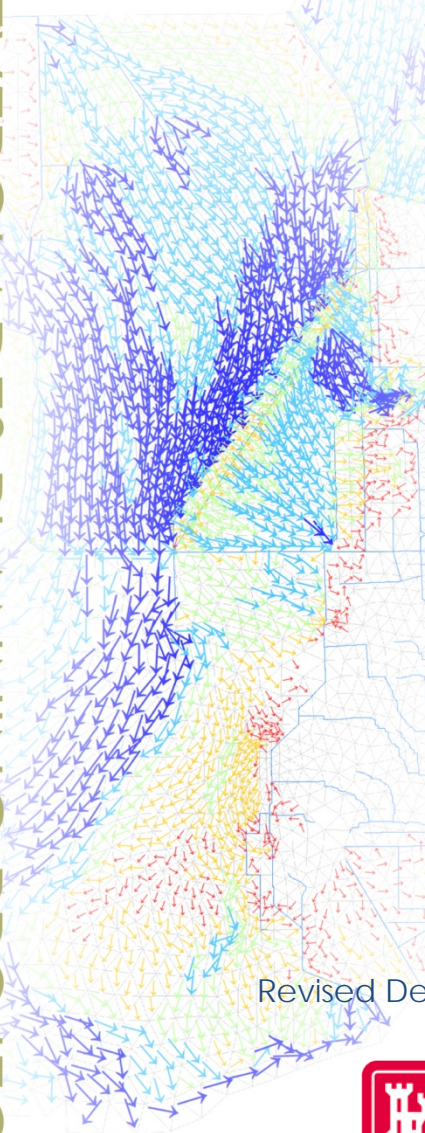


RESTORING THE HEART OF THE EVERGLADES

CENTRAL EVERGLADES PLANNING PROJECT

COMPREHENSIVE EVERGLADES RESTORATION PLAN
CENTRAL EVERGLADES
PLANNING PROJECT
FINAL INTEGRATED PROJECT
IMPLEMENTATION REPORT
AND ENVIRONMENTAL
IMPACT STATEMENT



July 2014
Revised December 2014



Cover insets (left to right):

Landscapes: Lake Okeechobee, Water Conservation Area 3, Everglades National Park, Florida Bay;

Map: Depicts Average Annual Overland Flow across the period of record (1965-2005) for existing conditions, as modeled by the CEPP regional hydrologic model (the coloration of the arrows represents the relative volume of flow, while the direction of the arrows represents the movement of flow across the landscape); **Small Landscapes:** Ponding, soil oxidation (peat reduction), dry area of Everglades National Park, juxtaposition of urban development.

**CENTRAL AND SOUTHERN FLORIDA PROJECT
COMPREHENSIVE EVERGLADES RESTORATION PLAN
CENTRAL EVERGLADES PLANNING PROJECT
FINAL INTEGRATED PROJECT IMPLEMENTATION REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT**

**ADDENDUM
DECEMBER 2014**

Following are updated costs and benefits of the Recommended Plan, escalated to FY15 price levels.

The total project first cost¹ of the Recommended Plan from the final PIR/EIS, escalated to FY15 price levels, is estimated at \$1,951,000,000. Total first cost for the ecosystem restoration features is estimated to be \$1,944,000,000, and for recreation is estimated to be \$6,600,000. In accordance with the cost-sharing requirements of Section 601(e) of the WRDA 2000, as amended, the Federal cost of the Recommended Plan is \$976,375,000 and the non-Federal cost is \$974,625,000. The Federal cost includes \$1,750,000 for cultural resources data recovery represented at 100% federal responsibility. The estimated lands, easements, right-of-way, and relocation (LERRs) costs for the recommended plan are \$37,000,000.

Based on FY15 price levels, a 50-year period of economic evaluation and a 3.375% discount rate, the equivalent annual cost of the proposed project is estimated to be \$102,600,000, which includes OMRR&R, monitoring, interest during construction and amortization, and is inclusive of recreation costs.

The Recommended Plan will produce an average annual increase of 280,094 habitat units per year at an annual cost of \$102,300,000. The average annual cost per average annual habitat unit is \$365. Based on these parameters, the Central Everglades Planning Project is justified by the environmental benefits derived by the South Florida ecosystem. The recreation first cost of the recommended plan is \$6,600,000. The average annual cost for recreation is \$355,000 and average annual net benefits are \$569,000. The benefit to cost ratio for the proposed recreation features is approximately 1.6 to 1.

¹ Construction costs have been rounded to the nearest million

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**CENTRAL EVERGLADES PLANNING PROJECT
FINAL INTEGRATED PROJECT IMPLEMENTATION REPORT
AND ENVIRONMENTAL IMPACT STATEMENT**

Dated July 2014

**ERRATA SHEET
December 2014**

The following corrections, clarifications and augmentations are made to the Final Integrated Project Implementation Report and Environmental Impact Statement:

Main Report, Executive Summary

Page ES-7. The text in the last sentence of the third paragraphs says “This includes the Seminole Indian Tribe of Florida’s Big Cypress Reservation and the Miccosukee Tribe of Indians of Florida’s reservation areas and resort.” The text was changed to “This includes the Seminole Tribe of Florida’s Big Cypress Reservation and the Miccosukee Tribe of Indian of Florida’s reservation and resort”.

Page ES-14. The text in the last sentence says “To ensure that the recommended plan meets State water quality standards, discharge permit with associated effluent limits will govern discharges from the State facilities.” The text was changed to “To ensure that the recommended plan meets State water quality standards, NPDES discharge permits and Everglades Forever Act Watershed permits with associated effluent limits will govern the Stormwater Treatment Area discharges from State facilities.”

Main Report, Section 2.6 Native Americans

Page 2-20. The text in the third sentence says “Members of the Seminole Tribe of Florida have several reservations in the State of Florida as well as an easement in WCA 3A for such purposes as hunting, fishing and frogging.” The was changed to “...for such purposes as hunting, trapping, fishing and frogging.”

Main Report, Section 6.8.2.1 Savings Clause – Water Supply From Existing Legal Sources

Page 6-77. Text in the second bulleted item says, “...the Seminole Indian Tribe of Florida...”. The text was changed to “...the Seminole Tribe of Florida...”.

