the nation's federal trustee for the conservation and management of marine, estuarine, and anadromous fishery resources, the following comments and recommendations are provided pursuant to authorities of the Fish and Wildlife Coordination Act and the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

Comments on the EFH Assessment
The EFH assessment includes the mandatory components set forth at 50 CFR 600.920(e). We agree with the District's determination that the long-term benefits to EFH would outweigh the construction related impacts to wetlands. However, we recommend that the final version of the EFH assessment provide habitat characterization information for the 101 acres of wetlands that would be impacted during construction. We understand that this information is provided in the U.S. Fish and Wildlife Service's concurrence letter on the Biological Assessment (provided in Annex A, starting on page 4-58), however, NMFS recommends incorporating this wetland habitat characterization information into the EFH assessment so that the Jacksonville District's determination regarding effects to EFH would be more clearly articulated.

Thank you for the opportunity to provide comments. Related correspondence should be directed to the attention of Ms. Jocelyn Karazsia at our West Palm Beach office, which is co-located with the US Environmental Protection Agency at USEPA, 400 North Congress Avenue, Suite 120, West Palm Beach, Florida, 33401. She may be reached by telephone at (561) 616-8880, extension 207, or by e-mail at Jocelyn.Karazsia@noaa.gov.

Sincerely,

/ for

Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

cc:

CESAJ, Bradley.A.Tarr@usace.army.mil
NMFS, Joan.Browder@noaa.gov
NMFS, David.Keys@noaa.gov
FWS, Patrick_Pitts@fws.gov
FWCC, Lisa.Gregg@MyFWC.com
EPA, Miedema.Ron@epa.gov
SAFMC, Roger.Pugliese@safmc.net
NOAA PPI, PPI.Nepa@noaa.gov
F, nmfs.hq.nepa@noaa.gov
F/SER, nmfs.ser.eis@noaa.gov
F/SER4, David.Dale@noaa.gov
F/SER47, Jocelyn.Karazsia@noaa.gov

- 2 -

B.5.6 Florida Fish and Wildlife Conservation Commission – April 2010

Florida Fish and Wildlife Conservation Commission

Commissioners
Rodney Barreto
Chairman
Miami

Richard A. Corbett
Vice Chairman
Tampa

Kathy Barco
Jacksonville

Ronald M. Bergeron
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Tallahassee

Executive Staff
Nick Wiley
Executive Director

Greg Holder
Assistant Executive Director

Karen Ventimiglia
Deputy Chief of Staff

Office of Planning and Policy Coordination
Nancy Linehan
Director
(850) 487-3794
(850) 410-5265 FAX
(850) 410-5272
(850) 922-5679 FAX

Managing fish and wildlife resources for their long-term well-being and the benefit of people.

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Tallahassee, Florida
32399-1600
Voice: (850) 488-4676

Hearing/speech impaired:
(800) 955-8771 (T)
(800) 955-8770 (V)

MyFWC.com

April 23, 2010

Ms. Lauren Milligan
Florida State Clearinghouse
Department of Environmental Protection
3900 Commonwealth Boulevard, MS 47
Tallahassee, FL 32399-3000

Re: SAI #FL201003115144C, Miami-Dade Co., Biscayne Bay Coastal Wetlands Project Draft Integrated Project Implementation Report and Draft Environmental Impact Statement

Dear Ms. Milligan:

The Division of Habitat and Species Conservation (HSC) of the Florida Fish and Wildlife Conservation Commission (FWC) has coordinated an agency review of the Biscayne Bay Coastal Wetlands (BBCW) Project Draft Integrated Project Implementation Report (DPIR) and Draft Environmental Impact Statement (DEIS). The following comments and recommendations are being provided in accordance with the Coastal Zone Management Act/Florida Coastal Management Program and the National Environmental Policy Act.

We fundamentally agree with the U.S. Army Corps of Engineers (USACOE) regarding the selection of Alternate O Phase I; however, we want to emphasize several areas of concern that we believe require further consideration by the USACOE. Our understanding of this project is based primarily on the information found in the BBCW DPIR and DEIS.

Project Description

The BBCW project is planned and designed to rehydrate coastal wetlands and to reduce point-source freshwater discharges that have had detrimental effects to coastal wetlands and altered nearshore marine resources of Biscayne Bay. The tentatively selected plan, Alternative O Phase I, seeks to restore 400 acres of freshwater wetlands by reestablishing overland flows to the estuary and by mimicking the historic natural timing and quantity of water delivery. The restoration of freshwater flow over a large area is also expected to restore saltwater wetlands and nearshore bay habitats by returning salinities to their historic concentrations and stabilizing them. Components of Alternative O that are not a part of Phase I were not addressed in this report.

The tentatively selected plan includes three primary components: the Deering Estate, the Cutler Wetlands, and the L-31 East Flowway. These components combined have a project footprint of roughly 3,761 acres of land, and incorporate the plugging of 2,500 feet of mosquito control ditches, the construction of seven pump stations, the installation of approximately 10 culverts, and 3 miles of spreader canals.

1) *Deering Estate:* The C-100A spur canal would be extended 500 feet to deliver freshwater to a constructed freshwater wetland. Water would flow from there to the Cutler Drain and ultimately coastal wetlands along Biscayne Bay.

2) *Cutler Wetlands*: Features in this region include a pump station, a conveyance canal, a spreader canal, culverts, and mosquito control ditch plugs. The pump station, located on the C-1 canal, would deliver water to a 6,900-foot lined conveyance canal that would run under SW 97th Avenue (L-31 E Levee) and across the L-31E Canal via concrete box

Ms. Lauren Milligan
Page 2
April 27, 2010

culverts and deliver water to the spreader canal located in the saltwater wetlands. This spreader canal is divided into four segments.

3) *L-31 East Flow Way:* Features in this region would isolate the L-31E Canal from the major discharge canals (C-102, Military Canal and C-103) and allow freshwater to flow through the L-31 E Levee to the saltwater wetlands. Gated culverts and inverted siphon structures would isolate L-31E canal from these other canals, thereby allowing L-31E to maintain higher water levels. Two pump stations and a series of culverts would move fresh water directly to the saltwater wetlands east of L-31E. Two more pump stations and a spreader canal would deliver water to the freshwater wetlands south of C-103.

The intentions of this project are to maximize net environmental and economic benefits on a system-wide basis. A total of 470 acres of freshwater wetlands will be rehydrated resulting in natural management of about 500 acres of exotic vegetation. The project should stabilize and improve estuarine and nearshore nursery habitat by returning salinity levels to a more natural state. By diverting approximately 40 percent of the available canal freshwater discharge into wetlands, it is anticipated that approximately 3,450 acres of saltwater wetlands would maintain stable salinities under 20 parts per thousand (ppt) as opposed to the current 1,870 acres under 20 ppt. Additionally, 30% (approximately 482 acres) of nearshore areas of Biscayne Bay (within 500 meters of shore) would meet the desired salinity target of less than 20 ppt. It is anticipated that the plan would reduce future nitrate loads into Biscayne Bay by 163 thousand tons, which is approximately 50 percent of the future predicted nitrate load. It would reduce phosphorous loading by 50% as well. Alternative O Phase I is projected to double the spatial extent of the functional habitat relative to that expected to exist in the future without-project modified conditions.

Monitoring and Adaptive Management:

It is indicated that the operations of Alternative O Phase I will be guided by adaptive management. The goal of applying adaptive management for the Biscayne Bay Coastal Wetlands is to generate information that will address key questions about how the project will achieve its restoration goals and objectives, assess ecological response, and provide feedback and options to adjust management actions, as necessary, to ensure restoration goals are likely to be achieved. The key to applying adaptive management techniques is in closely monitoring the ecosystem and its response to management actions to allow changes to be applied as necessary. However, the DPIR and DEIS indicate that funding for ecological monitoring is currently only planned for 5 years (Section 7.2).

Potentially Affected Fish and Wildlife Resources

Pages 3-40 and 3-41 of the DPIR/DEIS provide a list of both the federally and state-listed species that would potentially be affected by the BBCW project. The following are the species and resources that our staff has determined to be those that are most likely to be affected.

Nearshore Hardbottoms and Associated Benthic Organisms:

Nearshore hardbottoms, which occur in the project footprint (DPIR and DEIS Section 3.8.1.6), play a vital role in nearshore ecosystems and serve important functions in the life cycles of fishes; sea turtles; lobsters; and various species of corals, algae, and sponges (Holloway-Adkins 2001, Lindeman et al 2000, Lindeman and Snyder 1999). Additionally, the project area falls within the federally designated critical habitat for federally threatened *Acropora* spp. (http://www.nmfs.noaa.gov/pr).

Ms. Lauren Milligan
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April 27, 2010

We note that there is some conflation of seagrass and hardbottom habitats in the discussion in section 3.1.7.1. The seagrass and hardbottom communities are typically distinct and separate, although some mixing can occur. In the hardbottom community of Biscayne Bay, soft corals are very common and diverse, more common than are hard corals. Also, as a nursery habitat, while shrimp make extensive use of seagrass beds, the Florida spiny lobster (lobster) (*Panulirus argus*) uses structurally complex algae for settling and early life history foraging and sheltering habitat (Butler and Herrnkind 1992). Nursery habitat for later juvenile stages of lobster is predominately the hardbottom community (sponges, crevices, hard corals, and soft coral complexes) (Moe 1991, Smith and Herrnkind 1992). Adult lobsters use seagrass habitat for foraging, but generally not for sheltering. Additionally, FWC biologists have not documented juvenile lobster utilizing mangrove prop roots. Foraging habitat is more likely to be rubble zones and open hardbottom. Most adults will eventually leave Biscayne Bay for coral reef habitat toward the ocean as they mature to reproductive size (Herrnkind 1980).

The importance of nearshore habitats as nursery habitat for the economically important fish and lobster was not addressed in the DPIR and DEIS. The effects of the anticipated changes in salinity regimes are not clearly identified nor is monitoring or adaptive management proposed for this habitat type.

West Indian (Florida) Manatee:

Manatees (*Trichechus manatus latirostris*) have been documented using freshwater canal systems throughout south Florida including the canals adjacent to Biscayne Bay. Manatees regularly access the C-100, C-1, C-102, Military Canal, C-103 and the L-31E canals to reach important resources including freshwater, forage, warmer water during the winter months, and quiet waterways with limited vessel traffic. The FWC recognized manatee use of these areas and created slow and idle speed zones adjacent to and within these canals pursuant to 68C-22.025, Florida Administrative Code. Although these canals provide habitat that is often used by manatees, manatee use of these canal systems does not come without risk. Water-control structures operated by the South Florida Water Management District (SFWMD) for flood and salinity control purposes have been constructed on each of the five canals that are located within the project area. Manatee deaths due to crushing or drowning resulting from manatees being caught by the closure of the water-control structure's gates have been documented at most of these structures. Since 1974 a total of 19 manatee deaths have occurred as a result of the operation of the water-control structures within the project site (Table 1). Structure-related manatee deaths have long been identified as the second leading cause of human-related manatee mortality. Ongoing efforts since 1991 between the USACOE, SFWMD, FWC, and U.S. Fish and Wildlife Service (USFWS) have led to the retrofitting of water-control structures with manatee-protection devices, and the revision of their operational protocols. The retrofitting efforts have resulted in a significant reduction in structure-caused manatee deaths at retrofitted structures, including no manatee-related structure deaths within the project area since 2004. The construction of new water control structures and culverts may present new risks to manatees within the project site and further information will be required to determine any additional threats and potential techniques for the minimization of any new risks (FWC 2007).

Table 1. Manatee Deaths at Water-Control Structures

Canal	Structure	# of Manatee Deaths	Year of Last Death
C-100	S-123	0	N/A
C-1	S-21	5	2002
C-102	S-21A	3	2003

Ms. Lauren Milligan
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April 27, 2010

Military	S-20G	2	2002
C-103	S-20G	9	2004
Total		19	

Eastern Indigo Snake:

FWC biologists are aware of observations of eastern indigo snakes (*Drymarchon corais couperi*) along canals within the project area (FWC 2010). Construction activities can injure or kill individuals of this species, which is federally and state-listed as threatened.

Comments and Recommendations

Monitoring and Adaptive Management:

Given the uncertainties affiliated with an unprecedented project of this magnitude, thorough monitoring and effective adaptive management are critical. In order to ensure efficient adaptive management throughout the life of the project, we recommend that the monitoring program be extended beyond five years. Ultimately, monitoring should at least continue until the project has fully reached equilibrium and all ecological targets have been achieved.

Nearshore Hardbottoms and Associated Benthic Organisms:

Nearshore hardbottom communities serve vital roles in the life cycles of lobsters and fish and the current extent and characterization of this habitat type are not well described in the DPIR/DEIS. We recommend that the final PIR/EIS include a thorough description of existing communities and an assessment of predicted impacts to these communities. Additionally, we recommend that if there are significant hardbottom communities within the project area of influence, they be added to the monitoring plan and be considered in the adaptive management plan.

West Indian (Florida) Manatee:

The proposed construction of this project also has potential detrimental effects on manatees beyond the loss of existing habitat through the isolation of approximately 3.5 miles of the L-31E canal between proposed structures S-703 and S-709. The construction of six pump stations, multiple culverts, two inverted siphons, and a canal extension at the C-100A could also result in direct impacts to manatees during the construction phase and potentially through the operation of the new structures. Additionally, if explosives are required to accomplish the proposed construction, this action could result in direct impacts to manatees.

We recommend that adverse impacts to manatees during construction due to construction activities be minimized by using the 2009 FWC Manatee Construction Conditions (enclosed) and the 2006 Guidelines for Manatee Conservation during CERP Implementation. It is currently unclear, however, which structures proposed for construction will be accessible to manatees and if these structures would pose any threat. It is also not clear to what degree water levels in the existing canals will be modified through the pumping of water from them into the L-31E canal. Significant changes in water levels may result in entrapments or strandings of manatees within the canals.

To complete our assessment of the proposed project and determine if additional manatee conservation measures are warranted, the following additional information is required for permitting purposes. We also recommend that they be addressed, at least at the conceptual level, in the final PIR/EIS.

Ms. Lauren Milligan
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April 27, 2010

1) What measures will be used to prevent manatee access to the spreader canal in the C-100 extension?
2) Please provide diagrams of the proposed pump stations S-700, S-701, S-703, S-709, S-710, and S-711 and a description of how manatee entrapment or impingement will be prevented.
3) Please provide diagrams and operational information on the siphon pumps proposed at S-707 and the Riser Culvert at S-705 and any manatee protection measures that may be planned to be implemented at these structures.
4) Please provide diagrams of the proposed box culvert C-702 that will be used on the L-31E canal and any manatee protection measures that may be planned to be implemented at this structure.
5) How will the water levels in the C-100, C-102, Military Canal and the C-103 be affected by the removal of water from these canals?
6) If the project is implemented, what is the expected change in the frequency of the opening/closing of the gates on the salinity control structures on the C-100, C-102, C-103, and military canals?
7) If blasting is required during construction, the applicant is required to follow the Guidelines for the Protection of Marine Animals during the Use of Explosives in the Waters of the State of Florida, which may be found in the 2006 Guidelines for Manatee Conservation during CERP Implementation.
8) Closure of the L-31E canal between S-703 and S-709 could result in the entrapment of manatees within this area. The Guidelines to Minimize/Avoid Manatee Entrapment found in the Guidelines for Manatee Conservation during CERP Implementation document will be required to minimize the risk of manatee entrapment if this project is implemented.

Eastern Indigo Snake:

Due to the potential to injure or kill eastern indigo snakes during construction, please ensure that contractors are aware of the potential presence of eastern indigo snakes, have information available to identify them, and that plans are in place to cease all activities in the event that a snake is observed until it has cleared the area.

Summary

Based on the information provided, we do not find the DPIR/DEIS for the BBCW project to be inconsistent with Chapter 379, Florida Statutes, as cited under the Florida Coastal Management Program. After a review of the information available regarding this project, it appears that the potential cumulative adverse impacts to fish and wildlife resources, including seagrasses, manatees, marine turtles and hardbottom communities, are likely to be nominal as compared to the benefits that would be created; however, further information is required to complete our assessment.

If you have questions regarding our review of this project, Erin McDevitt is the point of contact for the coordination of these comments and can be contacted at (561) 625-5122.

Sincerely,

Mary Ann Poole

Mary Ann Poole
Commenting Program Administrator

Ms. Lauren Milligan
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map/ma/ks/rm/em
ENV 1-3-2
Biscayne Bay Coastal Wetlands Project_2706_042310
Enclosure

cc: Rebecca S. Griffith, Ph.D., PMP
Department of the Army
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

Paul Souza, USFWS, Vero Beach
Ernie Marks, DEP, Tallahassee
Greg Knecht, DEP, Tallahassee
Rod Bertelsen, FWC
Chuck Collins, FWC
David Crewz, FWC
Kerry Maxwell, FWC
Ron Mezich, FWC
Lindsay Nester, FWC
Harry Norris, FWC

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Moe, M., Jr. 1991. Lobsters: Florida, Bahamas, the Caribbean. Green Turtle Pub. Plantation, FL (USA). 510 pp.

STANDARD MANATEE CONDITIONS FOR IN-WATER WORK
2009

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

a. All personnel associated with the project shall be instructed about the presence of manatees and manatee speed zones, and the need to avoid collisions with and injury to manatees. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act, the Endangered Species Act, and the Florida Manatee Sanctuary Act.

b. All vessels associated with the construction project shall operate at "Idle Speed/No Wake" at all times while in the immediate area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

c. Siltation or turbidity barriers shall be made of material in which manatees cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee entanglement or entrapment. Barriers must not impede manatee movement.

d. All on-site project personnel are responsible for observing water-related activities for the presence of manatee(s). All in-water operations, including vessels, must be shutdown if a manatee(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving.

e. Any collision with or injury to a manatee shall be reported immediately to the FWC Hotline at 1-888-404-FWCC. Collision and/or injury should also be reported to the U.S. Fish and Wildlife Service in Jacksonville (1-904-731-3336) for north Florida or Vero Beach (1-772-562-3909) for south Florida.

f. Temporary signs concerning manatees shall be posted prior to and during all in-water project activities. All signs are to be removed by the permittee upon completion of the project. Awareness signs that have already been approved for this use by the Florida Fish and Wildlife Conservation Commission (FWC) must be used (see MyFWC.com). One sign which reads *Caution: Boaters* must be posted. A second sign measuring at least 81/2" by 11" explaining the requirements for "Idle Speed/No Wake" and the shut down of in-water operations must be posted in a location prominently visible to all personnel engaged in water-related activities.

CAUTION: MANATEE HABITAT

All project vessels

IDLE SPEED / NO WAKE

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

SHUT DOWN

Report any collision with or injury to a manatee:

Wildlife Alert:

1-888-404-FWCC(3922)

cell *FWC or #FWC

B.5.7 Florida State Clearinghouse – April 2010

Florida Department of Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

April 29, 2010

Mr. Brad A. Tarr
Environmental Branch, Planning Division
U. S. Army Corps of Engineers
P. O. Box 4970
Jacksonville, FL 32232-0019

RE: Department of the Army, Jacksonville District Corps of Engineers – Draft Integrated Project Implementation Report and Environmental Impact Statement, Biscayne Bay Coastal Wetlands Phase I Project – Miami-Dade County, Florida.
SAI # FL201003115144C

Dear Mr. Tarr:

The Florida State Clearinghouse has coordinated a review of the Draft Integrated Project Implementation Report/Environmental Impact Statement (PIR/EIS) under the following authorities: Presidential Executive Order 12372; Section 403.061(40), *Florida Statutes*; the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended; and the National Environmental Policy Act, 42 U.S.C. §§ 4321-4347, as amended.

The Florida Department of Environmental Protection (DEP) concurs that the project's design is consistent with the stated project goals and objectives. Operational flexibility will lead to increased benefits by further minimizing potential high flows to the estuary as well as other discharges and sediment loads. Although the project's long-term ecological benefits are somewhat uncertain due to potential climatic changes, the preferred alternative is expected to improve the fresh and saltwater wetlands, water quality and the near shore waters of Biscayne Bay. Staff states that the extent of the ecological benefits derived from project operation will be assessed by the monitoring plan and adjustments can be made to these features to improve performance. The DEP is currently reviewing a CERPRA permit application for Cutler Flow-way pursuant to Section 373.1502, *Florida Statutes*. Issuance of a CERPRA permit will be required for all phases of this project prior to construction. For additional information and assistance, please see the enclosed DEP memorandum and contact Ms. Katelyn Lynch at (850) 245-8350.

The Florida Department of Agriculture and Consumer Service (FDACS) has expressed concerns regarding the effects of increased water impoundment in the L-31E Flow Way project area on adjacent private agricultural lands. FDACS staff advises that Section

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www.dep.state.fl.us

Mr. Brad A. Tarr
April 29, 2010
Page 2 of 3

373.1501(5)(d), *Florida Statutes*, requires the South Florida Water Management District, in its role as the local sponsor, to provide reasonable assurances that existing Levels of Service for Flood Protection (LOSFP) will not be diminished by implementation of CERP projects. The L-31E Flow Way Flood Protection Analysis did not include an analysis of potential impacts to the existing LOSFP within the subsurface root zone of adjacent crop lands. In order to address the model uncertainty inherent in the project evaluation process and the lack of flood analysis in the root zone area, the FDACS requests project assurances to protect private agricultural lands from project related flood protection losses. Please see the enclosed FDACS memoranda for further detailed comments.

Florida Fish and Wildlife Conservation Commission (FWC) staff agrees with the selection of project Alternative O Phase I. The FWC has, however, identified several areas of concern for further consideration by project managers, including: the limited years (five) of funding planned to perform ecological monitoring needed to apply adaptive management of project operations; the need to distinguish between varied seagrass and hardbottom habitat types in the discussions of affected resources; the minimization of any new risks to manatees posed by construction of new water control structures and culverts; and avoidance of impacts to the threatened eastern indigo snake. Please refer to the enclosed FWC letter for additional staff comments, requested information and recommended actions to resolve the agency's concerns.

Based on the information contained in the Draft PIR/EIS and enclosed state agency comments, the state has determined that, at this stage, the proposed activities are consistent with the Florida Coastal Management Program (FCMP). To ensure the project's continued consistency with the FCMP, the concerns identified by our reviewing agencies must be addressed prior to project implementation. The state's continued concurrence will be based on the activity's compliance with FCMP authorities, including federal and state monitoring of the activity to ensure its continued conformance, and the adequate resolution of issues identified during this and subsequent reviews. The state's final concurrence of the project's consistency with the FCMP will be determined during the environmental permitting process in accordance with Section 373.428, *Florida Statutes*.

Thank you for the opportunity to review the proposed project. Should you have any questions regarding this letter, please contact Mr. Chris Stahl at (850) 245-2169.

Yours sincerely,

Sally B. Mann

Sally B. Mann, Director
Office of Intergovernmental Programs

SBM/cjs

Mr. Brad A. Tarr
April 29, 2010
Page 3 of 3

Enclosures

cc: John Shaffer, SFWMD
John Outland, DEP, Ecosystem Projects
Ernie Marks, DEP, RPPP
Tim Gray, DEP, Southeast District
Forrest Watson, FDACS
Ray Scott, FDACS
Mary Ann Poole, FWC

Florida State Clearinghouse

Florida
Department of Environmental Protection
"More Protection, Less Process"

Categories | Home | DEP Home | Contact DEP | Search | DEP Site Map

Project Information	
Project:	FL201003115144C
Comments Due:	04/16/2010
Letter Due:	04/26/2010
Description:	DEPARTMENT OF THE ARMY, JACKSONVILLE DISTRICT CORPS OF ENGINEERS - DRAFT INTEGRATED PROJECT IMPLEMENTATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT, BISCAYNE BAY COASTAL WETLANDS PHASE I PROJECT - MIAMI-DADE COUNTY, FLORIDA.
Keywords:	ACOE - DIPIR/EIS, BISCAYNE BAY COASTAL WETLANDS PHASE I PROJECT - MIAMI-DADE CO.
CFDA #:	99.997

Agency Comments:

SOUTH FL RPC - SOUTH FLORIDA REGIONAL PLANNING COUNCIL

No Comments Received

AGRICULTURE - FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES

FDACS staff has expressed concerns regarding the effects of increased water impoundment in the L-31E Flow Way project area on adjacent private agricultural lands. Staff advises that Section 373.1501(5)(d), Florida Statutes, requires the South Florida Water Management District, in its role as the local sponsor, to provide reasonable assurances that existing Levels of Service for Flood Protection (LOSFP) will not be diminished by implementation of CERP projects. The L-31E Flow Way Flood Protection Analysis did not include an analysis of potential impacts to the existing LOSFP within the subsurface root zone of adjacent crop lands. In order to address the model uncertainty inherent in the project evaluation process and the lack of flood analysis in the root zone area, the FDACS requests project assurances to protect private agricultural lands from project related flood protection losses. Please see the enclosed FDACS memoranda for further detailed comments and recommendations.

COMMUNITY AFFAIRS - FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS

FISH and WILDLIFE COMMISSION - FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

FWC staff agrees with the selection of project Alternative O Phase I. The FWC has, however, identified several areas of concern for further consideration by project managers, including: the limited years (five) of funding planned to perform ecological monitoring needed to apply adaptive management of project operations; the need to distinguish between varied seagrass and hardbottom habitat types in the discussions of affected resources; the minimization of any new risks to manatees posed by construction of new water control structures and culverts; and avoidance of impacts to the threatened eastern indigo snake. Please refer to the enclosed FWC letter for additional staff comments, requested information and recommended actions to resolve the agency's concerns.

STATE - FLORIDA DEPARTMENT OF STATE

No Comments Received

TRANSPORTATION - FLORIDA DEPARTMENT OF TRANSPORTATION

The Florida Department of Transportation, District Six, has reviewed the referenced document and attended the statewide teleconference conducted for this project on Monday, April 19, 2010. Based on the teleconference discussions and review of the document, this project does not affect any roadways on the State Highway System (SHS) and therefore we have no comment.

ENVIRONMENTAL PROTECTION - FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

The DEP concurs that the project's design is consistent with the stated project goals and objectives. Operational flexibility will lead to increased benefits by further minimizing potential high flows to the estuary as well as other discharges and sediment loads. Although the project's long-term ecological benefits are somewhat uncertain due to potential climatic changes, the preferred alternative is expected to improve the fresh and saltwater wetlands, water quality and the near shore waters of Biscayne Bay. Staff states that the extent of the ecological benefits derived from project operation will be assessed by the monitoring plan and adjustments can be made to these features to improve performance. The DEP is currently reviewing a CERPRA permit application for Cutler Flow-way pursuant to Section 373.1502, Florida Statutes. Issuance of a CERPRA permit will be required for all phases of this project prior to construction. For further information and assistance, please refer to the enclosed DEP memorandum and contact Ms. Katelyn Lynch at (850) 245-8350.

SOUTH FLORIDA WMD - SOUTH FLORIDA WATER MANAGEMENT DISTRICT

The SFWMD is a partner with the Corps in this project; consequently, a consistency determination is not necessary.

Memorandum

TO: Florida State Clearinghouse

THROUGH: Ernie Marks, Administrator
Restoration Planning and Permitting

FROM: Tim Gray, John Outland, Katelyn Lynch, Erin Steurer, Chad Kennedy

DATE: April 26, 2010

SUBJECT: Draft Integrated Project Implementation Report and Environmental Impact Statement, Biscayne Bay Coastal Wetlands Phase I Project – Miami-Dade County, Florida.

SAI #: FL10-5144C

BACKGROUND

The Biscayne Bay Coastal Wetlands project is a component of the Comprehensive Everglades Restoration Plan (CERP) which provides for the restoration, protection and preservation of the water resources of central and south Florida. The purpose of the Biscayne Bay Coastal Wetlands, Phase I project is to rehydrate coastal wetlands and reduce damaging point source freshwater discharges to Biscayne Bay.

The Biscayne Bay Coastal Wetland, Phase 1 project's primary purpose is to redirect freshwater, currently discharged directly to the Bay through man-made canals, to coastal wetlands adjacent to the Bay in order to restore a more natural water flow pattern to Biscayne Bay. By rehydrating coastal wetlands and reducing harmful point source freshwater discharge, the Tentatively Selected Plan (Alternative O, Phase 1) will help restore freshwater and saltwater wetlands, re-establish more natural salinity concentrations, and provide a more productive nearshore nursery habitat. The remaining features of Alternative O, which will be studied in a subsequent PIR, will greatly increase freshwater wetland benefits and further achieve restoration goals.

COMMENTS

Overall, the Department concurs with the PDT in that the project's design is consistent with attaining project goals and objectives. Operational flexibility will lead to increased

Florida State Clearinghouse
April 26, 2010
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benefits by further minimizing potential high flows to the estuary as well as other discharges and sediment loads.

The selected plan, Alternative O Phase 1 will provide ecosystem benefits by increasing the spatial extent of functioning fresh and saltwater wetlands, improving water quality, and provide more desirable salinity levels to near shore nursery areas of Biscayne Bay. The concerns for the project's long-term ecological benefits are the uncertainty of the lag time in ecological response time to hydrological changes, water availability, climate change and sea level rise. It is estimated that habitat improvement will occur over a ten year period following project operation. However, the extent of the improvement is subject to water availability, particularly in the dry season. For example, climate change which could reduce rainfall may result in a reduction of up to 10 percent of the project benefits. Similarly, in drought years, which occur on average once every ten years, could extend dry periods up to three months.

Nevertheless, even with some level of uncertainty for future project benefits it can be expected that the preferred alternative will improve the fresh and saltwater wetlands, water quality and the near shore waters of Biscayne Bay. The extent of the ecological benefits derived from project operation will be assessed by the monitoring plan and adjustments can be made to these features to improve performance. The economic importance of improving coastal wetlands and water quality in the project area is also noteworthy as they add value to the State's economy.

The Department is currently reviewing a CERPRA permit application for Cutler Flow-way pursuant to Section 373.1502, Florida Statutes (F.S.). Issuance of a CERPRA permit will be required for all phases of this project prior to construction. During the permitting process, please note that reasonable assurances must be provided to ensure that the project will meet relevant Department Statutory and Rule requirements including, but not limited to, State water quality standards.

The Draft PIR includes an initial version of the State Compliance Report. An earlier draft of the State compliance report was previously submitted for review and comment. At that time, the PIR was not available in order to determine whether sections or areas in the PIR that were referenced were adequate to meet the requirements under the Department's statutory authority. The Department will continue to review the Draft State Compliance Report and provide any additional comments to the District for incorporation into the final State Compliance Report prior to its submittal for review under Section 373.1501, F.S.

Florida State Clearinghouse
April 26, 2010
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The Department sincerely appreciates the opportunity to review and comment on the draft PIR. Should you have any questions on the comments provided, please feel free to contact Katelyn Lynch at (850) 245-8350.

Electronic copies to:
Greg Knecht
Stacey Feken
Inger Hansen
Tim Gray
John Outland
Katie Hallas
Annet Forkink
Erin Steurer
Chad Kennedy

Florida Department of Agriculture & Consumer Services
CHARLES H. BRONSON, Commissioner

DATE: April 27, 2010

TO: Lauren P. Milligan, Environmental Manager
Florida State Clearinghouse

FROM: W. Ray Scott, Conservation and Water Policy Federal Programs Coordinator
Office of Agricultural Water Policy

RE: State Clearinghouse Review Comments – (SAI # FL201003115144C)
Biscayne Bay Coastal Wetlands Phase 1 Draft Integrated Project Implementation Report and Environmental Impact Statement, March 2010, Central and Southern Florida Project Comprehensive Everglades Restoration Plan

The Florida Department of Agriculture and Consumer Services (FDACS) appreciates the opportunity to provide comments on the Biscayne Bay Coastal Wetlands Phase 1 Draft Integrated Project Implementation Report and Environmental Impact Statement dated March 2010. We are submitting the following comments for consideration as part of the Florida State Clearinghouse consistency evaluation.

The following comments are related to the private agricultural lands adjacent to the L-31E Flow Way project, the southernmost project area for the tentatively selected plan, Alt. O Phase 1. Three features in the L-31E Flow Way project area will impound water above currently existing levels: 1) the L-31E Northern Segment, 2) the L-31E Southern Segment and 3) the North Canal Impounded Wetlands.

Both federal and state laws require protection of certain water supply and flood control benefits in the implementation of CERP projects. Section 373.1501(5)(d), Florida Statutes, requires the South Florida Water Management District (SFWMD), in its role as the local sponsor, to provide reasonable assurances that existing Levels of Service for Flood Protection (LOSFP) will not be diminished by implementation of CERP projects.

The L-31E Flow Way Flood Protection Analysis did not include an analysis of potential impacts to the existing LOSFP within the subsurface root zone of adjacent crop lands. Maintaining the existing LOSFP within this zone is critical to avoid project induced flooding damages to the private agricultural lands in the project area. The flood analyses for the L-31E North and South Segments only addressed surface water elevations and the

Memorandum
April 27, 2010
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potential to overtop the L-31E levees on either side. The North Canal Impounded Wetlands flood analyses only considered whether water levels were either above or below ground.

In order to address the model uncertainty inherent in the project evaluation process and the lack of flood analysis in the root zone area, we would like to see project assurances to protect private agricultural lands from project related flood protection losses. There were similar concerns regarding implementation of the C-111 Spreader Canal Western Project and the approach taken there to provide assurances that flood protection would be maintained may also be necessary for the Biscayne Bay Coastal Wetlands Project.

Thank you for the opportunity to comment on the Biscayne Bay Coastal Wetlands Phase 1 Draft Integrated Project Implementation Report and Environmental Impact Statement, March 2010. More detailed staff comments regarding our review are enclosed. If you have questions regarding FDACS' comments, please contact Ray Scott at (850) 410-6714 or Rebecca Elliott at (561) 682-6040.

FDACS STAFF COMMENTS: Clearinghouse Comments
Department of the Army, Jacksonville District Corps of Engineers

Biscayne Bay Coastal Wetlands Phase 1 Draft Integrated Project Implementation Report and Environmental Impact Statement, March 2010
Central and Southern Florida Project Comprehensive Everglades Restoration Plan

Items (1) – (5) below provide additional comments by FDACS staff regarding excerpts from the Biscayne Bay Coastal Wetlands Phase 1 Draft Integrated Project Implementation Report and Environmental Impact Statement, March 2010. The following comments are related to the agricultural lands adjacent to the L-31E Flow Way project, the southernmost project area for the Tentatively Selected Plan selected, Alt. O Phase 1.

(1) Text implying a reduction in existing flood protection

The text underlined below indicates that existing levels of service for flood protection may be reduced through operational changes if it does not require a change in the operating rules, and implies that it is acceptable to no longer manage canal water levels to reduce flood damages due to storm events. If a modification to historic operating regimes is proposed that results in an increased flooding risk to adjacent lands, the project fails to maintain the existing level of service for flood protection as required by Section 373.1501(5)(d), Florida Statutes.

Main report: Section 3- Existing Conditions/Affected Environment
3.1.5.2 Flooding – Page 3-18

Water levels in canals in the study area are typically controlled at the lower end of the authorized range to provide additional storage within the canal and surficial aquifer in case of storm events. Therefore, project related changes in typical canal stages may not necessarily be considered a change in level of service of flood protection unless the authorized operating rules are changed.

(2) Outstanding design issue needing resolution

The outstanding design issues described below still needs to be resolved.

Main report: Section 7 – The **Tentatively Selected Plan**
7.7.3 Outstanding Design Issues – Page 7-21

Further detailed data collection is required for several existing culverts that were discovered late in the design process. These culverts are located on the western side of the L-31 E Borrow Canal, between C-102 and C-103. These culverts have the potential to affect the extent that the L-31 E Canal water levels can be raised. A recent site visit seemed to show that these culverts are no longer needed for drainage of lands to the west of L-31 E Canal, however

additional study is needed to assure the flood control for the area is not diminished and the full potential benefits of the proposed L-31 E Culverts are realized.

(3) The L-31E Flow Way project components do not include analyses for potential increases in root zone flooding for adjacent private agricultural lands.

We would like to see this oversight and the uncertainty inherent in model simulations addressed by a commitment to develop a real world strategy that will avoid any project-related flood protection losses to private agricultural lands. The C-111 Spreader Canal Western Project has already encountered similar issues and may help identify a strategy to address them.

3a) The L-31E Northern Segment and the L-31E Southern Segment flood analysis lacks any evaluation of groundwater levels in the root zone. There is a lack of seepage analyses and subsequent groundwater level interactions regarding the L-31E canal project components. The analyses in the Draft PIR/EIS only addresses surface water elevations and the potential that the L-31E levees will be overtopped on both the east and west side. Because the project will isolate sections of the L-31E and elevate the surface water elevations higher than what is possible under existing conditions, seepage impacting groundwater levels is also a concern.

Annex C - Analyses Required by Water Resources Development Act of 2000 and State Law
The L-31E Northern Segment (C-102 to Military Canal) and the L-31E Southern (Military Canal to C-103) on pages Annex C–11 through Annex C-15 & pages C-30 through C-33.

3b) The North Canal Impounded Wetlands flood analysis has a great degree of uncertainty given the crop damages a grower can experience due to root zone flooding. Only above ground or below ground elevations were considered. For the "best" scenario in wet years, this analysis shows an increase of above ground water levels for 20 more acres and an increase of water levels above ground from 99 days to 150 days.

Another source of information is the South Dade test impoundment north of the project's North Canal Impounded Wetlands. While useful to some degree, uncertainty is introduced due to the seepage variations inherent in the project area and that the test impoundment is much smaller than the project's North Canal Impounded Wetlands component.

Annex C - Analyses Required by Water Resources Development Act of 2000 and State Law
Pages Annex C-15 through C-25 & pages C-33 thru C- 44

The excerpt below is from Annex C - page Annex C-44:
"The results shown here should be used in a relative or comparative sense that is the basis of the Savings Clause analysis. Due to typical uncertainties in model input parameters such as topography, hydrogeology and rainfall, the area that would experience an increase in flooding based on model results is not definitive from an absolute perspective. The estimated area of impact is determined both

by the stages predicted by the model and the topographic data. ***FIGURE C-20*** *shows the standard deviation, within each MODBRANCH cell, of the light detection and ranging (LIDAR) data that were used as a source of topographic information. It is clear that the most accurate values have a standard deviation of +/- 0.25 feet, and some areas have variation of more than one foot. Therefore, one should use these simulated results on a comparative basis, and absent long term monitoring data for both the base and tentatively selected plan conditions, only represent simulated results that are limited by the uncertainties of the assumptions and data used in the model.*

The model simulations for the North Canal Impoundment suggest that under some conditions, maximum water stages within the wetland (i.e. 2.0 feet above land surface) may result in small increases of stages immediately outside the impoundment. The model results show that water stages adjacent to the impoundment respond to different configurations. It is likely that by designing an optimum configuration and managing water levels within the impoundment, significant and adverse offsite effects can be eliminated, if necessary."

4) "No modification to current seasonal operational criteria" operational constraint consistency.

The section in the DPOM describing constraints for the L-31E Flow Way canal segments is inconsistent between the north and south segments. For the North Segment, constraints that will be incorporated into the L-31E culverts operations include "No modification to current seasonal operational criteria". We would like to see this constraint also stated in section D.5.5 describing operational constraints for the South Segment.

Annex D – Draft Project Operating Manual
L-31 Features D.5.4 & D.5.5 – Pages Annex D-10 thru D-11

5) Operational text regarding water shortages

The last sentence underlined in the paragraph below appears to be unnecessary and confusing. We are unclear as to what is being recognized and how it would be implemented. If water shortage operations are to be addressed, then a simple statement saying "In the event of a water shortage declaration, the SFWMD Water Shortage Plan will be followed" would suffice.

Annex D – Draft Project Operating Manual – Section D.7.1- Page D-12
(And the sentence is repeated at the end of Section D.7.1.6 – page Annex D-17)

"The intent of the Biscayne Bay Coastal Wetlands project operations is to allow for meeting environmental demands without adversely impacting other water related needs. The initial operating regime is defined as reflecting the hydrologic regime in the south Florida ecosystem at the time a CERP project

Recommended Plan is selected. The Biscayne Bay Coastal Wetlands project will become an integral part of a water management system and, for Phase I, which includes the Deering Estate, and Cutler Wetlands (C-1 and C-100) Flow Way components. The operation of Phase I, water management features will be in accordance with the Central and Southern Florida Master Water Control Manual for East Coast Canals, Volume 5, and the SFWMD Operations Control Center Structure Book. Each individual element is expected to work in concert with one another. It is recognized that both environmental and existing legal uses may need to be met simultaneously in consideration of existing water shortage rules.

The water deliveries anticipated for the Biscayne Bay Coastal Wetlands project features are expected to become an important part of the water budget of this region. As a general operational strategy, project features for the Biscayne Bay Coastal Wetlands project are expected to redistribute water when water is available."

Florida Fish and Wildlife Conservation Commission

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Managing fish and wildlife resources for their long-term well-being and the benefit of people.

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April 23, 2010

Ms. Lauren Milligan
Florida State Clearinghouse
Department of Environmental Protection
3900 Commonwealth Boulevard, MS 47
Tallahassee, FL 32399-3000

Re: SAI #FL201003115144C, Miami-Dade Co., Biscayne Bay Coastal Wetlands Project Draft Integrated Project Implementation Report and Draft Environmental Impact Statement

Dear Ms. Milligan:

The Division of Habitat and Species Conservation (HSC) of the Florida Fish and Wildlife Conservation Commission (FWC) has coordinated an agency review of the Biscayne Bay Coastal Wetlands (BBCW) Project Draft Integrated Project Implementation Report (DPIR) and Draft Environmental Impact Statement (DEIS). The following comments and recommendations are being provided in accordance with the Coastal Zone Management Act/Florida Coastal Management Program and the National Environmental Policy Act.

We fundamentally agree with the U.S. Army Corps of Engineers (USACOE) regarding the selection of Alternate O Phase I; however, we want to emphasize several areas of concern that we believe require further consideration by the USACOE. Our understanding of this project is based primarily on the information found in the BBCW DPIR and DEIS.

Project Description

The BBCW project is planned and designed to rehydrate coastal wetlands and to reduce point-source freshwater discharges that have had detrimental effects to coastal wetlands and altered nearshore marine resources of Biscayne Bay. The tentatively selected plan, Alternative O Phase I, seeks to restore 400 acres of freshwater wetlands by reestablishing overland flows to the estuary and by mimicking the historic natural timing and quantity of water delivery. The restoration of freshwater flow over a large area is also expected to restore saltwater wetlands and nearshore bay habitats by returning salinities to their historic concentrations and stabilizing them. Components of Alternative O that are not a part of Phase I were not addressed in this report.

The tentatively selected plan includes three primary components: the Deering Estate, the Cutler Wetlands, and the L-31 East Flowway. These components combined have a project footprint of roughly 3,761 acres of land, and incorporate the plugging of 2,500 feet of mosquito control ditches, the construction of seven pump stations, the installation of approximately 10 culverts, and 3 miles of spreader canals.