Main Report, Section 6.8.2.2 Savings Clause: Flood Protection

Page 6-79. Text in the forth sentence says, “...the Seminole Indian Tribe of Florida...”. The text was changed to “...the Seminole Tribe of Florida...”.

Appendix A, Section A.3.2 Recommendation for Design Completion

Page A-13. The text in the second sentence says “All project components will be optimized during PED phase for cost efficiency and performance, incorporating updated data and

information as it becomes available.” New text was added immediately following the above sentence “Prior to finalizing design, an economic analysis will be conducted on pump station components to be in compliance with EM 1110-2-3102”. The last sentence remains unchanged, “Design completion recommendations are provided by geographic region and discipline specific areas.”

Appendix A, Section A.5.3.3.2.1.4 Pump Stations

Page A-39. The text in the fourth sentence of the third paragraph says “The diesel engine driven pumps are required per SFWMD Major Pump Station Engineering Guidelines.” The text was changed to “The diesel engine driven pumps are required per EM’s, ER’s and jointly developed DCM-5, Major Pump Station Engineering Guidelines.”

Appendix A, Section A.5.4.1 General Status of Completed and Non-Executed Efforts

Page A-54. The text in the last sentence of the first paragraph says “The structural design will conform with the appropriate Engineering Manual (EM), Engineering Regulations (ER), or Design Criteria Memorandums (DCM).” The text was changed to “The structural design will conform with the appropriate Engineering Manual (EM), Engineering Regulations (ER), and Design Criteria Memorandums (DCM).”

Appendix A, Section A.6.4.1 General Status of Completed and Non-Executed Efforts

Page A-83. The text in the last sentence of the first paragraph says “The structural design will conform with the appropriate Engineering Manual (EM), Engineering Regulations (ER), or Design Criteria Memorandums (DCM).” The text was changed to “The structural design will conform with the appropriate Engineering Manual (EM), Engineering Regulations (ER), and Design Criteria Memorandums (DCM).”

Appendix A, Section A.7.3.3.2.1 .3 Pump Stations

Page A-114. The text in the last sentence of the first paragraph says “The design condition of 1,000 cfs will be achieved with two 500 cfs diesel engine driven pumps, with one 500 cfs diesel engine to serve as a redundant pump unit, per SFWMD Major Pumping Station Engineering Guidelines.” The text was changed to “The design condition of 1,000 cfs will be achieved with two 500 cfs diesel engine driven pumps, with one 500 cfs diesel engine to serve as a redundant pump unit, per EM’s, ER’s and jointly developed DCM-5, Major Pumping Station Engineering Guidelines.”

Appendix A, Section A.7.4.1 General Status of Completed and Non-Executed Efforts

Page A-123. The text in the last sentence of the first paragraph says “The structural design will conform with the appropriate Engineering Manuals (EM), Engineering Regulations (ER), or Design Criteria Memorandums (DCM).” The text was changed to “The structural design will conform with the appropriate Engineering Manuals (EM), Engineering Regulations (ER), and Design Criteria Memorandums (DCM).”

Appendix A, Section A.7.5.3 Pumping Station S-356 Replacement Features

Page A-124. The last sentence of the first paragraphs says “One of the pumping systems for this station is a redundant system as required by SFWMD’s Major Pumping Station Engineering Guidelines.” The text was changed to “One of the pumping systems for this station is a redundant system as required per EM’s, ER’s and jointly developed DCM-5, Major Pumping Station Engineering Guidelines.”

Appendix A, Section A.8.3.1 Baseline Condition Modeling

Page A-149. The text in the second sentence of the second paragraph says “....second generation CERP projects still pending Congressional authorization....”. The text was changed to “second generation CERP projects authorized by Congress in WRRDA 2014...”.

Appendix A, Annex A-2, Section 3.1 CEPP Baseline Condition Modeling

Page A-2-18. The text in the third sentence of the second paragraph says “....second generation CERP projects still pending Congressional authorization....”. The text was changed to “second generation CERP project authorized by Congress in WRRDA 2014...”.

Appendix A, Annex B, Section GC-3 Optimize Pump Station Design

Page B-1-42. The second sentence of the first paragraph says “Design precedent has been to adhere to SFWMD standards.” The text was changed to “Design precedent has been to adhere to jointly developed DCM-5, Major Pumping Station Engineering Guidelines.”

Appendix C, Section C.1.3 FUTURE PROJECT CONDITIONS OF RESOURCES

Page C.1-87. The text in the forth sentence of the first paragraph says “Second generation of CERP projects for Congressional authorization....”. The text was changed to “Second generation of CERP project, authorized in WRDDA 2014,....”

Appendix C, Section C.1.3.8 Hydrology

Page C.1-94. The text in the third sentence of the first paragraph says “....second generation CERP projects still pending Congressional authorization....”. The text was changed to “second generation CERP project authorized by Congress in WRRDA 2014...”.

Appendix C, Section C.1.3.9 Regional Water Management (Operations)

Page C.1-109. The text in the second sentence of the first paragraph says “....second generation CERP projects still pending Congressional authorization....”. The text was changed to “second generation CERP projects authorized by Congress in WRRDA 2014...”.

Appendix C, Section C.2.2.20 Past, Present, and Reasonably Foreseeable Actions Affecting Resources within the Project Area

Page C.2.2-151. The text in the third sentence of the fifth paragraph says “The second generation of CERP projects for Congressional authorization....”. The text was changed to “The second generation of CERP projects, authorized in WRRDA 2014, includes...”

Appendix C, Section C.3 Pertinent Correspondence

Page C.3-444. The response to EPA-22 says “State and Federal water quality experts...”. The text was changed to “State and Federal water managers...”.

Appendix C, Section C.3 Pertinent Correspondence

Page C.3-722. The response to Citizen-11 Comment-1 says “The second generation of CERP projects, which are awaiting Congressional authorization,...”. The text was changed to “The second generation of CERP projects authorized by Congress in WRRDA 2014...”.

Annex B, Section B.3.1.2 Lower East Coast Service Area

Page B-23. The text in the second sentence of the first paragraph says “The Seminole Tribe of Florida also withdrawals...”. The text was changed to “The Seminole Tribe of Florida also withdraws...”.