1) *Deering Estate:* The C-100A spur canal would be extended 500 feet to deliver freshwater to a constructed freshwater wetland. Water would flow from there to the Cutler Drain and ultimately coastal wetlands along Biscayne Bay.

2) *Cutler Wetlands:* Features in this region include a pump station, a conveyance canal, a spreader canal, culverts, and mosquito control ditch plugs. The pump station, located on the C-1 canal, would deliver water to a 6,900-foot lined conveyance canal that would run under SW 97th Avenue (L-31 E Levee) and across the L-31E Canal via concrete box

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culverts and deliver water to the spreader canal located in the saltwater wetlands. This spreader canal is divided into four segments.

3) *L-31 East Flow Way:* Features in this region would isolate the L-31E Canal from the major discharge canals (C-102, Military Canal and C-103) and allow freshwater to flow through the L-31 E Levee to the saltwater wetlands. Gated culverts and inverted siphon structures would isolate L-31E canal from these other canals, thereby allowing L-31E to maintain higher water levels. Two pump stations and a series of culverts would move fresh water directly to the saltwater wetlands east of L-31E. Two more pump stations and a spreader canal would deliver water to the freshwater wetlands south of C-103.

The intentions of this project are to maximize net environmental and economic benefits on a system-wide basis. A total of 470 acres of freshwater wetlands will be rehydrated resulting in natural management of about 500 acres of exotic vegetation. The project should stabilize and improve estuarine and nearshore nursery habitat by returning salinity levels to a more natural state. By diverting approximately 40 percent of the available canal freshwater discharge into wetlands, it is anticipated that approximately 3,450 acres of saltwater wetlands would maintain stable salinities under 20 parts per thousand (ppt) as opposed to the current 1,870 acres under 20 ppt. Additionally, 30% (approximately 482 acres) of nearshore areas of Biscayne Bay (within 500 meters of shore) would meet the desired salinity target of less than 20 ppt. It is anticipated that the plan would reduce future nitrate loads into Biscayne Bay by 163 thousand tons, which is approximately 50 percent of the future predicted nitrate load. It would reduce phosphorous loading by 50% as well. Alternative O Phase I is projected to double the spatial extent of the functional habitat relative to that expected to exist in the future without-project modified conditions.

Monitoring and Adaptive Management:

It is indicated that the operations of Alternative O Phase I will be guided by adaptive management. The goal of applying adaptive management for the Biscayne Bay Coastal Wetlands is to generate information that will address key questions about how the project will achieve its restoration goals and objectives, assess ecological response, and provide feedback and options to adjust management actions, as necessary, to ensure restoration goals are likely to be achieved. The key to applying adaptive management techniques is in closely monitoring the ecosystem and its response to management actions to allow changes to be applied as necessary. However, the DPIR and DEIS indicate that funding for ecological monitoring is currently only planned for 5 years (Section 7.2).

Potentially Affected Fish and Wildlife Resources

Pages 3-40 and 3-41 of the DPIR/DEIS provide a list of both the federally and state-listed species that would potentially be affected by the BBCW project. The following are the species and resources that our staff has determined to be those that are most likely to be affected.

Nearshore Hardbottoms and Associated Benthic Organisms:

Nearshore hardbottoms, which occur in the project footprint (DPIR and DEIS Section 3.8.1.6), play a vital role in nearshore ecosystems and serve important functions in the life cycles of fishes; sea turtles; lobsters; and various species of corals, algae, and sponges (Holloway-Adkins 2001, Lindeman et al 2000, Lindeman and Snyder 1999). Additionally, the project area falls within the federally designated critical habitat for federally threatened *Acropora* spp. (http://www.nmfs.noaa.gov/pr).

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We note that there is some conflation of seagrass and hardbottom habitats in the discussion in section 3.1.7.1. The seagrass and hardbottom communities are typically distinct and separate, although some mixing can occur. In the hardbottom community of Biscayne Bay, soft corals are very common and diverse, more common than are hard corals. Also, as a nursery habitat, while shrimp make extensive use of seagrass beds, the Florida spiny lobster (lobster) (*Panulirus argus*) uses structurally complex algae for settling and early life history foraging and sheltering habitat (Butler and Herrnkind 1992). Nursery habitat for later juvenile stages of lobster is predominately the hardbottom community (sponges, crevices, hard corals, and soft coral complexes) (Moe 1991, Smith and Herrnkind 1992). Adult lobsters use seagrass habitat for foraging, but generally not for sheltering. Additionally, FWC biologists have not documented juvenile lobster utilizing mangrove prop roots. Foraging habitat is more likely to be rubble zones and open hardbottom. Most adults will eventually leave Biscayne Bay for coral reef habitat toward the ocean as they mature to reproductive size (Herrnkind 1980).

The importance of nearshore habitats as nursery habitat for the economically important fish and lobster was not addressed in the DPIR and DEIS. The effects of the anticipated changes in salinity regimes are not clearly identified nor is monitoring or adaptive management proposed for this habitat type.

West Indian (Florida) Manatee:

Manatees (*Trichechus manatus latirostris*) have been documented using freshwater canal systems throughout south Florida including the canals adjacent to Biscayne Bay. Manatees regularly access the C-100, C-1, C-102, Military Canal, C-103 and the L-31E canals to reach important resources including freshwater, forage, warmer water during the winter months, and quiet waterways with limited vessel traffic. The FWC recognized manatee use of these areas and created slow and idle speed zones adjacent to and within these canals pursuant to 68C-22.025, Florida Administrative Code. Although these canals provide habitat that is often used by manatees, manatee use of these canal systems does not come without risk. Water-control structures operated by the South Florida Water Management District (SFWMD) for flood and salinity control purposes have been constructed on each of the five canals that are located within the project area. Manatee deaths due to crushing or drowning resulting from manatees being caught by the closure of the water-control structure's gates have been documented at most of these structures. Since 1974 a total of 19 manatee deaths have occurred as a result of the operation of the water-control structures within the project site (Table 1). Structure-related manatee deaths have long been identified as the second leading cause of human-related manatee mortality. Ongoing efforts since 1991 between the USACOE, SFWMD, FWC, and U.S. Fish and Wildlife Service (USFWS) have led to the retrofitting of water-control structures with manatee-protection devices, and the revision of their operational protocols. The retrofitting efforts have resulted in a significant reduction in structure-caused manatee deaths at retrofitted structures, including no manatee-related structure deaths within the project area since 2004. The construction of new water control structures and culverts may present new risks to manatees within the project site and farther information will be required to determine any additional threats and potential techniques for the minimization of any new risks (FWC 2007).

Table 1. Manatee Deaths at Water-Control Structures

Canal	Structure	# of Manatee Deaths	Year of Last Death
C-100	S-123	0	N/A
C-1	S-21	5	2002
C-102	S-21A	3	2003

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Military	S-20G	2	2002
C-103	S-20G	9	2004
Total		19	

Eastern Indigo Snake:

FWC biologists are aware of observations of eastern indigo snakes (*Drymarchon corais couperi*) along canals within the project area (FWC 2010). Construction activities can injure or kill individuals of this species, which is federally and state-listed as threatened.

Comments and Recommendations

Monitoring and Adaptive Management:

Given the uncertainties affiliated with an unprecedented project of this magnitude, thorough monitoring and effective adaptive management are critical. In order to ensure efficient adaptive management throughout the life of the project, we recommend that the monitoring program be extended beyond five years. Ultimately, monitoring should at least continue until the project has fully reached equilibrium and all ecological targets have been achieved.

Nearshore Hardbottoms and Associated Benthic Organisms:

Nearshore hardbottom communities serve vital roles in the life cycles of lobsters and fish and the current extent and characterization of this habitat type are not well described in the DPIR/DEIS. We recommend that the final PIR/EIS include a thorough description of existing communities and an assessment of predicted impacts to these communities. Additionally, we recommend that if there are significant hardbottom communities within the project area of influence, they be added to the monitoring plan and be considered in the adaptive management plan.

West Indian (Florida) Manatee:

The proposed construction of this project also has potential detrimental effects on manatees beyond the loss of existing habitat through the isolation of approximately 3.5 miles of the L-31E canal between proposed structures S-703 and S-709. The construction of six pump stations, multiple culverts, two inverted siphons, and a canal extension at the C-100A could also result in direct impacts to manatees during the construction phase and potentially through the operation of the new structures. Additionally, if explosives are required to accomplish the proposed construction, this action could result in direct impacts to manatees.

We recommend that adverse impacts to manatees during construction due to construction activities be minimized by using the 2009 FWC Manatee Construction Conditions (enclosed) and the 2006 Guidelines for Manatee Conservation during CERP Implementation. It is currently unclear, however, which structures proposed for construction will be accessible to manatees and if these structures would pose any threat. It is also not clear to what degree water levels in the existing canals will be modified through the pumping of water from them into the L-31E canal. Significant changes in water levels may result in entrapments or strandings of manatees within the canals.

To complete our assessment of the proposed project and determine if additional manatee conservation measures are warranted, the following additional information is required for permitting purposes. We also recommend that they be addressed, at least at the conceptual level, in the final PIR/EIS.

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1) What measures will be used to prevent manatee access to the spreader canal in the C-100 extension?
2) Please provide diagrams of the proposed pump stations S-700, S-701, S-703, S-709, S-710, and S-711 and a description of how manatee entrapment or impingement will be prevented.
3) Please provide diagrams and operational information on the siphon pumps proposed at S-707 and the Riser Culvert at S-705 and any manatee protection measures that may be planned to be implemented at these structures.
4) Please provide diagrams of the proposed box culvert C-702 that will be used on the L-31E canal and any manatee protection measures that may be planned to be implemented at this structure.
5) How will the water levels in the C-100, C-102, Military Canal and the C-103 be affected by the removal of water from these canals?
6) If the project is implemented, what is the expected change in the frequency of the opening/closing of the gates on the salinity control structures on the C-100, C-102, C-103, and military canals?
7) If blasting is required during construction, the applicant is required to follow the Guidelines for the Protection of Marine Animals during the Use of Explosives in the Waters of the State of Florida, which may be found in the 2006 Guidelines for Manatee Conservation during CERP Implementation.
8) Closure of the L-31E canal between S-703 and S-709 could result in the entrapment of manatees within this area. The Guidelines to Minimize/Avoid Manatee Entrapment found in the Guidelines for Manatee Conservation during CERP Implementation document will be required to minimize the risk of manatee entrapment if this project is implemented.

Eastern Indigo Snake:

Due to the potential to injure or kill eastern indigo snakes during construction, please ensure that contractors are aware of the potential presence of eastern indigo snakes, have information available to identify them, and that plans are in place to cease all activities in the event that a snake is observed until it has cleared the area.

Summary

Based on the information provided, we do not find the DPIR/DEIS for the BBCW project to be inconsistent with Chapter 379, Florida Statutes, as cited under the Florida Coastal Management Program. After a review of the information available regarding this project, it appears that the potential cumulative adverse impacts to fish and wildlife resources, including seagrasses, manatees, marine turtles and hardbottom communities, are likely to be nominal as compared to the benefits that would be created; however, further information is required to complete our assessment.

If you have questions regarding our review of this project, Erin McDevitt is the point of contact for the coordination of these comments and can be contacted at (561) 625-5122.

Sincerely,

Mary Ann Poole

Mary Ann Poole
Commenting Program Administrator

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Biscayne Bay Coastal Wetlands Project_2706_042310
Enclosure

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STANDARD MANATEE CONDITIONS FOR IN-WATER WORK
2009

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

a. All personnel associated with the project shall be instructed about the presence of manatees and manatee speed zones, and the need to avoid collisions with and injury to manatees. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act, the Endangered Species Act, and the Florida Manatee Sanctuary Act.

b. All vessels associated with the construction project shall operate at "Idle Speed/No Wake" at all times while in the immediate area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

c. Siltation or turbidity barriers shall be made of material in which manatees cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee entanglement or entrapment. Barriers must not impede manatee movement.

d. All on-site project personnel are responsible for observing water-related activities for the presence of manatee(s). All in-water operations, including vessels, must be shutdown if a manatee(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving.

e. Any collision with or injury to a manatee shall be reported immediately to the FWC Hotline at 1-888-404-FWCC. Collision and/or injury should also be reported to the U.S. Fish and Wildlife Service in Jacksonville (1-904-731-3336) for north Florida or Vero Beach (1-772-562-3909) for south Florida.

f. Temporary signs concerning manatees shall be posted prior to and during all in-water project activities. All signs are to be removed by the permittee upon completion of the project. Awareness signs that have already been approved for this use by the Florida Fish and Wildlife Conservation Commission (FWC) must be used (see MyFWC.com). One sign which reads *Caution: Boaters* must be posted. A second sign measuring at least 81/2" by 11" explaining the requirements for "Idle Speed/No Wake" and the shut down of in-water operations must be posted in a location prominently visible to all personnel engaged in water-related activities.

CAUTION: MANATEE HABITAT

All project vessels

IDLE SPEED / NO WAKE

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

SHUT DOWN

Report any collision with or injury to a manatee:

Wildlife Alert:

1-888-404-FWCC(3922)

cell *FWC or #FWC

B.5.8 Biscayne National Park and Everglades National Park – April 2010

United States Department of the Interior
National Park Service

Biscayne National Park
9700 SW 328 Street
Homestead, FL 33033

Everglades National Park
40001 State Road 9336
Homestead, FL 33034

N-16

Brad Tarr
United States Army Corps of Engineers
Environmental Branch, Planning Division
P.O. Box 4970
Jacksonville, Florida 32232-0019

April 20, 2010

***Review and Comments* on:**
Draft Integrated Project Implementation Report and Environmental Impact Statement for the Biscayne Bay Coastal Wetlands Phase 1 Project

We would like to thank the U.S. Army Corps of Engineers (USACE) and the South Florida Water Management District (SFWMD) for working closely with the National Park Service (NPS) in the planning process for the Biscayne Bay Coastal Wetlands Project via the Project Delivery Team (PDT). The following document provides comments from the NPS on the March, 2010 Draft Integrated Project Implementation Report and Environmental Impact Statement (Draft PIR/EIS) for the Biscayne Bay Coastal Wetlands (BBCW) Phase 1 Project. While it is beyond the scope of this letter to comment on each project feature that has been considered during the multi-year project development process, we would like to comment on several key features that we consider necessary for the success of the project.

As stated in the Biscayne Bay Coastal Wetlands Project Management Plan (2002) "The goal of the Biscayne Bay Coastal Wetlands Project is to restore or enhance freshwater wetlands, tidal wetlands, and nearshore bay habitat." (ACOE & SFWMD, 2002). The means to achieve this goal are as follows:

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to re-establish productive shoreline nursery habitat; rehydrate the coastal wetlands; restore ecologically viable marine habitat with nearshore region salinity below 20 ppt; eliminate potentially damaging point-source discharges of freshwater within the project region with redistribution of freshwater; preserve and restore the spatial extent of natural coastal glades habitat; re-establish connectivity between Biscayne Bay, the BBCW, the Model Lands Basin, and the C-111 project; and provide the infrastructure to allow for better control of water delivery and maintenance of higher stages in coastal canals. The Project footprint extends from the Miami-Dade County Deering Estate properties in the north, through the Cutler Ridge and L-31E flow-way properties down to the Model Lands region in the south. After evaluation of alternatives and subsequent selection of the preferred alternative O, the project was divided into two phases, primarily to allow portions of the project that were not dependent upon other projects (such as C-111 spreader canal or Wastewater Re-Use) to move forward in an expedited manner. Phase 1 of the Tentatively Selected Plan (TSP), Alt. O, has features in all but the southernmost Model Lands portion of the overall project footprint.

The Draft PIR/EIS describes features specific to Alt. O Phase 1 and provides a cost to benefit ratio analysis. We agree with the selection of this alternative and the Next-Added Increment analysis that states the benefits of this project alone will, for the most part, be realized without the completion of any other projects in this region. However, it is clear that the coastal wetlands will benefit from additional aspects of CERP that increase available freshwater in the southern part of the Miami-Dade County conveyance system. It is important that the remainder of Alternative O, Phase II, and other CERP projects in the area be completed in an expedited fashion to achieve maximum benefit in the early years of the project implementation.

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It is also important to identify additional freshwater sources for the BBCW Project in order to achieve the desired goals of this project, especially reducing exceedingly high nearshore salinity and maintaining stable salinity through the dry season. Delay in the completion of project features, specifically those that bring additional freshwater to the region, provides opportunity for sea level rise related saltwater intrusion to cause ecological damage to the coastal region.

Comments for Specific Project Features

Deering Estate Region

The Deering Estate region is in the northern end of the project footprint, encompassing properties at the coastal terminus of the C-1 near existing structure S-123. Project features in the Deering Estate region include a canal extension to the C-100A spur canal, establishing a freshwater wetland, and a pump with conveyance to transfer freshwater past Old Cutler Road into the coastal wetland region. The features in this region are important to provide sufficient hydraulic retention time that will allow treatment of freshwater in the wetland, improving water quality before being discharged into the coastal saltwater marsh and nearshore bay zone. Benefits from this aspect of the project require monitoring for changes in wetland stage, monitoring for salinity changes in the near-shore environment, monitoring water quality impacts due to surface and subsurface migration of urban contaminants into natural areas, and monitoring wetland effluent water quality prior to transiting into the Bay.

The NPS recommends the placement of one additional monitoring station in the nearshore region north of S-123 to provide a direct measure of changes in salinity as a measure of the effectiveness of this portion of the project. Also, changes in stage will be detected in the saltwater marsh region upstream from the existing weir by having a technician read the stage using an existing staff gage. This is

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scheduled for monthly readings; however, we suggest adding additional readings when water is flowing in order to capture changes associated with pump operation events and avoid missing critical data during times when stage in this region fluctuates.

Cutler Properties Region

The Cutler Properties region is in the center of the project, located in the C-1 basin near existing structure S-21. New features in this region include a lined spillway, C-701, to transfer water from a new pump station S-701 to spreader canal C-702 in order to move water, when available, from the C-1 into the coastal wetlands and eliminate, as much as possible, point source outflow from S-21. Benefits from this aspect of the project include improved habitat in the coastal wetlands region, reduction of seepage from the new flow-way back to the C-1 canal, and sufficient hydraulic retention time within the wetlands that will provide treatment and improve water quality as it migrates to the nearshore region.

The monitoring program for the Cutler Properties appears to be inadequate to determine the extent of freshwater flow along the spreader canal toward the north. However, even with the addition of plugs in the historic mosquito ditches, water could potentially seep from the canal close to the junction with C-701 and flow directly to the coast without rehydrating the northern wetland regions of this property. It is possible that increasing stage will alleviate or improve this by-pass effect; however, the stage necessary to achieve hydration throughout this area and to the north would be unknown without improvements in the monitoring program. Additional telemetric surface level monitoring appears to be necessary to assist in the operation and adaptive management of these pump structures. We recommend an additional recorder be placed near the northern end of the C-702 spreader canal on the eastern side of the canal to provide real time data feedback into operations management to maintain

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flow until stage increases are observed in this region. Additionally, monitoring of staff gage BBCW PL_2 should take place whenever S-701 is flowing in order to avoid missing critical data during times when stage in the region fluctuates.

L-31E Flow-way Region

The L-31E Flow-way region is the southernmost section to the Alt. O Phase 1 project footprint, located along the L-31E primarily from C-102 to C-103, and includes the saltwater coastal wetlands between the canal and the coast. Features in this region include an impoundment area to allow flexibility in operations while meeting flood control guidelines for the canal, five new pump stations to move water into the L-31E from C-102 (pumps S-703, S-705, and S-709), and two pump stations (pumps S-710 and S-711) to move water south from C-103 into these saltwater wetlands regions. Additionally, gated culverts and inverted siphons are included in L-31E to allow stage to be held higher than the surrounding region. This action provides passive multipoint connections between the L-31E canal and the saline coastal wetlands, and reduces or eliminates surface saltwater intrusion back to the canal during extreme events. Benefits from this portion of the project include improved habitat in the coastal wetlands, reconnection of the freshwater wetlands with the saline wetlands, improved habitat in the nearshore Bay regions, and reduction of direct point source discharge from S-20F and S-21A.

Monitoring aspects of the L-31 Flow-way section appear adequate for the task of providing data on changes in the environment to be used in the adaptive management of the related structures, with one exception. The project staff gages should be monitored when flowing, in addition to the planned monthly data collection interval, to assure that changes related to structure operations are detected.

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Monitoring and Assessment

Since the Draft PIR/EIS has been released, the USACE independent scientific external review committee comments have been received by the ACOE. Shortcomings of the project monitoring program that specifically tie the changes in physical parameters (flow and stage) into project benefits (ecological improvements) were noted and shared with the PDT. In response, additional PDT meetings were called and the ecological monitoring subteam was re-engaged. The result of these meetings was a set of suggested changes to the project monitoring plan designed to specifically address the monitoring issues. These changes include:

- Addition of a monitoring station just north of S-123 in the shallow mangrove coastal zone, preferably within 150 m of shore, to fill a gap in coverage and provide a direct measure of changes in salinity and water quality within the 'Deering Estate' region of the project.
- Addition of a monitoring station just north of S-21 in the shallow mangrove coastal zone, preferably within 150 m of shore, to fill a gap in coverage and provide a direct measure of changes in salinity and water quality within the 'Cutler Ridge' region of the project.
- Repositioning of the monitoring location on L-31E from the east-west section of the canal near S-21 to a location along the north-south trending section of the same canal just north of C-102, downstream of the Old South Dade Landfill, in order to capture information on seepage and contaminant migration from the landfill.
- Changes in the sample frequency from "monthly" to "bi-weekly when flowing" for the stations in the C-103 upstream of S-20F, collocated with the new pump stations S-710 and S-711, in order to match the sampling frequency in other portions of the project and to provide flexibility in the sample regime to match conditions at the sample sites.

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Each of these changes is critical in addressing both shortcomings in the Draft PIR/EIS as published, to meet the monitoring needs for the project, and to provide data for adaptive management. It is our understanding that the monitoring program funding limitations, originally set at 1% of total project cost, have been relaxed to allow for additional monitoring efforts as required to meet the external review requirements. The project benefits cannot be quantified without these monitoring aspects nor can the project features be properly managed through the adaptive management plan without this information. Continued support for the monitoring effort as detailed here and in updated comments from the PDT is important and appreciated.

Interaction with other projects and activities in the region:

Competing freshwater interests in the region

The NPS notes that regional canal water level management for the agricultural community may run contrary to the project needs. For project benefits to be realized, the BBCW Phase 1 implementation requires the freedom to manage water levels for the benefit of the natural environment. The draft PIR/EIS acknowledges that the project intent is to partially compensate for loss of groundwater flow by "…redistributing freshwater flow across a broad front…"

As evidence of the hydraulic connectivity between surface and ground water in the region, it has been noted that current operations in the C-102 and C-103 to lower stage by 0.8' on Oct. 15th each year cause reductions in surface water in a region larger than the intended basin. None of the design features in the L-31E Flow-way region of the project change the permeability of the underlying soil layer. Therefore, it is expected that continued reduction of the stage in C-102 and C-103 to meet agricultural purposes, even with pumping into the L-31E as the mechanism, will cause a regional reduction in stage and continue to force a discharge of water at the end of the wet season. An alternate discharge pattern

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that maximizes benefit in the coastal habitat by mimicking the quantity and timing of natural freshwater discharge would be preferred. We have been participating in the SFWMD review process to determine how best to meet the conflicting water management needs in the region. The uncertainty with respect to the future canal operations in this region adds uncertainty to the project's expected benefits. The USACE's participation in this process will help ensure maximum benefit for the BBCW project.

Availability of Water

The NPS strongly urges the USACE and partner agencies to unequivocally commit to protecting the full amount of freshwater defined in this document as the "Total Available Canal Flow". Protecting only the "Total Diverted Canal Flow", as described in Annex C Figure C-22 of the Draft PIR will not protect the total amount of freshwater needed to meet the salinity targets of this project. Inadequate availability of freshwater in the future, due to lack of protection, would likely lead to the failure to achieve project goals. The target salinity for restoration of the Bay cannot be met without the "Total Available Canal Flow", and reserving only a portion of the available current surface water flow could exacerbate hypersaline events. Furthermore, the modeled restoration salinity targets and resulting benefits were based on an assumption of increased surface water flow; therefore, reserving only the "Total Diverted Canal Flow" is incompatible with the BBCW restoration objective.

The NPS supports the BBCW PDT findings that all of the current surface water flow to the Bay through the major conveyance canals is necessary to maintain current productivity levels and healthy function of the system. The BBCW PDT also determined that more water than is currently flowing into the Bay through the major conveyance canals is needed for restoration of the Bay to more historical

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conditions. Any reduction in the current flow would make the restoration of the Bay to more historical conditions unachievable and jeopardize the health of the ecosystem. The NPS believes it is essential to protect the full amount of freshwater flowing into Biscayne Bay from both consumptive use allocation and from diversion by other CERP projects, as well as to identify and deliver additional sources of water in Phase 2 of the project.

Area of Restoration and Amount of Freshwater Necessary

Annex C of the Draft PIR states that 517,000 acre-feet of freshwater are needed to provide ecosystem restoration in BBCW. This is based on the assumption that the wetland communities and only the area of benthic organisms out to 500 meters (during the wet season) and out to 250 meters (during the dry season) are dependent on fresh water flows for health and sustainability. The NPS believes this is a limited view of ecological health for western Biscayne Bay. Because benthic communities are dependent on specific benthic conditions and stable salinity regimes, the NPS believes that extrapolating from existing conditions provides a more accurate target area for restoration. Benthic mapping and the evaluation of abundance and distribution of benthic community types suggest that the nearshore portion of the bay dependent on freshwater flow is approximately twice as large as that identified in the Draft PIR. The two documents prepared by the NPS, *Ecological Targets for Western Biscayne National Park (April 2006)* and *Estimates of Flows to Meet Salinity Targets for Western Biscayne National Park (June 2008)* further describe the rational used by the NPS in making these determinations. The NPS encourages the USACE and its partner agencies to reassess the area of ecological restoration during Phase 2 of this project.

Phase 2, BBCW

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The NPS strongly encourages the USACE and its partner agencies to initiate the remainder of the BBCW project as soon as possible to take advantage of reduced land costs at this time, and to ensure that restoration options are not eliminated, as well as to provide early restoration benefits to this highly impacted natural system. Early restoration of the BBCW will help ameliorate saltwater intrusion impacts to both the natural and built systems, especially considering projected sea level rise, by increasing water stage in some areas and by more efficiently utilizing existing freshwater along the coastal wetlands. As an important part of this planning process, the NPS encourages the USACE and SFWMD to seek ways to move additional freshwater to the BBCW footprint from the regional system, as well as examine ways to more efficiently use the fresh water currently in the BBCW footprint.

Thank you for the opportunity to comment on the Draft PIR of BBCW Phase 1, and to provide the concerns of one of the significant benefiting stewardship agencies for this project. If you need further clarification, please feel free to contact the Superintendent, Biscayne National Park.

Sincerely,

Mark Lewis, Superintendent
Biscayne National Park

Dan B. Kimball, Superintendent
Everglades National Park

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B.5.9 United States Department of the Interior – May 2010

United States Department of the Interior
OFFICE OF THE SECRETARY
Washington, DC 20240

TAKE PRIDE IN AMERICA

MAY 03 2010

Colonel Alfred Pantano
Commander
United States Army Corps of Engineers
Jacksonville District
P.O. Box 4970
Jacksonville, FL 32232-0019

Dear Colonel Pantano:

Thank you for the opportunity to review and provide comments on the *Central and Southern Florida Project Comprehensive Everglades Restoration Plan Biscayne Bay Coastal Wetlands Phase 1 Draft Integrated Project Implementation Report and Environmental Impact Statement* (DPIR/EIS), dated March 2010. The Biscayne Bay Coastal Wetlands Project, the only Comprehensive Everglades Restoration Plan (CERP) Project to benefit Biscayne Bay and Biscayne National Park, is a high priority for the Department of the Interior (Department). The National Parks Conservation Association has recently listed Biscayne National Park, an Outstanding Florida Water, as one of the five most endangered parks in the United States. The Department appreciates the efforts of the United States Army Corps of Engineers (USACE) and the South Florida Water Management District (SFWMD) in moving forward with Phase 1 of this project. The Department further urges the USACE and the SFWMD to expedite Phase 2 of this project and other CERP projects in the area in order to achieve maximum benefits.

The primary purpose of the BBCW Project is to redirect freshwater, currently discharged directly to the Bay through man-made canals, to coastal wetlands adjacent to the Bay in order to restore a more natural water flow pattern to Biscayne Bay. The proposed redistribution of freshwater flow across a wide area is expected to restore or enhance freshwater wetlands, tidal wetlands, and near-shore Bay habitat. The project is expected to create conditions that will be conducive to the reestablishment of oysters and other components of the oyster reef community, reestablish productive nursery habitat, and reduce abrupt freshwater discharges that are physiologically stressful to fish and benthic invertebrates in the Bay near canal outlets.

The Department supports the Tentatively Selected Plan (TSP) for Phase 1 of Alternative O as a first step toward meeting restoration goals in the project study area. Alternative O, Phase 1, includes a footprint of roughly 3,761 acres of land, seven pump stations, approximately 10 culverts reconnecting wetlands, approximately 3 miles of spreader canals, and plugging 2,500 feet of mosquito control ditches. Phase 1 has been divided into three sub-components: Deering Estate, Cutler Wetlands, and L-31 East Flow Way. Specific recommendations for project features of these sub-components involve monitoring. Monitoring for this project is important to assist in developing operations, analyzing the effectiveness of the project, and assisting in adaptive management. As to the Deering Estate sub-component, the addition of an additional monitoring station in the nearshore region north of S-123 is recommended to provide a direct measure of changes in salinity. As to the Cutler Properties sub-component, the addition of an additional recorder near the northern end of the C-702 spreader canal is recommended to assist in the operation and adaptive management of the C-701 pump station. Also, in addition to monthly readings, taking

Colonel Alfred Pantano
Page 2

additional readings when water is flowing is suggested. Additional suggested changes to the monitoring plan from the USACE independent scientific review committee should be incorporated in the DPIR/EIS. The Department believes that both the water made available to the natural system by the BBCW Project and the existing freshwater currently flowing to Biscayne Bay are necessary to maintain project benefits and must be protected from consumptive use through the State of Florida's reservation or allocation authority as required by the Water Resources Development Act of 2000. The Department believes that revisions to the Identification of Water to be Reserved or Allocated for the Natural System and Project Assurances sections of the DPIR/EIS are necessary to incorporate protection for the existing water as well as the water made available by the project and has begun discussions with the USACE and the SFWMD regarding needed revisions.

The remaining features of Alternative O, which will be studied in a subsequent Project Implementation Report (PIR) for Phase 2, will greatly increase freshwater wetland benefits and further achieve restoration goals. The DPIR/EIS states that the timetable for achieving the subsequent PIR is currently an unresolved issue. Key to restoring the health of Biscayne Bay is not only to protect the freshwater presently flowing into the Bay from consumptive use allocation, but also to identify and deliver additional sources of water to the Bay in Phase 2 in order to achieve the desired goals of the BBCW Project, especially the goals to reduce the exceedingly high near shore salinity and to maintain stable salinity through the dry season.

Although the SFWMD has begun the Miami-Dade Canal Agricultural Drawdown Study, the present practice of the SFWMD to lower water levels in South Miami-Dade County at the start of the dry season to benefit agriculture remains a concern for the Department. It has been suggested that the drawdown be eliminated as part of the Phase 2 PIR. It is expected that continued reduction of the stage in C-102 and C-103 to meet agricultural purpose, even with pumping into the L-31, will continue to cause a regional reduction in stage and continue to force a discharge of water at the end of the wet season. An alternate discharge pattern that maximizes benefit in the coastal habitat by mimicking the quantity and timing of natural freshwater discharge is preferred and should be analyzed in the Phase 2 PIR.

The DPIR/EIS states that 517,000 acre-feet of freshwater are needed to provide ecosystem restoration in BBCW. This is based on the assumption that the wetland communities and the area of benthic invertebrates out to 500 meters (during the wet season) and out to 250 meters (during the dry season) are dependent on freshwater flows for health and sustainability. The Department believes that the nearshore portion of the Bay dependent on freshwater flow is potentially larger than that identified in the DPIR/EIS and urges the USACE to reassess the area of ecological restoration during the Phase 2 of this project if it is not done earlier. The National Park Service's supporting rationale is contained in two documents prepared by the South Florida Natural Resources Center: *Ecological Targets for Western Biscayne National Park* (April 2006) and *Estimates of Flows to Meet Salinity Targets for Western Biscayne National Park* (June 2008).

Separate comments from the National Park Service and specific technical comments regarding operations are attached. Although the United States Fish and Wildlife Service (Service) has not provided separate comments on the DPIR/EIS, the Service has issued a draft Fish and Wildlife Coordination Act (FWCA) Report on July 9, 2008, and will be issuing a final FWCA Report in the near future. The Service has also completed informal consultation under Section 7 of the Endangered Species Act, dated November 18, 2009, for Phase 1.

Colonel Alfred Pantano
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We look forward to working with your staff as this draft is improved and the Final PIR/EIS is developed. The Department appreciates the hard work of the Jacksonville District in implementing Everglades restoration programs. If you would like to discuss this specific project or these comments, please do not hesitate to contact me at 202-208-6273.

Sincerely,

Donald Jodrey
Attorney – Advisor

Enclosure

B.5.10 Non-Governmental Organizations – May 2010

AUDUBON OF FLORIDA
EVERGLADES FOUNDATION
NATIONAL PARKS CONSERVATION ASSOCIATION
NATURAL RESOURCES DEFENSE COUNCIL
TROPICAL AUDUBON SOCIETY

May 2, 2010

Mr. Brad Tarr
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

<*Submitted via email to* BBCWDPIRComments@evergladesplan.org>

Re: Biscayne Bay Coastal Wetlands Draft Integrated Project Implementation Report and Environmental Impact Statement

Dear Mr. Tarr:

We have long looked forward to on-the-ground progress on the Biscayne Bay Coastal Wetlands (BBCW) project and we appreciate that this project is moving forward and will be one of the first Everglades restoration projects implemented. As a result of significantly reduced freshwater inflows, Biscayne Bay has become a seasonally salty lagoon, often experiencing bouts of hypersalinity that have changed the habitat characteristics of the Bay and reduced its productivity. Biscayne National Park and Biscayne Bay Aquatic Preserve were established because of their unique resources but their quality of habitat has been significantly diminished by the altered quantity, timing and delivery method of freshwater inflows to the Bay. Therefore, we fully support the rapid implementation of this project, as it will begin to reverse damage caused by water delivered only as a point source release through canals, by re-hydrating coastal wetlands and distributing available freshwater more naturally to the benefit of both the National Park and the Aquatic Preserve. However, we also recognize it is only a first step toward the restoration of Biscayne Bay. This project in itself does not provide an adequate amount of freshwater to the Bay and additional sources of freshwater must be identified and delivered to achieve the level of restoration originally envisioned by the Comprehensive Everglades Restoration Plan (CERP). The following outlines our comments on the Draft Project Implementation Report and Environmental Impact Statement (DPIR), noting some sections where revision and/or further explanation is needed. Our ultimate objective is for this project to be ready for inclusion in the next Water Resources Development Act (WRDA).

First, we suggest a change in the way the DPIR describes the relationship between "expedited construction projects" and CERP. Instead of saying, as it does on page 1-11, "All state expedited construction projects must be specifically authorized by Congress before becoming a part of the Federal CERP. . .", we believe it would be more accurate to say that state expedited projects

must be specifically authorized by Congress (or approved by Congressional committees, in certain instances) before being *eligible for funding* as CERP projects.

Availability of Water

The DPIR appears to identify, as the WRDA of 2000 (WRDA 2000) requires, the *quantity* of water the project will make available for the natural system.[1] It does so by identifying the total amount of water that would be diverted from all the canals addressed by the project. DPIR at 8-6, Annex C-46-48 (according to modeling, the total water diverted would range from 113,619 acre-feet per year at the 10th percentile to 282,982 acre-feet per year at the 90th percentile). It is less clear whether it adequately identifies the *timing* or *distribution* of water made available by the project, in that it does not appear to identify precisely when water would be diverted (it does distinguish between a dry year – the 10 percentile year – and a wet year – the 90 percentile year. But it does not specify when during the year water will be diverted, *i.e.*, wet season or dry season) or the areas to which the water would be diverted in a manner that would allow for the protection (under State law) of that "new" water (either in terms of what amount of water particular canals would have diverted, or in terms of the particular wetlands to which water would be diverted). We believe the DPIR should be revised to identify not only the water diverted by the project, but also the places to which and the time at which water is diverted.

The discussion in the DPIR about the constraints that limit the project's ability to capture water sufficient to meet established salinity targets needs clarification. Although target flows (defined as those needed to maintain specified salinity levels in nearshore Biscayne Bay 517,000 acre-feet/year) are never met by way of the project's diversions, part of the reason for this appears to be that sufficient water is rarely available to meet the target flows (only in the modeled 90th percentile year do total canal flows exceed the target). However, the DPIR indicates that project features are capable of diverting up to 560,000 acre-feet per year, and yet they regularly divert significantly less than this amount. By way of explanation, the DPIR simply reiterates that although "project features are physically capable of using about 560,000 acre-feet per year . . . [,] water is not available on any given day, because it is not cost effective to design pump stations to capture peak flows." DPIR at Annex C-48. There may be many reasons for the project's apparent failure to divert available flows – related to when water is available to be diverted and when water is needed to meet salinity targets, *see e.g.*, DPIR at 6-12, 6-13, 6-14 – but the DPIR is unclear as to precisely what those reasons are. Thus, we believe more explanation is needed for when and why varying amounts of water would be diverted by the project.[2]

[1] WRDA § 601(h)(4)(A)(iii)(V) states that a PIR shall "identify the amount of water to be reserved or allocated for the natural system necessary to implement, under State law, subclauses (IV) and (VI)." Subclause (IV) states that a PIR shall "identify the appropriate quantity, timing, and distribution of water dedicated and managed for the natural system."

[2] This is especially true given that there may be pressures to operate the project in ways to increase flood protection in the area. *See* DPIR at 6-16 ("There are opportunities within the Biscayne Bay Coastal Wetlands project area to further reduce the extent of damages from flooding through operational and structural changes."); *see also id.* at 6-17 (discussing pump operation triggers that limit water diversions to avoid increased flooding risks); *id.* at D-12 (discussing need for flood control releases that can result in below-target salinity levels).

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While it appears that the preferred alternative discussed in the DPIR will provide slightly fewer habitat units than the original CERP project plan would have, we are pleased that Alternative O as a whole would provide more than originally expected. *See* DPIR at 6-43. We also believe that changes in water use since CERP's original design and WRDA 2000's passage may affect "baseline" water considerations, which may in turn affect the project's restoration benefits. Therefore, we suggest a determination of any such change in baseline water that is no longer available to the natural system and possible alternatives to recapture any baseline water lost to the natural system.[3] *See* DPIR at 6-7 (acknowledging that "Hydrologic modeling results generated by the South Florida Water Management Model indicate that water withdrawals for agriculture and urban uses affect the quantity of fresh water that ultimately flows into Biscayne Bay (SFWMD, 2000)"); *id.* at C-8 (figure showing canal flows reduced from levels in 1995 and at the time of WRDA 2000's passage).

The discussion in the DPIR about whether and when the State of Florida intends to protect "existing water" in the project also needs clarification. The DPIR is clear that the State intends to protect the water the project diverts as the "water made available" by the project in accordance with WRDA 2000. The DPIR also indicates that Florida intends to protect "existing water in the natural system that the DPIR identifies as necessary to achieve the benefits of the project, using resource protection authority under Florida law." DPIR at Annex C-48. The language suggests that the reason for protecting existing water is because that water is needed "to achieve the benefits of the project," but it fails to acknowledge that the DPIR determines what flows are needed, at least to achieve salinity targets – a "more or less constant daily flow of 1,416 acre feet or 517,000 acre-feet per year." DPIR at C-47. We believe the PIR should clearly identify what quantity of existing canal flows Florida is committing to protect as "existing water . . . necessary to achieve the benefits of the project."

Compounding these uncertainties is the final statement in the section of the DPIR addressing compliance with WRDA 2000 that points to the South Florida Water Management District's (SFWMD) plans to "protect water for Biscayne Bay based on the best available science to support the identification of water for the natural system at the time such protection is undertaken. The SFWMD is currently collecting and analyzing the best available science which would be the basis to defining flows to the natural system in Biscayne Bay." DPIR at Annex C-48. Given that the DPIR determines what flows are needed in the area to meet salinity targets, as well as what salinity targets are, it is unclear what scientific questions the District continues to examine that would "be the basis to defining flows to the natural system of Biscayne Bay." We would be concerned by efforts to revisit the identification of water for the natural system included in this DPIR that might delay project implementation and any reservation of water made available by the project for the natural system. We also note that the need for increased

[3] Pursuant to WRDA 2000 and the draft Guidance Memoranda, agencies implementing CERP projects need to look at how water demands (public supply and agricultural uses) have changed since CERP was developed in 1995 and WRDA 2000 was passed in 2000, with a view to (1) understanding how increases in those demands may affect a CERP project's efficacy at meeting CERP's restoration goals and (2) considering and implementing as necessary, alternatives that would ensure that projects meet CERP goals. *See* Final Draft Guidance Memoranda § 2.6 (project managers must compare the existing conditions baseline to the pre-CERP baseline to determine if water that was originally available to the natural system has been lost to intervening non-CERP events); WRDA 2000 § 601(h)(2)(A)(requiring the State and the federal government to ensure that water made available for the Everglades ecosystem by CERP projects is not "made unavailable" before appropriate reservations are in place).

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freshwater flows to Biscayne Bay is already well documented; in most years, as the DPIR makes clear, the total available canal flow is insufficient to protect the ecological health of the Bay and additional flow is necessary. However, if the statements listed above explain that the State is planning to reserve additional water, above and beyond what is identified in this DPIR, this should be clarified. We are supportive of any additional efforts to establish a reservation of freshwater to protect the natural system in addition to what is protected by this DPIR.

Water Quality

We want to caution, however, that any new sources of water utilized for future phases of the project must meet water quality standards so as not to exacerbate water quality problems in Biscayne Bay. In particular, any consideration of waste water reuse as a potential source of freshwater for the Bay must be fully investigated, including for purposes of setting adequately stringent standards in the event that reclaimed water does have a role to play in replenishing the Bay. It is also critical to continue to look for other alternative water sources for the Bay, while ensuring that any potential sources of water are not permitted away to other users. As freshwater enters the Bay through more natural means, as planned by this and hopefully future phases of the project, this water will have a longer residence time in the Bay. Instead of being delivered at higher velocities further out to the Bay by point canal discharges that are picked up by marine currents and diluted, it will remain in the near shore area for longer periods of time. Thus, while we encourage every possible source of freshwater be evaluated for use in this project, we reiterate that any such water must be of acceptable quality.