Annex D, Part 1

Page 88. The text in the fifth sentence of the first paragraph says “Minimum Flows and Levels Rule; SFWMD proposed Water Reservation Rule for the CERP Biscayne Bay Coastal Wetlands Project – Phase I.” The text was changed to “Minimum Flows and Levels Rule; SFWMD Water Reservation Rule for the CERP Biscayne Bay Coastal Wetlands Project – Phase I.”

FINAL INTEGRATED PROJECT IMPLEMENTATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT

**Central Everglades Planning Project
St. Lucie, Martin, Okeechobee, Glades, Hendry, Palm Beach, Broward, Miami-Dade, Monroe,
Collier, Lee and Charlotte Counties, FL**

**Lead Agency: Department of Army
U.S. Army Corps of Engineers, Jacksonville District**

Abstract:

The purpose of the Central Everglades Planning Project (CEPP) is to improve the quantity, quality, timing and distribution of water flows to the Northern Estuaries, central Everglades (Water Conservation Area 3 (WCA 3) and Everglades National Park (ENP)), and Florida Bay while increasing water supply for municipal, industrial and agricultural users. The recommended plan would achieve these benefits by reducing the large pulses of regulatory flood control releases sent from Lake Okeechobee by redirecting approximately 210,000 acre-feet of water on an annual basis to the historical southerly flow path. Prior to delivering additional water to existing State-owned and State-operated stormwater treatment areas (STAs), water will be delivered first to the flow equalization basins (FEBs) which will: (1) provide storage capacity, (2) attenuate high flows, and (3) provide incidental water quality benefits. The STAs reduce phosphorus concentrations in the water to meet required water quality constraints. Rerouting this treated water south and redistributing it across spreader canals will facilitate hydropattern restoration in WCA 3A. This, in combination with Miami Canal backfilling and other CERP components, will re-establish a 500,000-acre flowing system through the northern most extent of the remnant Everglades. The treated water will be distributed through WCA 3A to WCA 3B and ENP via structures and creation of the Blue Shanty Flowway. The Blue Shanty Flowway will restore continuous sheetflow and re-connection of a portion of WCA 3B to ENP and Florida Bay. A seepage barrier wall and pump station will manage seepage to maintain levels of flood protection and water supply in the urban and agricultural areas east of the WCAs and ENP. The CEPP recommended plan was chosen based upon detailed estimates of hydrology across the 41-year period of record (January 1965 – December 2005) generated by the Regional Simulation Model for Basins (RSM-BN) for the Northern Estuaries and the RSM for the Glades and Lower East Coast Service Area (RSM-GL) for the Greater Everglades and Florida Bay. The first cost (2014 price level) of the recommended plan is \$ 1,900,000,000.

Send your comments by:
September 8th, 2014

For further information on this statement, please contact

**Dr. Gretchen Ehlinger
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019
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Annex G: Invasive and Nuisance Species Management Plan

Annex H: Hazardous, Toxic and Radioactive Waste

Annex I: Sea Level Rise Assessment

Elements marked with an asterisk (*) provide further detail on sections required for National Environmental Policy Act compliance.

EXECUTIVE SUMMARY

The Final integrated project implementation report (PIR) and environmental impact statement (EIS) evaluates the Federal interest in implementing the Central Everglades Planning Project (CEPP), a component of the Comprehensive Everglades Restoration Plan (CERP), which was approved as a framework for restoring the south Florida ecosystem while providing for other water-related needs of the region in the 2000 Water Resources Development Act (WRDA). The Final PIR/EIS presents a description of existing and expected future conditions in the south Florida Everglades ecosystem, formulation and evaluation of plans considered to address ecosystem restoration needs in the region, analysis of environmental effects of the recommended plan, project costs, and implementation issues.

PURPOSE AND NEED

The purpose of the CEPP is to improve the quantity, quality, timing and distribution of water flows to the Northern Estuaries, central Everglades (Water Conservation Area 3 [WCA 3] and Everglades National Park [ENP]), and Florida Bay while increasing water supply for municipal and agricultural users. Since the CERP was approved, three projects were authorized in the 2007 WRDA and proceeded into construction (Indian River Lagoon-South, Picayune Strand, and Site 1 Impoundment) and a fourth project, Melaleuca and Other Exotic Plants Biological Controls, was implemented under the programmatic authority in WRDA 2000. Despite this progress, ecological conditions and functions within the central portion of the Everglades ridge and slough community continue to decline due to lack of sufficient quantities of freshwater flow into the central Everglades and timing and distribution problems (**Figure 1**). To respond to this concern, the U.S. Army Corps of Engineers (Corps) and the South Florida Water Management District (SFWMD) initiated the CEPP in November 2011 to evaluate alternatives for restoring ecosystem conditions in the central portion of the Everglades and opportunities for providing for other water-related needs in the region.

AUTHORITY

The CEPP study is being conducted under the authority provided by Section 601(d)(2)(b) of WRDA 2000, which requires preparation of a PIR to implement components of the CERP. Upon approval of the PIR by the Governing Board of the SFWMD and the Assistant Secretary of the Army for Civil Works (ASA-CW), the recommended plan will be submitted to Congress for authorization. The CEPP is also a national pilot project for the Corps, testing opportunities for expediting the planning phase of civil works projects, confirming Federal interest, and providing a recommendation to Congress. The goal of this pilot project was to identify a draft recommended plan within 18 months of initiating the study and preparing a recommendation to Congress in less than three years.

ALTERNATIVE PLANS AND THE RECOMMENDED PLAN

Planning goals for CERP projects include enhancing ecological values and enhancing economic values and social well-being. Both goals were considered during the formulation of CEPP alternative plans, and project specific objectives and constraints were established to evaluate the plans. In general, ecosystem restoration objectives focused on providing additional water to the Everglades by capturing freshwater discharges from Lake Okeechobee to the St. Lucie and Caloosahatchee Estuaries. Timing of deliveries and distribution of flows to the Everglades and improvements to water supply for municipal, agricultural, and Tribal use were also evaluated.

The plan formulation strategy for CEPP consisted of multiple formulation phases that followed the natural southerly flow of water from Lake Okeechobee through the Everglades ecosystem to Florida Bay. The strategy involves the formulation of management measures and components that serve to restore

the central portions of the Everglades including WCA 3A, WCA 3B, and ENP, while improving the northern and southern estuary ecosystems and increasing water supply for municipal, industrial and agricultural users.