Sea Level Rise

As the DPIR Volume 1 states that sea level rise is expected to result in a 17% decrease in average annual benefits over the 50-year life of project, it is critical to evaluate the effects of sea level rise for future project planning. Completing Phase I and future phases of this project will reduce the impact of sea level rise on Biscayne Bay coastal wetlands by creating a freshwater head that will push back on saltwater intrusion induced by rising seas. Further, once these habitats are restored, they will also be more able to cope with slow changes such as sea level rise. One of the most important reasons to expedite BBCW Alternative O is the potential to reduce the effects caused by sea level rise and saltwater intrusion.

Other Activities in Region

As there are numerous factors contributing to saltwater intrusion in the project area, it is also relevant to evaluate those factors. The practice of the seasonal agricultural canal drawdown, rock mining, and Florida Power and Light's proposed nuclear Power Plant expansion at Turkey Point all pose serious concerns that could limit the success of this restoration project. Thus it is worthwhile to evaluate, monitor, and limit the impacts of land uses in the region in order to reduce the impacts of sea level rise on the BBCW project. A water reservation, as discussed above, will help ensure that water is available for the success of this and future phases of the project, and to maintain the health of this estuary.

We reiterate that Phase I of the BBCW project alone is not nearly enough to restore Biscayne Bay. The availability of water for diversion into the project features is a significant source of uncertainty for success of the project (DPIR, page xi). It is imperative that sources of additional

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freshwater for Biscayne Bay are identified to both secure the investment in this project, and for future phases of the BBCW project. Phase I includes no water storage features and the need for storage to provide dry season flows must be included in the next phase of the project. Additionally, a critical component to completing future restoration activities in this region is further land acquisition, which will allow for Alternative O as it is envisioned without changes to the project footprint.

Monitoring Plan

A robust monitoring plan is also vital to determine the success of the project. Therefore, the projected $657,975 cost increase for a comprehensive monitoring plan is justified in order to observe the future ecological response in the Bay. We applaud the Project Delivery Team's efforts to improve the monitoring plan and increase its funding, as otherwise the project benefits could not be quantified without these improvements or properly managed through an adaptive management program in the future. We support the inclusion of ecological indicators, such as oysters, as well as increasing sampling frequencies as necessary. Adequate monitoring is the key to demonstrating success of the project and appropriately planning for future phases of the project.

Finally, this project cannot be considered in a vacuum, rather, it should be considered with other restoration projects designed to benefit the southern Everglades (including the C-111 Spreader Canal project) as well as other efforts which contribute to the overall success of restoring more natural delivery patterns and quantities of freshwater to Biscayne Bay and its coastal wetlands. BBCW Alternative O has limited restoration benefits for the Model Lands, and Phase I does not have any features that addresses hydrologic issues in the Model Lands. Phase II is an opportunity to improve hydrologic conditions in the Model Lands. With this in mind it is imperative that planning for Phase II of both BBCW and the C-111 Spreader Canal begin as soon as possible and are coordinated together in a manner that will benefit the Model Lands, South Dade wetlands, and Biscayne and Florida Bays. BBCW Phase I is a critical first step toward re-establishing more historical conditions in Biscayne Bay by increasing the ecological productivity of the Bay and creating a more estuarine environment in certain areas. Thus, we support the expeditious implementation of this restoration project.

Sincerely,

<Signatures waived to expedite delivery>

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Executive Director
Tropical Audubon Society
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B.5.11 Florida Department of Environmental Protection: Biscayne Bay Aquatic Preserve – May 2010

Florida Department of
Environmental Protection
Biscayne Bay Aquatic Preserve
Biscayne Bay Environmental Center
1277 NE 79th St. Causeway
Miami, Florida 33138-4206

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

DATE: May 3, 2010

TO: Brad Tarr, U.S. Army Corps of Engineers

THROUGH: Stephanie Culp, Assistant Director
Office of Coastal and Aquatic Managed Areas

FROM: Pamela Sweeney, Manager
Biscayne Bay Aquatic Preserve
Office of Coastal and Aquatic Managed Areas

SUBJECT:Biscayne Bay Coastal Wetlands Phase I Project, Draft Integrated Project Implementation Report and Environmental Impact Statement, Miami-Dade County, FL

SAI # FL 201003115144C

Dear Mr. Tarr,

The proposed project is located within the boundaries of the Biscayne Bay Aquatic Preserves, as described in Chapter 258.397 Florida Statute (FS) and Chapter 18-18 Florida Administrative Code (FAC). The Biscayne Bay Aquatic Preserves (BBAP) are managed by the Florida Department of Environmental Protection's Office of Coastal and Aquatic Managed Areas (CAMA) and were "established for the purpose of preserving and enhancing Biscayne Bay and all natural waterways tidally connected to the bay in an essentially natural condition so that its biological and aesthetic values may endure for the enjoyment of future generations," as stated in 18-18.001(1) FAC. Encouraging activities that "protect or enhance the biological and aesthetic values of the preserve, including but not limited to the modification of existing manmade conditions towards their natural condition…" is a specific goal named in the 'Intent' of the Biscayne Bay Aquatic Preserve Rule, Paragraph 18-18.001(1)(e) FAC. Preservation and promotion of "indigenous life forms and habitats including but not limited to sponges, soft corals, hard corals, seagrasses, mangroves, mud flats, marine reptiles, game and non-game fish species, marine mammals, tropical marine invertebrates, birds and shellfish…" is also a goal in managing the BBAP, per paragraph 18-18.001(1)(f). It is

"More Protection, Less Process"

important to note both in graphic and narrative descriptions of the Biscayne Bay Coastal Wetlands projects that some or all these projects are located within and will benefit the Biscayne Bay Aquatic Preserves, and not Biscayne National Park exclusively.

The purpose of the Biscayne Bay Coastal Wetlands Phase I project (BBCW), a component of the Comprehensive Everglades Restoration Plan (CERP), is to rehydrate coastal wetlands by redirecting freshwater in canals to flow in a manner representative of historic sheet flow as opposed to the current point-source pulse discharges into the Biscayne Bay Aquatic Preserves and Biscayne National Park that currently occur seasonally and before major storm events. The tentatively selected plan is comprised of three components including 1) the Deering Estate (located entirely within BBAP boundaries), 2) Cutler Wetlands and 3) L-31 East Flow way and is projected to restore ecologically viable marine habitat with nearshore habitat with a salinity below 20 ppt through the use of spreader canals, culverts, pumps to move water and plugging mosquito control ditches.

In particular, it is recognized that the benefits of rehydrating coastal wetlands and reducing point-source pulsed discharges into Biscayne Bay include re-establishing productive nursery habitat along the shoreline by improving estuarine conditions, enhancing and improving quantity, quality, timing and distribution of freshwater to Biscayne Bay, maintain higher stages in coastal canals allowing for aquifer recharge and improved groundwater exchange, preserving and restoring the spatial extent of natural coastal glades habitat, restore nearshore and tidal wetland salinity regimes. In accomplishing these goals, BBCW Phase 1 will be implemented to attempt to restore the natural salinity regimes in Biscayne Bay and supports the mission of the BBAP in maintaining Biscayne Bay in an essentially natural condition. Increasing water stages by keeping canal water levels high will allow for greater protection against saltwater intrusion now and in the future. Keeping coastal habitats intact is a key strategy in staving off the effects of sea level rise in the future by allowing habitats such as mangroves and seagrasses to slowly accrete over time and occupy areas that were previously untenable or less hospitable to growing conditions thereby maintaining ecological productivity of the ecosystem overall.

While the overall project should significantly benefit Biscayne Bay and the three components included in Phase I should be implemented as soon as possible, several concerns should be noted moving forward. Alternative O was chosen because it allows for adaptive management strategies to be undertaken and is most cost effective. It is favorably noted that funding for monitoring efforts was once set at 1% of total project costs and has been made to be more flexible per the recommendation of the external peer review team to allow for additional monitoring as needed. Additional monitoring in the Deering Estate footprint should be considered as opposed to monthly monitoring, such as continuous monitoring using a datasonde when water is actively flowing in order to capture changes in salinity associated with operation of the water control

structures. Use of an instrument like a datasonde will also allow for other parameters to be measured more frequently over time, such as dissolved oxygen and nutrients which may alleviate concerns about the quality of water being received through the coastal wetlands. At this time ecological monitoring is only planned for five years, and may need to be extended or enhanced as necessary depending on how closely the ecological response observed meet intended targets.

Annex C of the Draft Integrated Project Implementation Report (PIR) defines the water that is being legally protected from future consumptive uses or other allocations as only the water that makes up the "Total Diverted Canal Flow" and may mean that water needed for the project in the future is unavailable because it has not been set aside for use in restoration. Protecting the water that comprises the "Total Available Canal Flow" will help ensure that all of the freshwater necessary to meet the water quality and salinity targets identified in the PIR will be met as the projects included in Phase I, and eventually Phase II, are implemented. It is important to note that freshwater is received by Biscayne Bay along the length of the bay through groundwater inputs and canals, and the quantity and timing of freshwater deliveries received in the northern part of Biscayne Bay must remain intact in order for this part of the bay to maintain a healthy and viable ecosystem as historic groundwater inputs have been severely cut back over time.

This staff assessment is preliminary and is designed to assist in the review of the application prior to final agency action. The comments provided herein are not the final position of the Department and may be subject to revision pursuant to additional information and further review.

Thank you for the opportunity to review and comment on the PIR. Please feel free to contact me at 305-795-3486 or via email pamela.sweeney@dep.state.fl.us

Best regards,

Pamela Sweeney

Electronic copies to:
Gary Lytton, FDEP CAMA, Rookery Bay National Estuarine Research Reserve
Erin Steurer, FDEP, Everglades Restoration Planning and Permitting Program
Ernie Marks, FDEP, Everglades Restoration Planning and Permitting Program
Lauren Milligan, FDEP, Office of Intergovernmental Programming
Penny Isom, FDEP CAMA

File

"More Protection, Less Process"

B.5.12 Miami-Dade County Park and Recreation Department – March 2010

MIAMI-DADE COUNTY

Carlos Alvarez, Mayor

Park and Recreation
275 NW 2nd Street
Miami, Florida 33128
T 305-755-7800

miamidade.gov

ADA Coordination
Agenda Coordination
Animal Services
Art in Public Places
Audit and Management Services
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Building
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Business Development
Capital Improvements
Citizens' Independent Transportation Trust
Commission on Ethics and Public Trust
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Police
Procurement Management
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Seaport
Solid Waste Management
Strategic Business Management
Team Metro
Transit
Task Force on Urban Economic Revitalization
Vizcaya Museum And Gardens
Water & Sewer

March 24, 2010

Ms. Rebecca S. Griffith, Ph.D., PMP
Chief, Planning Division
Environmental Branch
Department of the Army
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

Dear Ms. Griffith:

Thank you for providing an opportunity for the Miami-Dade County Park and Recreation Department to include written comments on the Draft Environmental Impact Statement for the Biscayne Bay Coastal Wetlands Project. The DEIS covers a wide variety of environmental, engineering, and recreation topics and considerations. The comments provided below are specific to recreational plans and facility recommendations as they relate to Miami-Dade County park properties.

1. The DEIS addresses the Powers Property of the Deering Estate in the form of the rehydration project, but does not make any recommendations about the addition of recreational facilities on a property that can and should support it.

2. The DEIS addresses the Lakes by the Bay property in a way that may undermine future use and development. Without an extension of the levee around the eastern boundary of the park, rehydration from the spreader canal will make most of the remaining park land unusable. Furthermore, this park property should be considered for recreational facilities since it is uniquely located to function as a public access point to much of the Coastal Wetland.

3. The DEIS proposes to make recreational improvements to the C-102 Canal just east of SW 97 Avenue. In part, it relies on a proposed acquisition of the Cemex quarry located at SW 268 Street and SW 99 Avenue. It is a property under consideration for acquisition jointly by the U.S. Department of Defense, the South Florida Water Management District, and Miami-Dade County. It might make sense to locate the recreational facilities closer or within this property since it has access to lakes, canals and uplands for development.

4. There is a relatively new proposal for a future multi-use recreational trail along a 42-mile east-west corridor that will connect Biscayne National Park to Everglades National Park. This project came about after the inception of the Biscayne Bay Coastal Wetlands DEIS planning process, and is known as the Biscayne-Everglades Greenway. Several public agencies are partnering in this

MIAMI-DADE COUNTY

Carlos Alvarez, Mayor

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Enterprise Technology Services
Environmental Resources Management
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Housing Finance Authority
Human Services
Independent Review Panel
International Trade Consortium
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Medical Examiner
Metro-Miami Action Plan
Metropolitan Planning Organization
Park and Recreation
Planning and Zoning
Police
Procurement Management
Property Appraisal
Public Library System
Public Works
Safe Neighborhood Parks
Seaport
Solid Waste Management
Strategic Business Management
Team Metro
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project, including the National Park Service, Miami-Dade County, South Florida Water Management District, the City of Homestead, and others. The eastern terminus of this greenway is proposed for alignment along SW 328 Street and SW 87 Avenue near the entrances to Homestead Bayfront Park and Biscayne National Park, in the southern portion of the DEIS project area.

Thanks again for the opportunity to correspond with you about this proposed project. Please contact me at (305) 755-7860 with any questions about the above comments.

Sincerely,

Andy McCall
Park Planner II

C: Bradley A. Tarr, USACE
W. Howard Gregg, Deputy Director, MDPR
Joe Webb, Park System Planning Section Supervisor, MDPR
Kevin Asher, Special Projects Administrator, MDPR

B.5.13 Environmental Protection Agency – April 2010

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4
SAM NUNN
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA GEORGIA 30303-8960

April 27, 2010

Mr. Brad Tarr
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

Subject: EPA NEPA Comments on COE CERP DEIS for the "Biscayne Bay Coastal Wetlands Phase 1"; March 2010; Miami-Dade County, FL; CEQ #20100078; ERP #COE-E39080-FL

Dear Mr. Tarr:

In accordance with our responsibilities under Section 102(2)(C) of the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has reviewed the referenced U.S. Army Corps of Engineers (COE) Draft Environmental Impact Statement (DEIS) for Phase I of the proposed Biscayne Bay coastal wetland restoration. EPA is a cooperating agency and believes that this proposed project is an important component of the Comprehensive Everglades Restoration Plan (CERP). We are familiar with this proposed project and have discussed it with the COE (Jacksonville District), National Park Service (Biscayne National Park) and Miami-Dade County (Department of Environmental Resources Management: DERM).

The Biscayne Bay coastal wetlands consist of onshore freshwater wetlands (Biscayne Bay shorelands) and nearshore saltwater wetlands (Biscayne Bay). Over time, this project area has been degraded through canal drainage of freshwater runoff, which has changed the hydroperiod of affected onshore freshwater wetlands and reduced non-point flows into the Bay, which in turn created hypersaline conditions in nearshore Bay waters. The area has further been degraded through point source discharges of freshwater from the canal system into the Bay, which created hyposaline conditions at the point of discharge in nearshore Bay waters.

The Biscayne Bay Coastal Wetlands Project proposes to restore coastal freshwater wetlands by re-establishing overland flows cut off by the canal system and roadways, through redistribution of that water by a spreader system to rehydrate the 11,000-acre project area. The saltwater wetlands of nearshore Biscayne Bay would also be restored by limiting point source (canal) freshwater discharges into Biscayne Bay. Both actions would help restore Bay salinities to more natural/ambient levels that are more suitable for nursery and other nearshore habitats such as oyster reefs.

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The proposed project is to be accomplished in two phases (two separate EISs and Project Implementation Reports: PIRs). The Tentatively Selected Plan identified in the DEIS to implement the present Phase 1 of the project is Alternative O. This alternative would help restore a 3,761-acre footprint through establishing seven pump stations, 10 culverts, three miles of spreader canals, and plugging 2,500 feet of mosquito control ditches.

Comments & Recommendations

EPA strongly supports this proposed project as a CERP water quality, wetland and habitat restoration project. We believe it constitutes a useful first step to accomplishing the project goals within current funding. We recommend the expedited implementation of Phase 1 – as well as prospective Phase 2 to further restore the coastal wetlands of Biscayne Bay. The Final EIS (FEIS) should discuss the availability of sufficient freshwater in the area to rehydrate the onshore wetlands and, accordingly, the feasibility of constructing additional features in the project area targeted for Phase 2.[1]

EPA DEIS Rating

Because EPA strongly supports Phase 1 and prospective Phase 2 of the Biscayne Bay Coastal Wetlands Project, we rate this DEIS as an "LO" (Lack of Objections).

EPA appreciates the opportunity to review the DEIS. Should you have questions regarding these comments, feel free to contact Chris Hoberg of my staff for NEPA issues (404-562-9619 or hoberg.chris@epa.gov) and Eric Hughes of the EPA Water Protection Division (located in the Jacksonville District office) for technical issues (904/232-2464 or Eric.H.Hughes@usace.army).

Sincerely,

Heinz J. Mueller, Chief
NEPA Program Office
Office of Policy and Management

[1] Editorially, we also note from page i that the NEPA public review time for this DEIS was inadvertently listed as 30 days instead of the appropriate 45 days for DEISs. We assume that the COE will provide the additional public review time until the designated 5/3/10 due date.

B.5.14 Alger Farms, Inc. – March 2010

Alger Farms, Inc.

950 N.W 8th Street
PO Box 1253
Homestead, Florida 33030

Phone (305) 247-4334
Fax (305) 247-4157
Email jlalger@aol.com
Mobile 305 342 2505
Efax 786 228 4950

March 17, 2010

Bradley Tarr
USACE
PO Box 4970
Jacksonville, Fla. 32232-0019
bradley.a.tarr@usace.army.mil

Re: Biscayne Bay Restoration comments

Mr. Tarr,

I am a third generation farmer in Homestead growing crops in the area known as the East Glade. We own a large majority of the land we farm. We have enjoyed drainage in our area due to a system of canals dug in the 1920's and this drainage is essential to our survival.

The SFWMD took over control of the drainage in the 1960's and continued a practice called the "draw down" each October for the planting season. It became part of the written operating procedure in the 1980's. Without this rapid system of drainage, I cannot continue to farm and therefore do not have the full use of my land.

I appreciate the efforts of restoration. I understand that the south area of Biscayne National Park is the most pristine. This is where my water drains. If we have been draining into south BNP for 90 years and it is still the most ecologically preserved area, I can't see that we have been hurting the bay.

The attempt to slow down drainage via sheet flow will back water on to my land. I object to any project that prevents drainage from occurring as it does now, the status quo, and would consider such an interruption of drainage a "taking" of my land. I would expect to be compensated for my loss.

John L. Alger
Alger Farms, Inc.

B.6 PUBLIC MEETING – APRIL 21, 2010

B.6.1 BBCW Draft PIR Public Meeting E-Mail Advertisement

Subject bar: Public meeting April 21 for Biscayne Bay Coastal Wetlands Project

E-mail text:

The U.S. Army Corps of Engineers, Jacksonville District will host a public meeting for the Biscayne Bay Coastal Wetlands Project April 21 in Miami-Dade County. The purpose is to present the Draft Project Implementation Report (PIR) and Environmental Impact Statement (EIS) and take public comments. Public and agency comments may be submitted in writing through May 2, as well.

The Biscayne Bay Coastal Wetlands Project is a component of the Comprehensive Everglades Restoration Plan (CERP). The project goal is to improve the ecology of Biscayne Bay, including the freshwater wetlands, tidal creeks and near-shore habitat. The project team will accomplish this by adjusting the quantity, quality, timing and distribution of fresh water entering the bay and Biscayne National Park. The project includes pump stations, spreader swales, storm water treatment areas, flow ways, levees, culverts and backfilling canals in southeast Miami-Dade County.

The Corps is hosting the public meeting Wednesday, April 21 at the Deering Estate at Cutler, 16701 S.W. 72nd Ave., Miami, Fla. An open house begins at 6:30 p.m., followed by the public meeting at 7 p.m. Persons needing special assistance such as Spanish-language translation are asked to call 561-472-8885.

A public comment period is open through May 2, 2010. The draft PIR/EIS is available online at http://tinyurl.com/ydg4mkf. People may submit comments online at BBCWDPIRComments@evergladesplan.org or via mail to Brad Tarr, U.S. Army Corps of Engineers, Jacksonville District, P.O. Box 4970, Jacksonville, Fla. 32232-0019.

This is a project of the U.S. Army Corps of Engineers and South Florida Water Management District. For more information, please contact Eunice Ford, Corps of Engineers project manager, at 904-232-3618 or eunice.ford@usace.army.mil; or John Shaffer, SFWMD project manager, at 561-681-2563 or jshaffe@sfwmd.gov. More is available online by visiting www.evergladesplan.org, and clicking Projects on the top right. For information on the public meeting, please call 561-472-8885.

###

B.6.2 BBCW Draft PIR Public Meeting Advertisement

Public Meeting Draft Integrated Project Implementation Report and Environmental Impact Statement for the

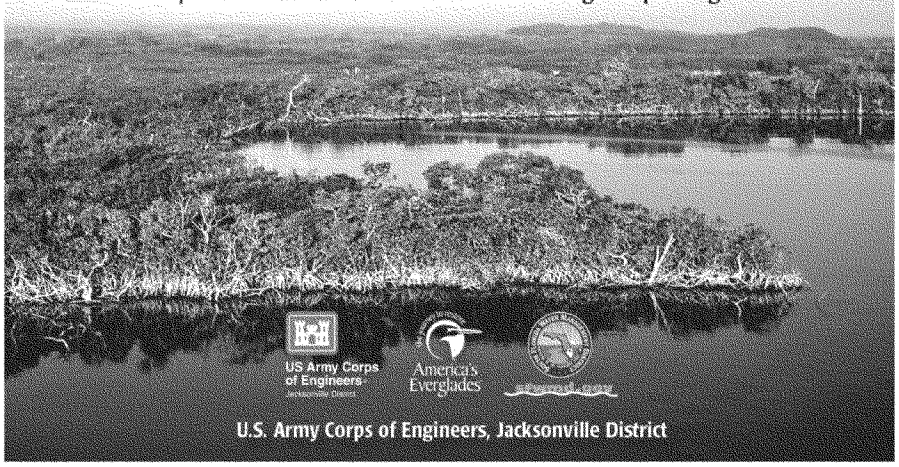
Biscayne Bay Coastal Wetlands Restoration Project

Where: Deering Estate at Cutler, 16701 S.W. 72nd Ave., Miami, Fla.

When: Wednesday, April 21, 2010
6:30 p.m. – Open House • 7 p.m. – Public Meeting

The Biscayne Bay Coastal Wetlands Restoration Project is a component of the **Comprehensive Everglades Restoration Plan**. The project goal is to improve the ecology of **Biscayne Bay**, including the freshwater wetlands, tidal creeks and near-shore habitat. This will be accomplished by adjusting the quantity, quality, timing and distribution of fresh water entering the bay and **Biscayne National Park**. The public meeting is to present the draft report and proposed restoration plan, and take public comments.

For more information or special assistance such as Spanish translation, please call **561-472-8885** or visit **www.evergladesplan.org.**



B.6.3 Public Meeting Comments on the Draft PIR

TABLE B-3: PUBLIC MEETING COMMENT MATRIX

Biscayne Bay Coast Wetlands Restoration - 21 Apr 10 Public Meeting

Name	Organization	Comment	Response
David McDonald	McDonald Attorneys	Would like invitation to groundbreaking. Thank you for answering questions very well.	John Shaffer invited all meeting attendees to attend the Deering Estate Flow-way groundbreaking on 7 May 2010.
Andy McCall	Miami-Dade Parks	Concerned about potential flooding of planned future park and would like more details regarding selection of location of recreation features.	See Public and Agency Review Comment Matrix for more detailed agency letter and response.
Bill Meiklejohn		How much fresh water do we need from towns storm drains flowing into the bay to keep coral in the bay alive? Thank you for your answer.	Coral reefs do not need freshwater. They need a consistent salinity level of between 30 and 35 ppt and the correct temperature. Additional freshwater will not help the coral grow.
Amy Roda, PhD		This project should be highlighted as a good thing for the area. I am a resident and scientist and feel the public should have access to the knowledge learned from the project.	We agree. Information will be provided to the sponsor and the park service highlighting positive aspects of the project to provide to the public.
Joan Lawrence	US DOI	Will be submitting comments to the USACE and SFWMD. Believe groundwater and surface waters in the area need to be protected. Looking forward to the groundbreaking and to Phase II.	See Public and Agency Review Comment Matrix for more detailed agency letter and response.
Juan Comendeiro		Is there enough stuff there, plants to clean the water before it gets to Biscayne Bay? You're just going to throw silt into the Bay.	The water is being spread. There are mangroves and other plant species on the property. The project should not input silt into the Bay.
Juan Comendeiro		What about using giant pipes with many holes in them to spread the water, like a garden hose? What about debris? Is there any technology for a BritaFilter in the Bay?	Extremely expensive and difficult to maintain something like that. There is a debris removal system in the pump station. The filter idea would be extremely cost prohibitive. The water will be flowing through wetlands so it may not be tap ready at the end, but will likely be much cleaner.

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Kahlil Kettering	NPCA	FPL; AG drawdown; Water reserved and more needed; Public involvement	See Public and Agency Review Comment Matrix for more detailed agency letter and response.
Kahlil Kettering	NPCA	How does the public meeting process work? Would encourage more public meetings.	There are PDT meetings to which the public is welcome to come and provide input. The meetings are generally held monthly and are announced on evergladesplan.org. There have been stakeholder meetings and design meetings as well. Comments are noted, considered and incorporated into the plan wherever possible.
Marilyn Tendrich		How can a pump canal or culvert be ecologically the correct solution to this project?; Why is a pump needed at all? Why can't water just flow from canal C100 into the spreader structure?; If the problem is low water level, why can't water flow under old cutler road into the aquifer adding adding extra water that will filter through the limestone and vegetation before going into the bay?	The path of least resistance right now for the water is to flow into the existing canals- a point source discharge. The pumps will help move the water to rehydrate dry areas. It is not a channelized system. Additionally, the pump system is set up with 2 25cfs pumps and 1 50 cfs pump in order to effectively address different water flow needs at different times.
Laura Reynolds	Tropical Audubon	BBRCT appreciates the last sixth months of more involvement from BBCW team. Would like to move faster and Phase II and the remainder of Phase I. Always need more cooperation and communication. Must identify more water to be reserved for the project.	The project is intended to follow the law regarding water reservations and will protect the minimal flows to the Bay. It may not be possible to reserve excess water because the project can only legally do what it has been mandated to do.

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Unidentified Speaker		Has someone actually been on the property and evaluated what is already there? There are 100 year old oak trees that will die if the land is hydrated.	There are some very significant oak trees and other hardwoods downstream of the spreader. However, they are very big because they are so old and predate everglades drainage in this area. They are growing on the higher areas. The project proposes to hydrate only the lower areas where the sawgrass prairie was located. Old photos show this prairie extended all the way to the area of the Chinese Bridge. This has been reviewed by biologists from every level of government from ours up to the Corps and FWS and they are aware that the slough identified for restoration runs through a topographically complex area of high and low spots and that the sawgrass was growing in the low spots, not on top of the Miami ridge outcroppings where the large hardwood trees are/were growing.
Unidentified Speaker		Does the Military Canal still have jet fuel in it?	No, the canal does not have jet fuel in it.
Unidentified Speaker		When will Phase II begin?	Phase II is not currently in the USACE's five year plan, but that plan is reviewed and updated annually. Phase II may be expedited by SFWMD.
Unidentified Speaker		Where is the 175 million to fund the project coming from?	The project is cost shared between SFWMD and USACE.
Unidentified Speaker		How many gallons per day will be flowing?	It is not a consistent daily flow rate, it is in response to hydrometeorological conditions. With gravity structures, it is related to levels. We can provide discharge numbers all the way back to the 1940s if you are interested.
Unidentified Speaker		Is there a bicycle path? To link the park with ENP would be wonderful and would bring a lot of visitors to the area.	There is a three mile trail and a parking lot, but it does not link with the other area trails.

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B.7 PUBLIC AND AGENCY COMMENTS, AND RESPONSES ON THE DRAFT REPORT

TABLE B-4: PUBLIC AND AGENCY COMMENTS, AND RESPONSES ON THE DRAFT REPORT

Biscayne Bay Coastal Wetlands Public and Agency Comment Response Matrix

Comment Number	Organization/ Agency	Date Received	Comment	Response
AF-1	Alger Farms	17- Mar-10	Any attempt to slow down drainage via sheet flow will back water on to my land. I object to any project that prevents drainage from occurring as it does now, the status quo, and would consider such an interruption of drainage a "taking" of my land. I would expect to be compensated for my loss.	The project is not designed to slow down the drainage of water on lands outside the project boundary. Sheet flows will be created by pumping water from existing canals to the spreader canals to create sheet flow discharges. Removing water from canals with pumps will not interfere with drainage of any surrounding lands. The non-federal sponsor, SFWMD, is currently exploring the possibility of making modifications to the seasonal drawdown practice for possible implementation, either in future CERP projects, or outside of CERP. The plan recommended within the current PIR/EIS does not include changes to the seasonal drawdown practice. Subsequent PIRs will evaluate the impacts to flood protection associated with all recommended management measures, including modifications to seasonal drawdown practices, if recommended.
MDC-1	Miami-Dade County Park & Recreation Department	25- Mar-10	The DEIS addresses the Powers Property of the Deering Estate in the form of the rehydration project, but does not make any recommendations about the addition of recreational facilities on a property that can and should support it.	We have added a section H.3.4 to the recreation appendix (Appendix H) recommending construction of an educational wetland site to be operated and maintained by Dade County Parks and Recreation.
MDC-2	Miami-Dade County Park & Recreation Department	25- Mar-10	The DEIS addresses the Lakes by the Bay property in a way that may undermine future use and development. Without an extension of the levee around the eastern boundary of the park, rehydration from the spreader canal will make most of the remaining park land unusable. Furthermore, this park property should be considered for recreational facilities since it is uniquely located to function as a public access point to much of	As discussed during our recent meeting, the western side of the spreader canal will include a berm to ensure that water from the Cutler Wetlands component will not be discharged onto the Lakes by the Bay park site. It was the teams' belief that Miami Dade County intends to construct fairly traditional recreational facilities on this site. The team can further explore the possibility of utilizing the Lakes by the Bay as an alternate, or second, access point to the Cutler Wetlands as part of the project's detailed design. As agreed during a recent meeting, we have added text to the end of section H.3.1 to the effect of "Miami-Dade Parks & Recreation Department has recommended flexibility in

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			the Coastal Wetland.	the final siting of the recreation features associated with the proposed Cutler Flow Way/C-1 wetlands feature, and the team has agreed to consider possibly siting them at the Lakes by the Bay Park site if it is determined to be mutually beneficial to all parties, and subject to Miami- Dade County Parks and the Non-Federal Sponsor's mutual willingness to enter into a partnership agreement describing mutual responsibilities with respect to ownership and maintenance responsibilities."
MDC-3	Miami-Dade County Park & Recreation Department	25- Mar-10	The DEIS proposes to make recreational improvements to the C-102 Canal just east of SW 97 Avenue. In part, it relies on a proposed acquisition of the Cemex quarry located at SW 268 Street and SW 99 Ave. It is a property under consideration for acquisition jointly by the U.S. Department of Defense, the SFWMD and Miami-Dade County. It might make sense to locate the recreational facilities closer or within this property since it has access to lakes, canals and uplands for development.	As described in section H.3.2 of the recreation appendix (Appendix H), the recommended features are to be constructed entirely on land owned by the non-federal sponsor, and do not rely on acquisition of any additional land. The improvements, are limited to a shade shelter near the intersection of C-102 and L-31E, and six elevated tent platforms intended to serve kayakers without competition from other potential users.
MDC-4	Miami-Dade County Park & Recreation Department	25- Mar-10	There is a relatively new proposal for a future multi-use recreational trail along a 42 mile east-west corridor that will connect Biscayne National Park to Everglades National Park. This project came about after the inception of the BBCW DEIS planning process, and is known as the Biscayne-Everglades Greenway. Several public agencies are partnering in this project, including the National Park Service, Miami-Dade County, SFWMD, the city of Homestead, and others. The eastern terminus of this greenway is proposed for alignment along SW 328 Street and SW87 Ave. near the entrances to Homestead Bayfront Park and Biscayne National Park, in the southern portion of the DEIS project area.	We have added a section H.3.5 to the recreation appendix (Appendix H) to recognize the relatively new proposal for a future multi-use recreational trail along a 42 mile east-west corridor that will connect Biscayne National Park to Everglades National Park. The new text indicates that the project came about after the inception of the BBCW DEIS planning process, is known as the Biscayne-Everglades Greenway, and that several public agencies are partnering in this project, including the National Park Service, Miami-Dade County, SFWMD, the city of Homestead, and others. The new text also indicates that the eastern terminus of this greenway is proposed for alignment along SW 328 Street and SW87 Ave. near the entrances to Homestead Bayfront Park and Biscayne National Park, and that connectivity to CERP features north of the North Canal should be considered during detailed design.
DOI-1	Department of the Interior	26-Apr-10	We agree with the selection of Alt.O Phase I and the NAI that states the benefits of this project alone will be realized without the completion of any other projects in the	We concur with the Department of the Interior on expediting Phase II of this project and other CERP Projects. USACE and SFWMD are working diligently to complete all CERP Projects in a timely manner.

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			region. However, it is clear that the coastal wetlands will benefit from additional aspects of CERP that increase available freshwater in the southern part of the Miami-Dade county conveyance system. It is important that the remainder of Alt. O Phase II and other CERP projects in the area be completed in an expedited fashion to achieve maximum benefit in the early years of the project implementation.	
DOI-2	Department of the Interior	26-Apr-10	It is important to identify additional freshwater sources for the BBCW Project in order to achieve the desired goals of this project, especially reducing exceedingly high nearshore salinity and maintaining stable salinity through the dry season. Delay in the completion of the project features, specifically those that bring additional freshwater to the region, provides opportunity for sea level rise related saltwater intrusion to cause ecological damage to the coastal region.	Identification of additional freshwater sources for the BBCW is clearly important. The selected plan is intended to serve as an initial increment of restoration. Because the pumps were generally sized to divert the mean wet season flows which would otherwise be discharged by the coastal structures, they will frequently (e.g. in the dry season, or wet season of dry years) have significant additional capacity which will otherwise go unutilized. The search for additional freshwater sources will continue both inside, and outside of, CERP.
DOI-3	Department of the Interior Everglades National Park and Biscayne National Park	26-Apr-10	Benefits from the Deering Estate aspect of the project require monitoring for changes in wetland stage, monitoring for salinity changes in the nearshore environment, monitoring water quality impacts due to surface and subsurface migration of urban contaminants into natural areas, and monitoring wetland effluent water quality prior to transiting into the Bay.	The monitoring plan (Annex E) includes monitoring for wetland water stage elevation, and salinity nearshore. A revised version added additional water quality monitoring at the mangrove/bay transition. Groundwater will not be monitored for contaminants as neither the PDT or the regulatory agencies identified any concerns about groundwater contamination.
DOI-4	Department of the Interior Everglades National Park and Biscayne National Park	26-Apr-10	The NPS recommends the placement of one additional monitoring station in the nearshore region north of S-123 to provide a direct measure of changes in salinity as a measure of the effectiveness of this portion of the project. Also, changes in stage will be detected in the saltwater marsh region upstream from the existing weir by having a technician read the stage using an existing staff gage. This is scheduled for monthly readings; however, we suggest adding additional readings when water is flowing in	A revised project monitoring plan includes an additional salinity monitoring site north of S-123 at the mouth of Cutler Creek where changes to salinity will be most likely to occur. A revised RECOVER salinity monitoring plan adds monitoring in the nearshore area near the project. Groundwater stage will be monitored near the site of the weir continuously.

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			order to capture changes associated with pump operation events and avoid missing critical data during times when stage in the region fluctuates.	
DOI-5	Department of the Interior Everglades National Park and Biscayne National Park	26-Apr-10	The monitoring program for the Cutler Properties appears to be inadequate to determine the extent of freshwater flow along the spreader canal toward the north. However, even with the addition of plugs in the historic mosquito ditches, water could potentially seep from the canal close to the junction with C-701 and flow directly to the coast without rehydrating the northern wetland regions of this property. It is possible that increasing stage will alleviate or improve this by-pass effect; however, the stage necessary to achieve hydration throughout this area and to the north would be unknown without improvements in the monitoring program. Additional telemetric surface level monitoring appears to be necessary to assist in the operation and adaptive management of these pump structures. We recommend an additional recorder be placed near the northern end of the C-702 spreader canal on the eastern side of the canal to provide real time data feedback into operations management to maintain flow until stage increases are observed in this region. Additionally, monitoring of staff gage BBCW PL_2 should take place whenever S-701 is flowing in order to avoid missing critical data during times when stage in the region fluctuates.	An existing monitoring well (BBCW2) that records water level continuously is located near the northern most reach of the spreader canal. These data should be adequate to determine how the project affects water levels in this area. Water level within the saltwater wetlands is not considered to be a critical measure of project performance since it will primarily reflect tidal range, but rather salinity near the shore line. The project includes three nearshore monitoring sites where water quality is measured monthly, and six sites where salinity is measured continuously. Possible changes to operations or configuration of the project will rely primarily on the salinity results to ensure a reasonable distribution of water reaching the shoreline.
DOI-6	Department of the Interior Everglades National Park and Biscayne National Park	26-Apr-10	Monitoring aspects of the L-31 Flow-way section appear adequate for the task of providing data on changes in the environment to be used in the adaptive management of the related structures, with one exception. The project staff gages should be monitored when flowing, in addition to the planned monthly data collection interval, to assure that changes	It is not possible to monitor staff gauges at all times when water is flowing. Field notes should indicate when water is flowing at the time measurements are recorded. There should be little if any difference in water level in the coastal wetlands caused by inflow of freshwater. Water levels will be essentially the same as the tide level. Water level within the saltwater wetlands is not considered to be a critical measure of project performance since it will primarily reflect tidal range, but rather salinity near the shore line. The project includes

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			related to structure operations are detected.	five nearshore monitoring sites where water quality is measured monthly, and nine sites where salinity is measured continuously. Possible changes to operations or configuration of the project will rely primarily on the salinity results to ensure a reasonable distribution of water reaching the shoreline.
DOI-7	Department of the Interior Everglades National Park and Biscayne National Park	26-Apr-10	Since the original monitoring funding limitations have been relaxed, the following additions have been made to the monitoring. The project benefits cannot be quantified without these monitoring aspects nor can the project features be properly managed through the adaptive management plan without this information. Continued support for the monitoring effort as detailed here and in updated comments from the PDT is important and appreciated. (Addition of monitoring station north of S-123 in the shallow mangrove coastal zone, preferably within 150m of shore, to fill a gap in coverage and provide a direct measure of changes in salinity and water quality within the "Deering Estate" region of the project., Addition of a monitoring station just north of S-21 in the shallow mangrove coastal zone, preferably 150m of shore, to fill a gap in coverage and provide a direct measure of changes in salinity and water quality within the "Cutler Ridge" region of the project., Repositioning of the monitoring location on L-31E from the east-west section of the canal near S-21 to a location along the north-south trending section of the same canal just north of C-102, downstream of the Old South Date Landfill, in order to capture information on seepage and contaminant migration from the landfill., Change in the sample frequency from monthly to biweekly when flowing for the stations in the C-103 upstream of S-20F, collocated with the new pump stations S-710 and S-711, in order to match the sampling frequency in other portions of the project and to provide flexibility in the sample regime to match conditions at the sample sites. Each of	The PDT has expanded the project monitoring plan to address comments from an independent peer review. These include three new stations: One at the mouth of Cutler Creek north of S-123, one at the mouth of an embayment north of S-21 and Black Point, and one within the L-31E borrow canal north of C-102. Since an extensive period of record of water quality results are available from the C-103 canal upstream of pumps S-710 and S-711, the PDT did not recommend increasing the frequency of monitoring C-103 at station MW04 more than once per month.

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			these changes is critical in addressing both shortcomings in the DPIR/EIS as published, to meet the monitoring needs for the project, and to provide data for adaptive management.	
DOI-8	Department of the Interior	26-Apr-10	It is expected that continued reduction of the stage in C-102 and C-103 to meet agricultural purposes, even with pumping into the L-31E as the mechanism, will cause a regional reduction in stage and continue to force a discharge of water and the end of the wet season. An alternate discharge pattern that maximizes benefit in the coastal habitat by mimicking the quantity and timing of natural freshwater discharge would be preferred. We have been participating in SFWMD review process to determine how best to meet the conflicting water management needs in the region. The uncertainty with respect to the future canal operations in this region adds uncertainty to the project's expected benefits. The USACE's participation in this process will help ensure maximum benefit for the BBCW project.	USACE team will participate with SFWMD as appropriate in planning for the discharge of freshwater from C-102 and C-103
DOI-9	Department of the Interior	26-Apr-10	The NPS strongly urges the USACE and partner agencies to unequivocally commit to protecting the full amount of freshwater defined in this document as the "Total Available Canal Flow". Protecting on the "Total Diverted Canal Flow", as described in Annex C Figure C-22 of the DPIR will not protect the total amount of freshwater needed to meet the salinity targets of this project. Inadequate availability of freshwater in the future, due to lack of protection, would likely lead to the failure to achieve project goals. The target salinity for restoration of the Bay cannot be met without the "Total Available Canal Flow", and reserving only a portion of the available current surface water flow could exacerbate hypersaline events. The modeled restoration salinity targets and	Section C.3.1.4 will be revised to reflect the following: As required by Section 385.35 of the Programmatic Regulations for the Implementation of CERP and CERP Guidance Memoranda #4, "Identifying Water Made Available for the Natural System and for Other Water Related Needs," the water made available (diverted) by Phase I of the Project will be protected using the State of Florida's reservation or allocation authority under state law as is represented by the "Total Diverted Canal Flow" line in Figure C-22 of Annex C. The South Florida Water Management District has further committed to protect the difference between the existing water in the system, identified as the "Total Available Canal Flow" and the "Total Diverted Canal Flow" up to the "Target Flow" line under State's reservation or allocation authority. The State is currently determining the most appropriate means for undertaking this protection of water for the natural system.