The plan formulation framework started with consideration of measures north of the Everglades in the Everglades Agricultural Area (Red Line) to capture, store, and deliver water south to the Everglades (**Figure 2**). The sequential formulation which followed then considered measures for redistributing water within WCA 3A (south of the Red Line) creating additional hydrologic connectivity between WCA 3A, WCA 3B (Green Line), and ENP (Blue Line), and effectively managing seepage along the eastern boundary of the Everglades (Yellow Line). The CEPP study recommends increments of six components of the CERP:

- Everglades Agricultural Storage Reservoirs (Component G)
- WCA 3 Decompartmentalization and Sheetflow Enhancement (Components AA and QQ)
- S-356 Pump Station Modifications (Component FF)
- L-31 N Improvements for Seepage Management (Component V)
- System-wide Operational Changes – Everglades Rain-Driven Operations (Component H)
- Flow to Northwest and Central WCA 3A (Component II)

To facilitate the evaluation of thousands of possible combinations of measures, screening criteria were developed to select the array of measures and plans for detailed modeling and evaluation. Four alternative plans (**Figure 2**) and the no-action plan were evaluated using hydrologic simulation model outputs. Performance measures were used to evaluate the degree to which proposed alternative plans met restoration targets representative of pre-drainage conditions. Planning-level cost estimates were developed for the four alternative plans, ecosystem restoration benefits were calculated, and additional selection criteria were applied.

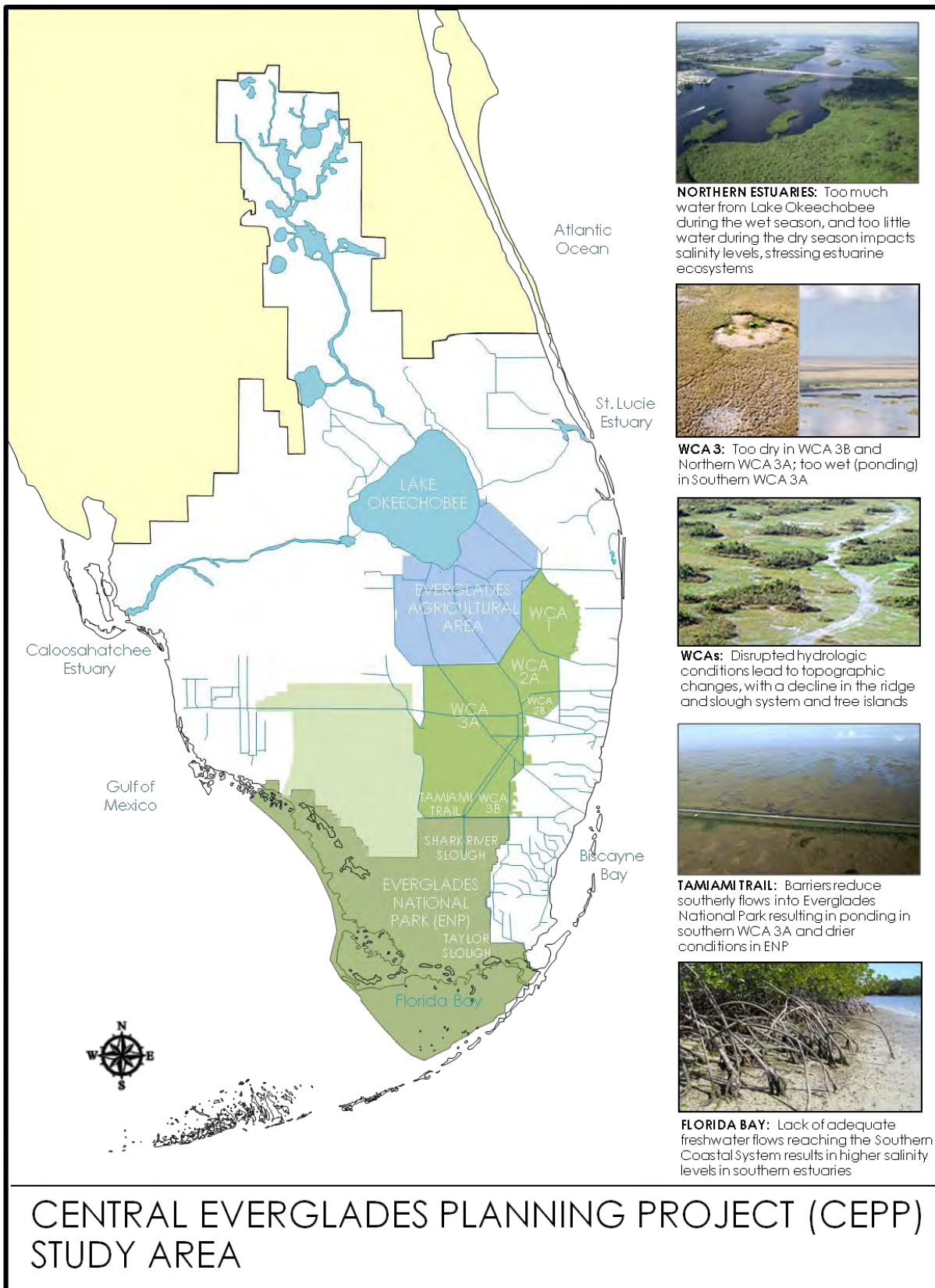


Figure 1. Map of Study Area



Combining alternative plan benefits, costs, and other selection criteria, a modified version of Alternative 4 (Alternative 4M) was identified as both cost-effective and with the most ecosystem restoration benefits. Alternative 4R2 was developed from Alternative 4M by optimizing its operations to improve water supply performance and to address WRDA 2000 Savings Clause concerns about effects on the Biscayne Aquifer and Biscayne Bay. Alternative 4R2 (**Figure 3**) is the Recommended Plan and consists of the following features:

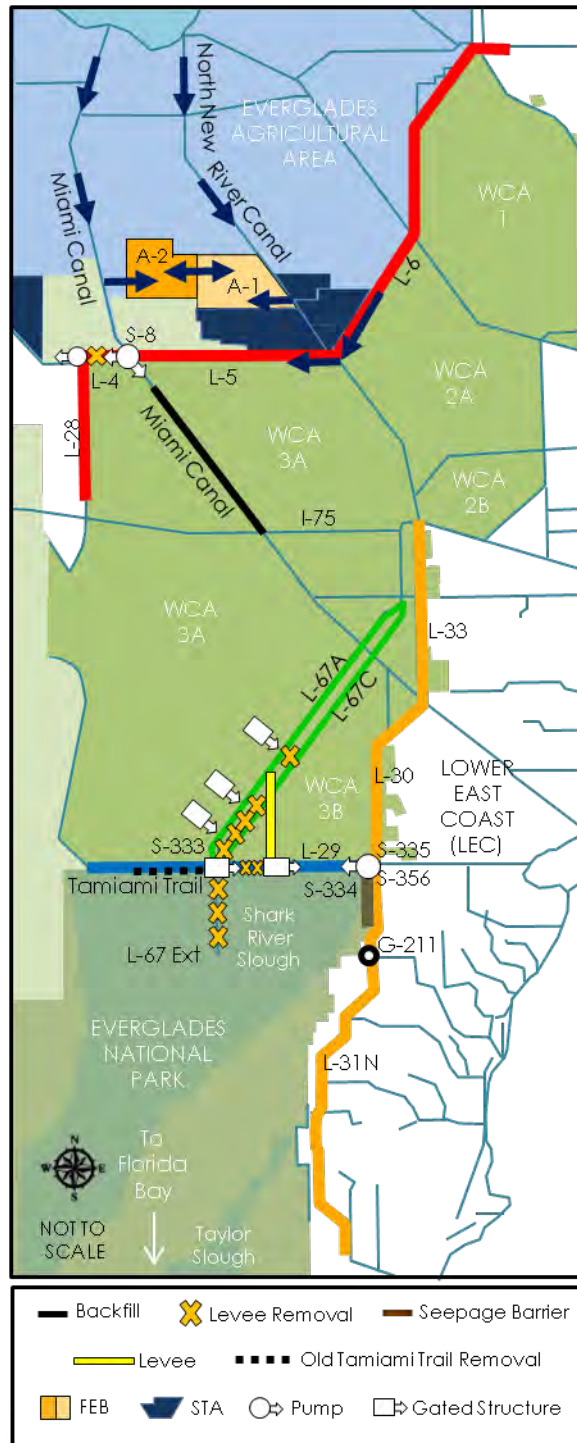


Figure 3. Recommended Plan

- A-2 Flow Equalization Basin (FEB) (14,000 acres), including exterior and internal levees
 - Seepage Pump Station (500 cubic feet per second (cfs))
 - Water Control Structures (culverts, spillway)
 - Emergency Overflow Weir
 - Canals (inflow, seepage collection, internal collection, and discharge)
- L-6 Canal Flow Diversion
- L-5 Canal Conveyance Improvements
- S-8 Pump Station Complex Modifications
- L-4 Levee Degrade (approximately 2.9 miles) and Pump Station (360 cfs)
- Miami Canal Backfill (approximately 13.5 miles from 1.5 miles south of S-8 to Interstate 75)
- S-333 Spillway Modification (1,150 cfs gated spillway adjacent to S-333; 2,500 cfs total)
- L-29 Canal Gated Spillway (1,230 cfs)
- L-67A Conveyance Structures (three, 500 cfs)
- L-67C Levee Gap (6,000 feet)
- L-67C Levee Degrade (approximately 8 miles)
- Blue Shanty Levee, WCA 3B (approximately 8.5 miles)
- L-29 Levee Degrade (4.3 mi, within Blue Shanty Flowway)
- L-67 Extension Levee Degrade and Canal Backfill (approximately 5.5 miles)
- Old Tamiami Trail Removal (approximately 6 miles)
- S-356 Pump Station Modifications (increase to 1,000 cfs)
- Seepage Barrier, L-31N Levee (approximately 4.2 miles)
- System-wide Operations Refinements

BENEFITS OF THE RECOMMENDED PLAN

The recommended plan beneficially affects more than 1.5 million acres in the St. Lucie and Caloosahatchee Estuaries, WCA 3A, WCA 3B, ENP, and Florida Bay. In addition to redistributing existing treated water in a more natural sheetflow pattern, the recommended plan provides an average of approximately 210,000 acre-feet per year of additional clean freshwater flowing into the central portion of the Everglades. This increase in freshwater flow to the Everglades is approximately two-thirds of the additional flow estimated to be provided by the CERP. The recommended plan also reduces the number and severity of undesirable, high-volume discharges from Lake Okeechobee, improving salinity in the St. Lucie and Caloosahatchee Estuaries. The additional water flowing into northern WCA 3A and ENP will help to restore pre-drainage vegetative communities and habitat for fish and wildlife while providing incremental improvement of natural processes critical for the development of peat soils and tree islands, which are essential features of the Everglades ridge and slough landscape. Increased flows to Florida Bay will improve salinities, resulting in greater abundance and diversity of sea grasses and other estuarine plant and animal species.

Ecosystem services provided by the recommended plan include carbon sequestration, reduced fire risks, increased commercial and recreational fish catches (such as pink shrimp and spotted sea trout), increased water supply, and other recreational use and aesthetic values associated with the Everglades and south Florida's estuaries. The recommended plan also boosts resiliency to potential climate change effects by increasing freshwater in the Everglades and buffering natural system areas and the underlying aquifer against possible sea level rise and minor decreases in rainfall.

Recreational benefits provided by the recommended plan include enhanced outdoor recreation opportunities and improved access to Everglades marshes for tourists and Floridians. The cost to construct the recreational features is cost-shared. Operations, maintenance, repair, and rehabilitation (OMRR&R) of recreational features becomes the sole responsibility of the non-Federal sponsor. The average annual cost of the recreation features is \$355,000 and the average annual benefits are \$570,000, resulting in net benefits of \$215,000 and a benefit to cost ratio of 1.6 to 1.

The recommended plan fulfills WRDA 2000 Project Assurance requirements (Section 601(h)(4)) by identifying the water for the natural system (**Table 6-17 in Section 6.8**). The quantity, timing and distribution of water are identified at three locations: inflows to WCA 3, inflows to ENP, and overland flows to Florida Bay. Protection of water made available by CEPP project features is required for the SFWMD and the Department of the Army to enter into one or more project partnership agreements (PPA) to construct the CEPP project features. The SFWMD has already protected the pre-project water for the natural system in the Holey Land and Rotenberger Wildlife Management Areas; WCA 1, WCA 2A, WCA 2B, WCA 3A and WCA 3B; and ENP through the Restricted Allocation Area Rule for the Everglades and North Palm Beach/Loxahatchee River Watershed water bodies. The SFWMD will protect the water made available by the CEPP project features using its reservation or allocation authority as required by Section 373.470, Florida Statutes. The combination of protecting the pre-project existing water and the water made available by the CEPP project features is needed for the CEPP to achieve its intended benefits.

The project also increases the amount of water available for agricultural, municipal and industrial use in Lower East Coast Service Area (LECSA) 2 (Broward County) and LECSA 3 (Miami-Dade County) and maintains existing water supply performance for agricultural users in the Lake Okeechobee Service Area (LOSA) and the Seminole Tribe of Florida.

The recommended plan fulfills WRDA 2000 Saving Clause requirements (Sections 601(h)(5)(A) and 601(h)(5)(C)) which, in part, ensure existing legal sources of water supply such as water for municipal, agricultural, and fish and wildlife uses continue to be available with project implementation. If a CERP project is expected to eliminate or transfer an existing legal source of water, the PIR must include a replacement source of water in its implementation plan. Sources of water to meet agricultural and urban demand in the LECSAs will continue to be met by their current sources, primarily Lake Okeechobee, the Everglades (including the WCAs), surface water in the regional canal network, and the surficial aquifer system. Sources of water for the Seminole Tribe of Florida and Miccosukee Tribe of Indians of Florida will not be affected by the CEPP project. In addition, water supplies to ENP and water supplies for fish and wildlife located in the Northern Estuaries, WCA 2, WCA 3, Biscayne Bay, and Florida Bay will not be diminished.

Some Lake Okeechobee water utilized by agricultural users in the LOSA will be transferred to WCA 3A and further south as a result of implementation of the recommended plan. This transfer is anticipated to occur after the future modifications of the Lake Okeechobee Regulation Schedule that will allow full utilization of the CEPP A-2 FEB. Water of comparable quantity and quality will be available to replace the water sent south by backflowing a portion of the water stored in the CERP Indian River Lagoon-South C-44 Reservoir/Stormwater Treatment Area (STA) to Lake Okeechobee via the C-44 Canal and raising the Lake Okeechobee stage criteria to allow increased C-44 Canal backflow. The additional volume of water back-flowed to Lake Okeechobee from the C-44 Reservoir/STA and the C-44 Canal averages 57,300 acre-feet annually and represents approximately 10% of LOSA's average annual demand. The transfer of water from Lake Okeechobee to WCA 3A will not be implemented until the CERP C-44 Reservoir/STA, the canal connecting the C-44 Reservoir to the C-23 Canal, and the CEPP A-2 FEB site are operational.

The recommended plan also ensures that CERP implementation does not reduce the level of service for flood protection consistent with WRDA 2000 Savings Clause requirements (Section 601(h)(5)(B)). Comparison of canal stages and groundwater levels at key locations indicates the project will not reduce the flood protection within the areas affected by the project, including the EAA, LECSA 2, and LECSA 3. This includes the Seminole Tribe of Florida's Big Cypress Reservation and the Miccosukee Tribe of Indians of Florida's reservation areas and resort.

ENVIRONMENTAL CONSIDERATIONS

The recommended plan has been identified to be environmentally preferable and the least environmentally damaging practicable alternative. All practicable means to avoid or minimize adverse environmental effects were incorporated into the recommended plan. An Adaptive Management and Monitoring Plan is included in the Final PIR/EIS. Temporary short term impacts to air quality, the noise environment, aesthetic resources, vegetation, and disturbances to and displacement of fish and wildlife resources to other nearby habitat are expected from operation of construction equipment in lands designated for staging, access, and construction. Due to increased water flow and changes in water distribution, it is anticipated that overdrained areas in northern WCA 3A will be rehydrated, triggering a vegetation transition from upland to wetland habitat. Although mammals occurring within the project area are adapted to the naturally fluctuating water levels in the Everglades, there is an increased potential that mammals currently utilizing upland habitat may be negatively affected. Refuge for mammals will be provided by the retention of a portion of existing spoil mounds located adjacent to the Miami Canal in northern WCA 3A and the creation of additional upland landscape (constructed tree islands). Non-native and invasive plant infestations in the project area may be exacerbated by soil disturbance during construction and hydrological modification and may require active management.

Introduction or expansion of non-native fish species due to changes in water distribution and increased connectivity between WCA 3A, WCA 3B and ENP is expected to occur; however, the extent of the ecological impact is uncertain at this time and there are invasive species control programs in place.

Publicly owned lands will be utilized for the recommended plan. Portions of the A-2 footprint are currently leased for agricultural production, including sugar cane. Potential adverse impacts on prime and unique farmland will be assessed during detailed design. Adverse impacts on wetlands would occur within WCA 3B with implementation of the recommended plan as a result of the construction of the Blue Shanty Levee (L-67D). This loss would be offset by improved conditions in wetlands elsewhere within the project area.

To comply with the Endangered Species Act (ESA), the Corps entered formal consultation with USFWS on the Everglade snail kite (*Rostrhamus sociabilis plumbeus*), and its designated critical habitat, Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*), (CSSS) and its designated critical habitat, wood stork (*Mycteria americana*) and eastern indigo snake (*Drymarchon corais couperi*). A Programmatic Biological Opinion (BO) was received from USFWS on April 9, 2014, which clearly states that further consultation will be needed when more specific project details are finalized during project design and implementation activities. While the Biological Opinion does not authorize incidental take of three endangered avian species (CSSS, snail kite, and wood stork), it does describe the anticipated effects based on current information. When the Corps is closer to constructing phases of CEPP that will affect listed species, USFWS will provide separate consultation document(s) which may authorize incidental take, and provide applicable reasonable and prudent measures (RPMs) and terms and conditions (TCs). Upon completing ESA Section 7 consultation for each PPA, the Corps will undertake the agreed-to avoidance and minimization measures and implement any applicable TCs.