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			resulting benefits were based on an assumption of increased surface water flow; therefore, reserving only the "Total Diverted Canal Flow" is incompatible with the BBCW restorative objective.	
DOI-10	Department of the Interior	26-Apr-10	The NPS believes it is essential to protect the full amount of freshwater flowing into Biscayne Bay form the both consumptive use allocation and from diversion by other CERP projects, as well as to identify and deliver additional sources of water in Phase 2 of the project.	In addition to the water made available by the Phase I of the Project, the South Florida Water Management District is committing to protecting the difference between the existing water in the system, identified as the "Total Available Canal Flow" and the "Total Diverted Canal Flow" up to the "Target Flow" line under State's reservation or allocation authority as identified in Figure C-22 of Annex C. The State is currently determining the most appropriate means for undertaking this protection of water for the natural system. Additional sources of water for Biscayne Bay will be evaluated as part of the Phase II planning process.
DOI-11	Department of the Interior	26-Apr-10	The NPS encourages the USACE and its partner agencies to reassess the area of ecological restoration during Phase 2 of this project. Annex C of the DPIR states that 517,000 acre-feet of freshwater are needed to provide ecosystem restoration in BBCW. This is based on the assumption that the wetland communities and only the area of benthic organisms out to 500 m during the wet season and 250' during the dry season are dependent on freshwater flows for heath and sustainability. Because benthic communities are dependent on specific benthic communities and stable salinity regimes, the NPS believes this is a limited view of ecological health for the Biscayne Bay. The NPS believes that extrapolating from existing conditions provides a more accurate distribution of benthic community types. Benthic mapping and the evaluation of abundance and distribution of benthic community types suggest that the nearshore portion of the bay dependent of n freshwater flow is approximately twice as large as that identified in the DPIR.	Project goals include restoring an appropriate gradient of salinity from the wetlands into Biscayne Bay. This gradient extends a few kilometers into the bay, and will be documented by continuous salinity monitoring stations located more than five kilometers from shore. In addition, the project includes submersed aquatic vegetation monitoring within a zone that extends one kilometer into the bay to detect changes in vegetation abundance and distribution as a result of project effects.
DOI-12	Department of the Interior	26-Apr-10	The NPS strongly encourages the USACE and its partner agencies to initiate the remainder of the BBCW project as soon as	Agree. Efforts are being made to complete Phase I as fast as possible. We anticipate both agencies to schedule Phase II as soon as possible.

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			possible to take advantage of reduced land costs at this time and to ensure that restoration options are not eliminated as well as to provide early restoration benefits. As an important part of this planning process, the NPS encourages the USACE and SFWMD to seek ways to move additional freshwater to the BBCW footprint from the regional system, as well as examine ways to more efficiently use the freshwater currently in the BBCW footprint.	The team continues to look for ways to provide adequate water to the project.
EPA-1	U.S. Environmental Protection Agency	27-Apr-10	EPA strongly supports this proposed project as a CERP water quality, wetland and habitat restoration project. We believe it constitutes a useful first step to accomplishing the project goals within current funding. The Final EIS should discuss the availability of sufficient freshwater in the area to rehydrate the onshore wetlands and, accordingly, the feasibility of constructing additional features in the project area targeted for Phase 2. Because EPA strongly supports Phase I and prospective Phase 2 of the BBCW Project, we rate this DEIS as "LO" (Lack of Objections).	The team continues to look for ways to ensure sufficient freshwater to the project area.
NGO-1	Audubon of Florida, Everglades Foundation, National Parks Conservation Association, Natural Resources Defense Council, Tropical Audubon Society	2-May-10	We suggest a change in the way the DPIR describes the relationship between "expedited construction projects" and CERP. Instead of saying, as it does on p.1-11, "All state expedited construction project" must be specifically authorized by Congress before becoming a part of the Federal DERP…", we believe it would be more accurate to say that state expedited projects must be specifically authorized by Congress (or approved by Congressional committees, in certain instances) before being eligible for funding as CERP projects.	We have replaced the statement "All state expedited construction projects must be specifically authorized by Congress before becoming a part of the Federal CERP" with "State expedited construction must be consistent with the Congressionally authorized CERP project in order to be eligible for funding under the CERP.
NGO-2	Audubon of Florida, Everglades Foundation, National Parks	2-May-10	The DPIR appears to identify, as the WRDA of 2000 (WRDA 2000) requires, the *quantity* of water the project will make available for the natural system.1 It does so by identifying the total amount of water that would be	Section C.3.1.3 will be updated as follows to reflect the concerns with timing and distribution as reflected in this comment: The timing of water will be altered based on the redistribution of the identified diverted canal flow across the wetlands and ultimately into Biscayne Bay. However, the specific changes to the timing have not been

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	Conservation Association, Natural Resources Defense Council, Tropical Audubon Society		diverted from all the canals addressed by the project. DPIR at 8-6, Annex C-46-48 (according to modeling, the total water diverted would range from 113,619 acre-feet per year at the 10th percentile to 282,982 acre-feet per year at the 90th percentile). It is less clear whether it adequately identifies the *timing* or *distribution* of water made available by the project, in that it does not appear to identify precisely when water would be diverted (it does distinguish between a dry year – the 10 percentile year – and a wet year – the 90 percentile year. But it does not specify when during the year water will be diverted, *i.e.*, wet season or dry season) or the areas to which the water would be diverted in a manner that would allow for the protection (under State law) of that "new" water (either in terms of what amount of water particular canals would have diverted, or in terms of the particular wetlands to which water would be diverted). We believe the DPIR should be revised to identify not only the water diverted by the project, but also the places to which and the time at which water is diverted. 1	analyzed as part of the Phase I Project.
NGO-3	Audubon of Florida, Everglades Foundation, National Parks Conservation Association, Natural Resources Defense Council, Tropical Audubon Society	2-May-10	The discussion in the DPIR about the constraints that limit the project's ability to capture water sufficient to meet established salinity targets needs clarification. Although target flows (defined as those needed to maintain specified salinity levels in nearshore Biscayne Bay 517,000 acre-feet/year) are never met by way of the project's diversions, part of the reason for this appears to be that sufficient water is rarely available to meet the target flows (only in the modeled 90th percentile year do total canal flows exceed the target). However, the DPIR indicates that project features are capable of diverting up to 560,000 acre-feet per year, and yet they regularly divert	We have replaced the text in section C.3.1.3 (of Annex C) which read "In general, the features in Phase I use just a portion of the total amount available on any given day. This is especially true in the wet season when runoff is greatest. The project features are not designed to capture all water available, because it would be impractical to install pumps large enough to capture all peak flows" with; "The feature's pump stations were generally sized to accommodate the wet year, wet season median flows which would otherwise be discharged by the coastal structures. The 650 cubic feet per second of total planned pumping capacity has the capability (if run full time) to deliver approximately 91% of the 1,416 acre feet/day which are estimated to be needed to maintain the 20 PSU nearshore target. Unfortunately, excess water is often available only in response to rainfall, and rarely is it available exactly at the design flow rate. Absent identification of additional sources of water, there is little that can be done for the fact that on no, or low, flow days, the pumps will

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			significantly less than this amount. By way of explanation, the DPIR simply reiterates that although "project features are physically capable of using about 560,000 acre-feet per year . . . [,] water is not available on any given day, because it is not cost effective to design pump stations to capture peak flows." DPIR at Annex C-48. There may be many reasons for the project's apparent failure to divert available flows – related to when water is available to be diverted and when water is needed to meet salinity targets, *see e.g.*, DPIR at 6-12, 6-13, 6-14 – but the DPIR is unclear as to precisely what those reasons are. Thus, we believe more explanation is needed for when and why varying amounts of water would be diverted by the project.2	be underutilized, and will be un-able to deliver the targeted flow rate. Without increasing the pumps to a cost prohibitive sizes, there is also little that can be done about the fact that, on high flow days, the pumps stations will have insufficient to capture the peak flows. By way of example, S-123 currently has a wet year median wet season discharge of 109 CFS but has historically experienced peak discharges as high as 2753 CFS. Sizing the pumps to capture these types of flows would increase the pump costs by a factor of approximately 27 and the capacity would go largely un-used." For readability, this paragraph has been inserted just prior to the last paragraph in this section.
NGO-4	Audubon of Florida, Everglades Foundation, National Parks Conservation Association, Natural Resources Defense Council, Tropical Audubon Society	2-May-10	While it appears that the preferred alternative discussed in the DPIR will provide slightly fewer habitat units than the original CERP project plan would have, we are pleased that Alternative O as a whole would provide more than originally expected. *See* DPIR at 6-43. We also believe that changes in water use since CERP's original design and WRDA 2000's passage may affect "baseline" water considerations, which may in turn affect the project's restoration benefits. Therefore, we suggest a determination of any such change in baseline water that is no longer available to the natural system and possible alternatives to recapture any baseline water lost to the natural system.3 *See* DPIR at 6-7 (acknowledging that "Hydrologic modeling results generated by the South Florida Water Management Model indicate that water withdrawals for agriculture and urban uses affect the quantity of fresh water that ultimately flows into Biscayne Bay (SFWMD, 2000)"); *id.* At C-8 (figure showing canal flows reduced from levels in 1995 and at the time of WRDA 2000's	We believe the baseline water available in 2000 has not diminished due to change in water use, specifically for public water supply and domestic self-supply. In 1995, the baseline for the Restudy, the demand for public water supply and domestic self-supply for Miami-Dade County was 398 MGD, see Lower East Coast Regional Water Supply Plan, Appendix B, page B-8. In 2000, the raw water withdrawals were 384 MGD -14 MGD less than in 1995, see Lower East Coast Water Supply Plan 2005-2006 Update, Appendix D, page 20. In addition, the 2005 demands were still below the 1995 baseline and reported at 390 MGD in 2005, id. Compared to the 2000 demands, the 2005 demands remain essentially unchanged with less than a 2% increase. Although water withdrawals for public water supply and domestic self supply do affect the quantity of fresh water that ultimately flows to Biscayne Bay, these demands have decreased since 1995 and have not diminished the baseline water available for Biscayne Bay since completion of the original design of CERP and passage of WRDA.

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			passage).	
NGO-5	Audubon of Florida, Everglades Foundation, National Parks Conservation Association, Natural Resources Defense Council, Tropical Audubon Society	2-May-10	The discussion in the DPIR about whether and when the State of Florida intends to protect "existing water" in the project also needs clarification. The DPIR is clear that the State intends to protect the water the project diverts as the "water made available" by the project in accordance with WRDA 2000. The DPIR also indicates that Florida intends to protect "existing water in the natural system that the DPIR identifies as necessary to achieve the benefits of the project, using resource protection authority under Florida law." DPIR at Annex C-48. The language suggests that the reason for protecting existing water is because that water is needed "to achieve the benefits of the project," but it fails to acknowledge that the DPIR determines what flows are needed, at least to achieve salinity targets – a "more or less constant daily flow of 1,416 acre feet or 517,000 acre-feet per year." DPIR at C-47. We believe the PIR should clearly identify what quantity of existing canal flows Florida is committing to protect as "existing water . . . necessary to achieve the benefits of the project."	Section C.3.1.4 will be revised to reflect the following: As required by Section 385.35 of the Programmatic Regulations for the Implementation of CERP and CERP Guidance Memoranda #4, "Identifying Water Made Available for the Natural System and for Other Water Related Needs," the water made available (diverted) by Phase I of the Project will be protected using the State of Florida's reservation or allocation authority under state law as is represented by the "Total Diverted Canal Flow" line in Figure C-22 of Annex C. The South Florida Water Management District has further committed to protect the difference between the existing water in the system, identified as the "Total Available Canal Flow" and the "Total Diverted Canal Flow" up to the "Target Flow" line under State's reservation or allocation authority. The State is currently determining the most appropriate means for undertaking this protection of water for the natural system.
NGO-6	Audubon of Florida, Everglades Foundation, National Parks Conservation Association, Natural Resources Defense Council, Tropical Audubon Society	2-May-10	Compounding these uncertainties is the final statement in the section of the DPIR addressing compliance with WRDA 2000 that points to the South Florida Water Management District's (SFWMD) plans to "protect water for Biscayne Bay based on the best available science to support the identification of water for the natural system at the time such protection is undertaken. The SFWMD is currently collecting and analyzing the best available science which would be the basis to defining flows to the natural system in Biscayne Bay." DPIR at Annex C-48. Given that the DPIR determines what flows are needed in the area to meet salinity targets, as well as what salinity	As stated in response to NGO -5 above, the South Florida Water Management District is committing to protect water for Biscayne Bay in addition to the WRDA 2000 requirement to protect the water made available by Phase I of the Project. Should the State choose to use its reservation authority, linkages to the protection of fish and wildlife must be made, which requires the use of the best available science at the time that the reservation rulemaking is undertaken. Paragraph C.3.1.4 will be modified to reflect this clarification.

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			targets are, it is unclear what scientific questions the District continues to examine that would "be the basis to defining flows to the natural system of Biscayne Bay." We would be concerned by efforts to revisit the identification of water for the natural system included in this DPIR that might delay project implementation and any reservation of water made available by the project for the natural system. We also note that the need for increased freshwater flows to Biscayne Bay is already well documented; in most years, as the DPIR makes clear, the total available canal flow is insufficient to protect the ecological health of the Bay and additional flow is necessary. However, if the statements listed above explain that the State is planning to reserve additional water, above and beyond what is identified in this DPIR, this should be clarified. We are supportive of any additional efforts to establish a reservation of freshwater to protect the natural system in addition to what is protected by this DPIR.	
NGO-7	Audubon of Florida, Everglades Foundation, National Parks Conservation Association, Natural Resources Defense Council, Tropical Audubon Society	2-May-10	We want to caution, however, that any new sources of water utilized for future phases of the project must meet water quality standards so as not to exacerbate water quality problems in Biscayne Bay. In particular, any consideration of waste water reuse as a potential source of freshwater for the Bay must be fully investigated, including for purposes of setting adequately stringent standards in the event that reclaimed water does have a role to play in replenishing the Bay. It is also critical to continue to look for other alternative water sources for the Bay, while ensuring that any potential sources of water are not permitted away to other users. As freshwater enters the Bay through more natural means, as planned by this and hopefully future phases of the project, this water will have a longer residence time in the	The Federal and non-Federal sponsor recognize that any new sources of water utilized for future phases of the project must meet water quality standards so as not to exacerbate water quality problems in Biscayne Bay, and that waste water reuse as a potential source of freshwater for the Bay must be fully investigated. The team agrees that freshwater entering the Bay through more natural means, will likley have a longer residence time, and that the search for additional freshwater sources needs to continue both inside, and outside of, CERP This DPIR does not consider any new or different sources of water, but utilizes existing canal flows. If a second phase is formulated, new or additional sources of water may be considered for expanded features together with appropriate water quality criteria that may be required. The project is not expected to alter residence times of tidal waters within Biscayne Bay

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			Bay. Instead of being delivered at higher velocities further out to the Bay by point canal discharges that are picked up by marine currents and diluted, it will remain in the near shore area for longer periods of time. Thus, while we encourage every possible source of freshwater be evaluated for use in this project, we reiterate that any such water must be of acceptable quality.	
NGO-8	Audubon of Florida, Everglades Foundation, National Parks Conservation Association, Natural Resources Defense Council, Tropical Audubon Society	2-May-10	As the DPIR Volume 1 states that sea level rise is expected to result in a 17% decrease in average annual benefits over the 50-year life of project, it is critical to evaluate the effects of sea level rise for future project planning. Completing Phase I and future phases of this project will reduce the impact of sea level rise on Biscayne Bay coastal wetlands by creating a freshwater head that will push back on saltwater intrusion induced by rising seas. Further, once these habitats are restored, they will also be more able to cope with slow changes such as sea level rise. One of the most important reasons to expedite BBCW Alternative O is the potential to reduce the effects caused by sea level rise and saltwater intrusion.	The evaluation of the impact of sea level rise (SLR) on the project benefits is a qualitative estimate using the information currently available. The analysis conducted for the PIR was to determine the impact of SLR on the ecosystem benefits for which the project is intended. The fact that the project will provide increased quantities of fresh water that will slow the intrusion of saltwater into the ground water is probably correct.
NGO-9	Audubon of Florida, Everglades Foundation, National Parks Conservation Association, Natural Resources Defense Council, Tropical Audubon Society	2-May-10	As there are numerous factors contributing to saltwater intrusion in the project area, it is also relevant to evaluate those factors. The practice of the seasonal agricultural canal drawdown, rock mining, and Florida Power and Light's proposed nuclear Power Plant expansion at Turkey Point all pose serious concerns that could limit the success of this restoration project. Thus it is worthwhile to evaluate, monitor, and limit the impacts of land uses in the region in order to reduce the impacts of sea level rise on the BBCW project. A water reservation, as discussed above, will help ensure that water is available for the success of this and future phases of the project, and to maintain the health of this estuary.	The Federal and non-Federal sponsor recognize that there are numerous factors contributing to saltwater intrusion in the project area, and that the selected plan will only partially mitigate the effects of some of these factors. The Federal and non-Federal sponsors are both charged, through their regulatory roles, to evaluate regulated activities which could contribute to saltwater intrusion. The non-federal sponsor, SFWMD, has recently begun exploring the possibility of making modifications to the seasonal drawdown practice for possible implementation, either in future CERP projects, or outside of CERP. The non-federal sponsor has also recently worked with the Florida Department of Environmental Protection, and FP&L to significantly expand monitoring in and around Turkey Point, which will assist in identifying historical impacts, and to assist in developing future recommendations regarding power plant expansion. The non-Federal sponsor is currently also investigating the most effective way to ensure that water is available for the success of this project, and to

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				maintain the health of this estuary..
NGO-10	Audubon of Florida, Everglades Foundation, National Parks Conservation Association, Natural Resources Defense Council, Tropical Audubon Society	2-May-10	We reiterate that Phase I of the BBCW project alone is not nearly enough to restore Biscayne Bay. The availability of water for diversion into the project features is a significant source of uncertainty for success of the project (DPIR, page xi). It is imperative that sources of additional 4 freshwater for Biscayne Bay are identified to both secure the investment in this project, and for future phases of the BBCW project. Phase I includes no water storage features and the need for storage to provide dry season flows must be included in the next phase of the project. Additionally, a critical component to completing future restoration activities in this region is further land acquisition, which will allow for Alternative O as it is envisioned without changes to the project footprint.	The Federal and non-Federal sponsor recognize that the selected plan is insufficient to fully restore Biscayne Bay, and remain committed to search for additional freshwater sources. We have noted the recommendation that future BBCW projects should included storage to supplement dry season flows. Although we believe this particular management measure will likely be part of the suite of measures used to formulate future alternatives, committing to include storage, at this point in time, could be considered pre-decisional. The Federal and non-Federal sponsor understand the need to continue land acquisition so as not to foreclose on future BBCW restoration efforts. Most recently, the non-Federal sponsor completed advance acquisition of 129.88 acres outside the Phase I footprint at a cost of $24.5 Million.
NGO-11	Audubon of Florida, Everglades Foundation, National Parks Conservation Association, Natural Resources Defense Council, Tropical Audubon Society	2-May-10	A robust monitoring plan is also vital to determine the success of the project. Therefore, the projected $657,975 cost increase for a comprehensive monitoring plan is justified in order to observe the future ecological response in the Bay. We applaud the Project Delivery Team's efforts to improve the monitoring plan and increase its funding, as otherwise the project benefits could not be quantified without these improvements or properly managed through an adaptive management program in the future. We support the inclusion of ecological indicators, such as oysters, as well as increasing sampling frequencies as necessary. Adequate monitoring is the key to demonstrating success of the project and appropriately planning for future phases of the project.	In response to independent peer review comments regarding the project monitoring plan, the PDT expanded the plan to include additional monitoring locations and for a longer period of time (from 5 to 10 yrs.).
NGO-12	Audubon of Florida, Everglades Foundation,	2-May-10	Finally, this project cannot be considered in a vacuum, rather, it should be considered with other restoration projects designed to benefit the southern Everglades (including the C-111	The Federal and non-Federal sponsor share your belief that the BBCW, C-111 Spreader Canal, and other efforts not be considered independently. CERP projects, in particular, are required to be formulated for system wide benefits. We would like to assure you that

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	National Parks Conservation Association, Natural Resources Defense Council, Tropical Audubon Society		Spreader Canal project) as well as other efforts which contribute to the overall success of restoring more natural delivery patterns and quantities of freshwater to Biscayne Bay and its coastal wetlands. BBCW Alternative O has limited restoration benefits for the Model Lands, and Phase I does not have any features that addresses hydrologic issues in the Model Lands. Phase II is an opportunity to improve hydrologic conditions in the Model Lands. With this in mind it is imperative that planning for Phase II of both BBCW and the C-111 Spreader Canal begin as soon as possible and are coordinated together in a manner that will benefit the Model Lands, South Dade wetlands, and Biscayne and Florida Bays. BBCW Phase I is a critical first step toward re-establishing more historical conditions in Biscayne Bay by increasing the ecological productivity of the Bay and creating a more estuarine environment in certain areas. Thus, we support the expeditious implementation of this restoration project.	Planning for Phase II of both BBCW and the C-111 Spreader Canal will begin as soon as possible given the Federal and non-federal sponsor's other priorities, mandates, and missions. We thank you for your continued participation in, and support of, these important restoration projects.
FFWCC-1	Florida Fish and Wildlife Conservation Commission	27-Apr-10	In order to ensure efficient adaptive management throughout the life of the project, we recommend that the monitoring program be extended beyond five years. Ultimately, monitoring should at least continue until the project has fully reached equilibrium and all ecological targets have been achieved.	The PDT has expanded the period of monitoring from five to ten years in a revised project monitoring plan.
FFWCC-2	Florida Fish and Wildlife Conservation Commission	27-Apr-10	The current extent and characterization of the nearshore hardbottom communities are not well described in the DPIR/DEIS. We recommend the final PIR/EIS include a thorough description of existing communities and an assessment of predicted impacts to these communities within the project area of influence, they be added to the monitoring plan and be considered in the adaptive management plan.	The nearest hardbottom community with sensitive soft corals and sponges is estimated to be more than three kilometers offshore from a project component. Current salinity impacts to these sensitive hardbottom communities are expected to be reduced as a result of the project. Since the benefits are likely to be subtle, neither the PDT nor RECOVER teams could determine an effective approach to measure these changes. Rather, the PDT is relying on simulated salinity results with and without project to conclude that the salinity patterns resulting from the project will be beneficial to soft corals and sponges.
FFWCC-3	Florida Fish and	27-Apr-10	The proposed construction of this project has	Water levels in the primary canals will not be altered significantly by