The recommended plan may have adverse effects on cultural resources, some of which are unavoidable and long term, and/or cannot be assessed until the detailed design phase of the project. Avoidance of adverse effects to cultural resources is preferred, and therefore, throughout the planning process for CEPP, the project considered alternatives and features of alternatives that reduce or eliminate impacts to cultural resources. Pursuant to 36 CFR 800.1, where possible, the project design will be modified to avoid affecting significant historic properties and culturally significant sites. Where avoidance is not possible, other mitigation measures will be considered. Future mitigation measures will be developed during the preconstruction, engineering, and design phase in consultation with the State Historic Preservation Office, tribal groups and other interested parties as established in implementing regulations for Section 106 of the National Historic Preservation Act.

COST ESTIMATE AND IMPLEMENTATION PLAN

The first (2014 price level) cost of the recommended plan is \$1,900,000,000, including construction, non-construction items, and contingency (**Table 1**). Comparatively, the updated cost estimate (2014 price level) for similar features of the recommended plan included in the 1999 CERP is approximately \$1.7 billion. Differences are attributable to new information gained since 1999 about design and construction of similar projects in south Florida, and risk analysis establishing appropriate contingencies to better assure project cost estimates submitted for authorization will not be exceeded during implementation.

Table 1. CEPP Cost Estimates (2014 Price Level)^{1,2}

Construction and Operation, Testing, and Monitoring Phase Items	Cost
Ecosystem Restoration Costs	
06 Fish and Wildlife (monitoring and adaptive management)	\$106,000,000
09 Channels & Canals	\$370,000,000
11 Levees	\$399,000,000
13 Pumping Plant	\$133,000,000
15 Floodway Control and Diversion	\$342,000,000
18 Cultural Resources Preservation	\$26,000,000
32 HTRW Investigations	\$1,000,000
Construction Features Sub-Total	\$1,377,000,000
Preconstruction Engineering and Design (PED), Engineering During Construction (EDC) and Planning	\$345,000,000
Construction Management (S&A)	\$135,000,000
Lands & Damages	\$37,000,000
Total Ecosystem Restoration Costs	\$1,894,000,000
Recreation Costs	
14 Recreation Facilities	\$6,000,000
Total First Cost	\$1,900,000,000

1. Construction costs in this table include contingencies

2. Costs are rounded to the nearest \$1,000,000.

Implementation of CEPP will occur over many years and includes many actions by the Corps and SFWMD. Development of sequencing for CEPP features considers that a number of CERP and non-CERP projects (**Table 6-13**) must be constructed and operating before implementing many CEPP features to avoid unintended consequences.

Multiple PPAs composed of separable project elements that provide hydrologic and ecologic benefits in a cost effective manner will be executed prior to construction (**Table 2**). These PPAs include the construction of logical groupings of plan elements that maximize benefits to the extent practicable consistent with project dependencies. PPAs are legally binding agreements that describe the roles and responsibilities of the Corps and SFWMD for real estate acquisition, construction, construction management and operations and maintenance. Other factors that influence implementation include funding availability, cost-share balance between the Federal government and non-Federal sponsor, as well as the integration of projects that are to be constructed by other agencies. These groupings include a PPA of project features in northern WCA 3A (PPA North), a PPA of project features in southern WCA 3A, 3B and ENP (PPA South), and a final PPA which provides the new water and required seepage management that benefits the entirety of the study area (PPA New Water).

Table 2. Project Features by PPA.

PPA North	
• L-6 Diversion	
• S-8 Pump Modifications	
• L-4 Levee Degrade and Pump Station	
• L-5 Canal Improvements	
• Miami Canal Backfill	
PPA South	
• L-67 A Structure North	• L-67 C Levee Degrade (approx 8 miles)
• L-67 C Levee Gap (6,000 ft)	• Remove L-67 Extension Levee (No Backfill)
• Increase S-356 capacity to 1,000 cfs	• 8.5 Mile Blue Shanty Levee
• Increase S-333 capacity	• Remove L-29 Levee Segment
• L-29 Gated Spillway	• Backfill L-67 Extension
• L-67 A Structures 2 and 3 South	• Remove Old Tamiami Trail*
• L-67 A Spoil Mound Removal	
PPA New Water	
• Seepage Barrier L-31 N	
• A-2 FEB	

*Removal of Old Tamiami Trail can be completed at any time during implementation, but must precede backfilling of L-67 Extension Canal.

PPA North and PPA South are expected to achieve regional benefits by utilizing existing inflows to improve deliveries to WCA 3, ENP, and Florida Bay. PPA North includes the hydropattern restoration features in northern WCA 3A and the backfilling of the Miami Canal. Construction of these features that redistribute inflows into WCA 3A provide the benefits identified in the recommended plan associated with restoration of hydroperiods in northern WCA 3A, associated reduction in the risk of muck fires, and restoration of more natural sheetflow. A limited portion of these benefits could be realized through improvements in the re-distribution and delivery of water currently entering northwest WCA 3A prior to bringing in any additional water from Lake Okeechobee.

Features of the recommended plan to be implemented in PPA South would include conveyance features that function to re-distribute water from WCA 3A to WCA 3B and ENP. Benefit from PPA South facilities could be realized within WCA 3A, WCA 3B, and NESRS from the added outlet capacity. Improved hydrologic conditions in ENP are expected to result in improved salinity conditions in Florida Bay.

The ability to increase flows to the south as envisioned with the recommended plan depends on the construction of the A-2 FEB and seepage wall in PPA New Water, as well as the distribution and conveyance features in PPA North and PPA South. Implementation of all three PPAs are needed to realize all of the CEPP's improvements associated with the reduction of undesirable high volume discharges to the Northern Estuaries and the restoration of hydroperiods and sheetflow from WCA 3 and ENP to the coastal mangroves of Florida Bay. The total benefits predicted with implementation of the recommended plan cannot be achieved without the combination of storage and treatment, distribution and conveyance, and seepage management.

Uncertainty surrounding the timing of CEPP project dependencies, funding, resources, stakeholder input and potential conflicting priorities will likely lead to an extended implementation period. **Figure 4** illustrates the construction duration associated with implementation Scenario 1 (sequentially

constructing PPA North, then PPA South and finally PPA New Water) and assumes constrained project funding of \$100 million per year (\$50 million Federal, and \$50 Million non-Federal sponsor).