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	Wildlife Conservation Commission		the potential to have detrimental effects on manatees beyond the loss of existing habitat. We recommend that adverse impacts to manatees during construction due to construction activities be minimized by using the 2009 FWC Manatee Construction Conditions and the 2006 Guidelines for Manatee Conservation during CERP Implementation. It is currently unclear which structures proposed for construction will be accessible to manatees and if these structures would pose any threat. It is also not clear to what degree water levels in the existing canals will be modified through the pumping of water from them into the L-31E canal. Significant changes in water levels may result in entrapments or strandings of manatees within the canals.	the project. Water levels within portions of the L-31E borrow canal may be higher on average after the project, but not above top of bank. However, due to the potential accessibility of manatees in the L-31 East Canal all required safety measures will be implemented during construction to ensure manatee health. In addition detailed designs for culverts, pump stations and weirs will include manatee protection measures.
FFWCC-4	Florida Fish and Wildlife Conservation Commission	27-Apr-10	To complete our assessment of the proposed project and determine if additional manatee conservation measures are warranted, the following information is required for permitting purposes. We also recommend that they be addressed, at least at the conceptual level, in the final PIR/EIS.	Detailed design documents will include all required manatee protection measures.
FFWCC-5	Florida Fish and Wildlife Conservation Commission	27-Apr-10	What measures will be used to prevent manatee access to the spreader canal in the C-100 extension?	This portion of the project has been permitted and is currently under construction. Please see Biscayne Bay Coastal Wetlands-Phase 1 final design dated 10/23/09.
FFWCC-6	Florida Fish and Wildlife Conservation Commission		Please provide diagrams of the proposed pump stations S-700, S-701, S-703, S-709, S-710, and S-711 and a description of how manatee entrapment or impingement will be prevented.	Pump S-700 has been permitted and is currently under construction. Pump S-701 has been designed and is currently being permitted. Please see Biscayne Bay Coastal Wetlands-Phase 1 final design dated 10/23/09 and Biscayne Bay Coastal Wetlands-Phase 1 Cutler Wetlands C-1 Flow Way final design dated 10/23/09 for examples of manatee protection measures.
FFWCC-7	Florida Fish and Wildlife Conservation Commission		Please provide diagrams and operational information on the siphon pumps proposed at S-707 and the Riser Culvert at S-705 and any manatee protection measures that may be planned to be implemented at these structures.	Detailed design documents that will contain diagrams and manatee protection measures for S-707 and S-705 have not yet been produced. They will include all required manatee protection measures. Please see Annex D, Draft Project Operating Manual for proposed operations.
FFWCC-8	Florida Fish and Wildlife		Please provide diagrams of the proposed box culvert C-702 that will be used on the L-31E	Culvert S-702 is currently being permitted. Please see Biscayne Bay Coastal Wetlands-Phase 1 Cutler Wetlands C-1 Flow Way final

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	Conservation Commission		canal and any manatee protection measures that may be planned to be implemented at this structure.	design dated 10/23/09.
FFWCC-9	Florida Fish and Wildlife Conservation Commission		How will the water levels in the C-100, C-102, Military Canal and the C-103 be affected by the removal of water from these canals?	Water levels within the C-100, C-102 and C-103 canals will be maintained according to the existing water level operating criteria. Please see Annex D, Draft Project Operating Manual for proposed operations.
FFWCC-10	Florida Fish and Wildlife Conservation Commission		If the project is implemented, what is the expected change in the frequency of the opening/closing of the gates on the salinity control structures on the C-100, C-102, C-103 and military canals?	The frequency of openings of S-123, S-21A and S-20F are expected to be less than existing due to the operation of pumps upstream which will divert water prior to discharge. This is expected to improve manatee health, but cannot be quantified. Operation of S-20G (Military Canal) is not expected to change.
FFWCC-11	Florida Fish and Wildlife Conservation Commission		If blasting is required during construction, the applicant is required to follow the Guidelines for the Protection of Marine Animals during the Use of Explosives in the Waters of the State of Florida, which may be found in the 2006 Guidelines for Manatee Conservation during CERP Implementation.	No blasting is expected, however, if it becomes necessary all required protection measures will be employed.
FFWCC-12	Florida Fish and Wildlife Conservation Commission		Closure of the L-31E Canal between S-703 and S-709 could result in the entrapment of manatees within this area. The Guidelines to Minimize/Avoid Manatee Entrapment found in the Guidelines for Manatee Conservation during CERP Implementation document will be required to minimize the risk of manatee entrapment if this project is implemented.	Concur. Due to the potential accessibility of manatees in the L-31 East Canal all required measures, including manatee exclusion gates, will be designed into the features to ensure manatee health.
FFWCC-13	Florida Fish and Wildlife Conservation Commission		Due to the potential to injure or kill eastern indigo snakes during construction, please ensure that contractors are aware of the potential presence of eastern indigo snakes, have information available to identify them, and that plans are in place to cease all activities in the event that a snake is observed until it has cleared the area.	All required measures will be designed into the features to ensure indigo snake health.
FDACS-1	Florida Department of Agriculture and Consumer Service	29-Apr-10	Both federal and state laws require protection of certain water supply and flood control benefits in the implementation of CERP projects. Section 373.1501(5)(d), Florida Statutes, requires the South Florida Water Management District (SFWMD), in its role as the local sponsor, to provide reasonable assurances that existing Levels of Service for	We share FDACS concern with respect to preserving existing levels of flood protection. Please recall that the pumps which will serve the reach of L-31E between C-103 and C-102 are intended to pass water from the C-102 and C-103 canals (which serve the adjacent agricultural areas) to Biscayne Bay via the 8 culverts proposed to be installed through the eastern canal levee (as opposed to permanently staging water within the canal reach).

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			Flood Protection (LOSFP) will not be diminished by implementation of CERP projects. The L-31E Flow Way Flood Protection Analysis did not include an analysis of potential impacts to the existing LOSFP within the subsurface root zone of adjacent crop lands. Maintaining the existing LOSFP within this zone is critical to avoid project induced flooding damages to the private agricultural lands in the project area. The flood analyses for the L-31E North and South Segments only addressed surface water elevations and the potential to overtop the L-31E levees on either side. The North Canal Impounded Wetlands flood analyses only considered whether water levels were either above or below ground. In order to address the model uncertainty inherent in the project evaluation process and the lack of flood analysis in the root zone area, we would like to see project assurances to protect private agricultural lands from project related flood protection losses. There were similar concerns regarding implementation of the C-111 Spreader Canal Western Project and the approach taken there to provide assurances that flood protection would be maintained may also be necessary for the Biscayne Bay Coastal Wetlands Project.	Please also recall that, as described in Section D.8 (of Annex D), in anticipation of heavy rainfall based on National Weather Service Advisories and SFWMD forecasts, the canal levels, including those in the L-31E, would be drawn down as much as practicable in order to allow for the maximum amount of canal and groundwater storage.
FDACS-2	Florida Department of Agriculture and Consumer Service	29-Apr-10	Items (1) – (5) below provide additional comments by FDACS staff regarding excerpts from the Biscayne Bay Coastal Wetlands Phase 1 Draft Integrated Project Implementation Report and Environmental Impact Statement, March 2010. The following comments are related to the agricultural lands adjacent to the L-31E Flow	The text described has been replaced with the following; "Both federal and state laws require protection of certain water supply and flood control benefits in the implementation of CERP projects. Section 373.1501(5)(d), Florida Statutes, requires the South Florida Water Management District (SFWMD), in its role as the local sponsor, to provide reasonable assurances that existing Levels of Service for Flood Protection (LOSFP) will not be diminished by implementation of CERP projects.

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			Way project, the southernmost project area for the Tentatively Selected Plan selected, Alt. O Phase 1. (1) Text implying a reduction in existing flood protection The text underlined below indicates that existing levels of service for flood protection may be reduced through operational changes if it does not require a change in the operating rules, and implies that it is acceptable to no longer manage canal water levels to reduce flood damages due to storm events. If a modification to historic operating regimes is proposed that results in an increased flooding risk to adjacent lands, the project fails to maintain the existing level of service for flood protection as required by Section 373.1501(5)(d), Florida Statutes. *Main report: Section 3- Existing Conditions/Affected Environment* *3.1.5.2 Flooding – Page 3-18* *Water levels in canals in the study area are typically controlled at the lower end of the authorized range to provide additional storage within the canal and surficial aquifer in case of storm events. Therefore, project related changes in typical canal stages may not necessarily be considered a change in level of service of flood protection unless the authorized operating rules are changed.*	As a result of FDACS concerns, as described in the response to FDACS-1, the Hydrometeorological Monitoring Plan (Annex E Part 1) has been revised to include two real time telemetric monitoring wells in the adjacent agricultural lands (subject to agreement execution), and the Draft Project Operating Manual (Annex D) has been revised to describe how this canal reach will be adaptively managed to ensure no adverse impacts to existing levels of flood protection until one (or more) of the following events has occurred; 1) Detailed engineering studies performed during the Advance Planning Phase confirm that pumping into the reach of L-31E between C-102 and C-103 will not adversely affect existing levels of flood protection provided to privately owned lands west of L-31E; 2) privately owned lands west of L-31E are provided equivalent flood protection through alternative means; and/or 3) affected lands are acquired in support of the project. .
FDACS-3	Florida Department of Agriculture and Consumer Service	29-Apr-10	(2) Outstanding design issue needing resolution The outstanding design issues described below still needs to be resolved. *Main report: Section 7* – The Tentatively Selected Plan *7.7.3 Outstanding Design Issues – Page 7-21* *Further detailed data collection is required for several existing culverts that were discovered late in the design process. These*	The text described has been replaced with the following text; "Further investigations regarding the function of several existing culverts will need to be completed during the Advance Planning Phase of the project which precedes Preliminary Design. These culverts are located on the western side of the L-31 E Borrow Canal, between C-102 and C-103, and may continue to serve privately owned lands west of L-31E. As described in the revised Draft Project Operating Manual (Annex D), the project will be adaptively managed to ensure no adverse impacts to existing levels of flood protection until one (or more) of the following events has occurred; 1) Detailed engineering

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			culverts are located on the western side of the L-31 E Borrow Canal, between C-102 and C-103. These culverts have the potential to affect the extent that the L-31 E Canal water levels can be raised. A recent site visit seemed to show that these culverts are no longer needed for drainage of lands to the west of L-31 E Canal, however additional study is needed to assure the flood control for the area is not diminished and the full potential benefits of the proposed L-31 E Culverts are realized.	studies performed during the Advance Planning Phase confirm that pumping into the reach of L-31E between C-102 and C-103 will not adversely affect existing levels of flood protection provided to privately owned lands west of L-31E; 2) privately owned lands west of L-31E are provided equivalent flood protection through alternative means; and/or 3) affected lands are acquired in support of the project.
FDACS-4	Florida Department of Agriculture and Consumer Service	29-Apr-10	(3) The L-31E Flow Way project components do not include analyses for potential increases in root zone flooding for adjacent private agricultural lands. We would like to see this oversight and the uncertainty inherent in model simulations addressed by a commitment to develop a real world strategy that will avoid any project-related flood protection losses to private agricultural lands. The C-111 Spreader Canal Western Project has already encountered similar issues and may help identify a strategy to address them. 3a) The L-31E Northern Segment and the L-31E Southern Segment flood analysis lacks any evaluation of groundwater levels in the root zone. There is a lack of seepage analyses and subsequent groundwater level interactions regarding the L-31E canal project components. The analyses in the Draft PIR/EIS only addresses surface water elevations and the potential that the L-31E levees will be overtopped on both the east and west side. Because the project will isolate sections of the L-31E and elevate the surface water elevations higher than what is possible under existing conditions, seepage impacting groundwater levels is also a concern.	As described in the responses to FDACS-3 and FDACS-4, the Hydrometeorological Monitoring Plan (Annex E Part 1) has been revised to include two real time telemetric monitoring wells in the adjacent agricultural lands (subject to agreement execution), and the Draft Project Operating Manual (Annex D) has been revised to describe how this canal reach will be adaptively managed to ensure no adverse impacts to existing levels of flood protection until one (or more) of the following events has occurred; 1) Detailed engineering studies performed during the Advance Planning Phase confirm that pumping into the reach of L-31E between C-102 and C-103 will not adversely affect existing levels of flood protection provided to privately owned lands west of L-31E; 2) privately owned lands west of L-31E are provided equivalent flood protection through alternative means; and/or 3) affected lands are acquired in support of the project.

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			Annex C - Analyses Required by Water Resources Development Act of 2000 and State Law *The L-31E Northern Segment (C-102 to Military Canal) and the L-31E Southern (Military Canal* *to C-103) on pages Annex C–11 through Annex C-15 & pages C-30 through C-33.*	
FDACS-5	Florida Department of Agriculture and Consumer Service	29-Apr-10	3b) The North Canal Impounded Wetlands flood analysis has a great degree of uncertainty given the crop damages a grower can experience due to root zone flooding. Only above ground or below ground elevations were considered. For the "best" scenario in wet years, this analysis shows an increase of above ground water levels for 20 more acres and an increase of water levels above ground from 99 days to 150 days. Another source of information is the South Dade test impoundment north of the project's North Canal Impounded Wetlands. While useful to some degree, uncertainty is introduced due to the seepage variations inherent in the project area and that the test impoundment is much smaller than the project's North Canal Impounded Wetlands component. *Annex C - Analyses Required by Water Resources Development Act of 2000 and State Law* *Pages Annex C-15 through C-25 & pages C-33 thru C- 44* *The excerpt below is from Annex C - page Annex C-44:* *"The results shown here should be used in a relative or comparative sense that is the basis of the Savings Clause analysis. Due to typical uncertainties in model input parameters such as topography, hydrogeology and rainfall, the area that would experience an increase in flooding based on model results is not definitive from*	The referenced modeling indicates that the western 411' (25+/- acres) would generally experience stage increases on the order of 0.2' over approximately 2/3 of the year for very wet years (e.g. 1995). It appears as if this land is not currently in agricultural production, and may have reverted to jurisdictional wetlands. Independent of the current land use, as described in response to FDACS-1, and the Draft PIR/EIS, the selected plan includes a seepage collection canal immediately west of the seepage canal to provide an additional level of assurance. It is the teams' intent to optimize the design of this seepage canal so as to render the proposed wetland enhancements neutral from an adjacent flood protection standpoint. The discussions regarding modeling uncertainty were merely an attempt to caution against relying purely on the values predicted by the model, and the relative merits of using the model to model comparisons which were employed.

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			an absolute perspective. The estimated area of impact is determined both by the stages predicted by the model and the topographic data. FIGURE C-20 shows the standard deviation, within each MODBRANCH cell, of the light detection and ranging (LIDAR) data that were used as a source of topographic information. It is clear that the most accurate values have a standard deviation of +/- 0.25 feet, and some areas have variation of more than one foot. Therefore, one should use these simulated results on a comparative basis, and absent long term monitoring data for both the base and tentatively selected plan conditions, only represent simulated results that are limited by the uncertainties of the assumptions and data used in the model. The model simulations for the North Canal Impoundment suggest that under some conditions, maximum water stages within the wetland (i.e. 2.0 feet above land surface) may result in small increases of stages immediately outside the impoundment. The model results show that water stages adjacent to the impoundment respond to different configurations. It is likely that by designing an optimum configuration and managing water levels within the impoundment, significant and adverse offsite effects can be eliminated, if necessary	
FDACS-6	Florida Department of Agriculture and Consumer Service	29-Apr-10	"No modification to current seasonal operational criteria" operational constraint consistency. The section in the DPOM describing constraints for the L-31E Flow Way canal segments is inconsistent between the north and south segments. For the North Segment, constraints that will be incorporated into the L-31E culverts operations include "No modification to current seasonal operational criteria". We would like to see this constraint also stated in section D.5.5	The text cited has been revised in section D.5.4 (of Annex D) to read "No recommended plan-driven modifications to current seasonal operational criteria", and the same text was added to section D.5.5 (which addresses the south segment).

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			describing operational constraints for the South Segment. *Annex D – Draft Project Operating Manual L-31 Features D.5.4 & D.5.5 – Pages Annex D-10 thru D-11*	
FDACS-7	Florida Department of Agriculture and Consumer Service	29-Apr-10	Operational text regarding water shortages The last sentence underlined in the paragraph below appears to be unnecessary and confusing. We are unclear as to what is being recognized and how it would be implemented. If water shortage operations are to be addressed, then a simple statement saying "In the event of a water shortage declaration, the SFWMD Water Shortage Plan will be followed" would suffice. *Annex D – Draft Project Operating Manual – Section D.7.1- Page D-12* *(And the sentence is repeated at the end of Section D.7.1.6 – page Annex D-17)* *"The intent of the Biscayne Bay Coastal Wetlands project operations is to allow for meeting environmental demands without adversely impacting other water related needs. The initial operating regime is defined as reflecting the hydrologic regime in the south Florida ecosystem at the time a CERP project Recommended Plan is selected. The Biscayne Bay Coastal Wetlands project will become an integral part of a water management system and, for Phase I, which includes the Deering Estate, and Cutler Wetlands (C-1 and C-100) Flow Way components. The operation of Phase I, water management features will be in accordance with the Central and Southern Florida Master Water Control Manual for East Coast Canals, Volume 5, and the SFWMD Operations Control Center Structure Book. Each individual element is expected to work in concert with one another. It is recognized that both*	As requested, the sentence in Section D.7.1 (of Annex D) which read "It is recognized that both environmental and existing legal uses may need to be met simultaneously in consideration of existing water shortage rules" has been replaced with; "In the event of a water shortage declaration, the SFWMD Water Shortage Plan will be followed."

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			environmental and existing legal uses may need to be met simultaneously in consideration of existing water shortage rules. *The water deliveries anticipated for the Biscayne Bay Coastal Wetlands project features are expected to become an important part of the water budget of this region. As a general operational strategy, project features for the Biscayne Bay Coastal Wetlands project are expected to redistribute water when water is available."*	
FDEPBBAP-1	Florida Department of Environmental Protection Biscayne Bay Aquatic Preserve Biscayne Bay Environmental Center	3-May-10	Additional monitoring in the Deering Estate footprint should be considered as opposed to monthly monitoring, such as continuous monitoring using a datasonde when water is actively flowing in order to capture changes in salinity associated with operation of the water control structures. Use of an instrument like a datasonde will also allow for other parameters to be measured more frequently over time, such as dissolved oxygen and nutrients which may alleviate concerns about the quality of water being received through the coastal wetlands. At this time ecological monitoring is only planned for five years, and may need to be extended or enhanced as necessary depending on how closely the ecological response observed meet intended targets.	The project monitoring plan includes continuous monitoring of water levels and salinity for the Deering Estate component. Monthly monitoring of water quality has been deemed to be adequate by the PDT and regulatory agencies as a long period of record of canal water quality from the C-100 canal (source water) does not indicate significant degradation of water quality. A revised project monitoring plan extends the monitoring time frame from five to ten years.
FDEPBBAP-2	Florida Department of Environmental Protection Biscayne Bay Aquatic Preserve Biscayne Bay Environmental Center	3-May-10	Annex C of the Draft Integrated Project Implementation Report (PIR) defines the water that is being legally protected from future consumptive uses or other allocations as only the water that makes up the "Total Diverted Canal Flow" and may mean that water needed for the project in the future is unavailable because it has not been set aside for use in restoration. Protecting the water that comprises the "Total Available Canal Flow" will help ensure that all of the	Section C.3.1.4 will be revised to reflect the following: As required by Section 385.35 of the Programmatic Regulations for the Implementation of CERP and CERP Guidance Memoranda #4, "Identifying Water Made Available for the Natural System and for Other Water Related Needs," the water made available (diverted) by Phase I of the Project will be protected using the State of Florida's reservation or allocation authority under state law as is represented by the "Total Diverted Canal Flow" line in Figure C-22 of Annex C. The South Florida Water Management District has further committed to protect the difference between the existing water in the system, identified as the "Total Available Canal Flow" and the "Total

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			freshwater necessary to meet the water quality and salinity targets identified in the PIR will be met as the projects included in Phase I, and eventually Phase II, are implemented. It is important to note that freshwater is received by Biscayne Bay along the length of the bay through groundwater inputs and canals, and the quantity and timing of freshwater deliveries received in the northern part of Biscayne Bay must remain intact in order for this part of the bay to maintain a healthy and viable ecosystem as historic groundwater inputs have been severely cut back over time.	Diverted Canal Flow" up to the "Target Flow" line under State's reservation or allocation authority. The State is currently determining the most appropriate means for undertaking this protection of water for the natural system.
NOAA-1	U.S. Department of Commerce National Oceanic and Atmospheric Association	23-Apr-10	However, we recommend that the final version of the EFH assessment provide habitat characterization information for the 101 acres of wetlands that would be impacted during construction. We understand that this information is provided in the U.S. Fish and Wildlife Service's concurrence letter on the Biological Assessment (provided in Annex A, starting on page 4-58), however, NMFS recommends incorporating this wetland habitat characterization information into the EFH assessment so that the Jacksonville District's determination regarding effects to EFH would be more clearly articulated.	Agreed. A table listing impacted wetlands by component will be added to the document to address EFH concerns.

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FOR CONTINUATION OF HOUSE DOCUMENT 112-145

BISCAYNE BAY COASTAL WETLANDS FINAL INTEGRATED PROJECT IMPLEMENTATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT

SEE VOLUME 3