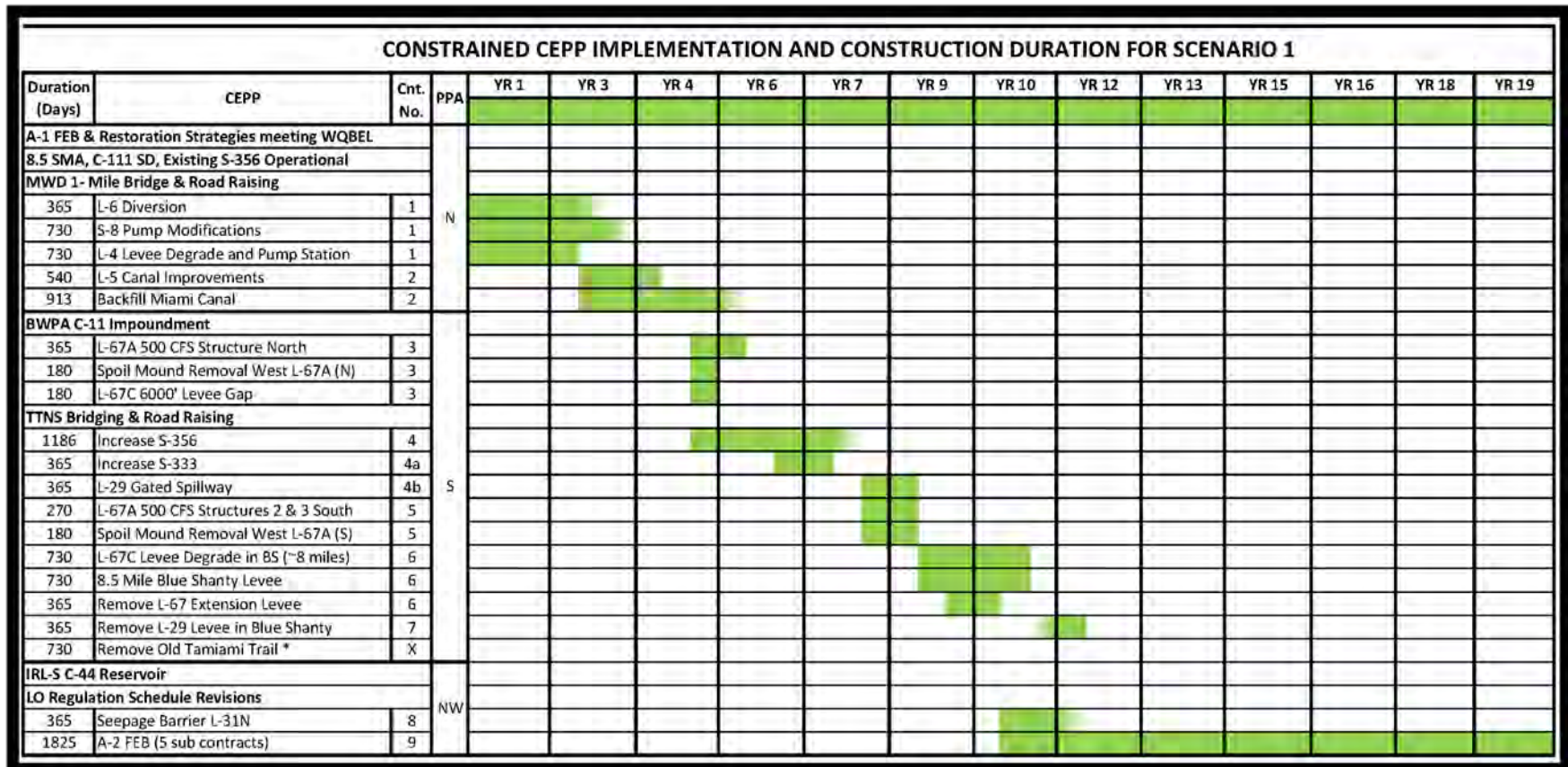


Figure 4. Constrained CEPP Implementation and Construction Duration for Scenario 1

Other viable options for the implementation of groupings into PPAs may be considered in the future. This flexibility is essential to successful CEPP implementation given the uncertainties associated with the lengthy implementation period and the inevitable improvement in scientific knowledge about the functioning of the greater Everglades that will occur as planned CERP and non-CERP projects are completed. The Corps and the SFWMD will incorporate the CEPP recommended plan and other CERP projects awaiting authorization into the south Florida ecosystem restoration programs' integrated delivery schedule through a public engagement process.

COORDINATION WITH AGENCIES AND THE PUBLIC

The expedited planning process for the CEPP study required extensive coordination with the public and Federal, Tribal, State, and local resource management and regulatory agencies. An interagency project team was formed and met regularly throughout the study, providing Federal, Tribal, State, and local agencies opportunities to comment on planning assumptions, evaluation tools and methods, and alternative plans. The South Florida Ecosystem Task Force's Working Group sponsored 18 public workshops throughout the study (November 2011 through February 2013) providing opportunities for the public to provide input to the Task Force, which in turn informed the study team. Formal consultation with the Task Force also occurred throughout the study, including presentations of the final array of alternatives (December 2012) and the recommended plan (July 2013). The SFWMD's Governing Board and Water Resources Advisory Commission also met monthly throughout the study, providing opportunities for information to be provided to elected and appointed officials and the public. The CEPP study project team also hosted public meetings (November – December 2012 and September 2013) summarizing the alternative plans, the recommended plan, and effects.

Initial public and agency comments received in response to a December 2, 2011 public notice of intent to prepare an Integrated PIR and EIS were mostly supportive of the project. Comments focused on the uncertainty in the expedited planning process, specific features, links to other CERP projects and planning constraints. Two National Environmental Policy Act (NEPA) public scoping workshops were held in December 2011. Five public workshops were held in December 2012 to receive comments on the final array of alternatives. Stakeholders, local governments, and representatives of non-governmental environmental organizations provided written comments and statements. The primary concerns centered on the need to move as much water south as possible, reduce releases to the Caloosahatchee and St. Lucie Estuaries, the effect of water levels on recreation opportunities, impacts to Biscayne Bay and Florida Bay, and water supply.

Similar issues, as well as new concerns, were raised in response to the public and agency review and comment of the CEPP Draft PIR/EIS, for which a notice of availability was published in the Federal Register on August 30, 2013. During the 64 day review period, a project overview was presented and questions answered at five public meetings held in south Florida. While there was tremendous support for the project and the expedited planning process, additional concerns included the implementation schedule, water supply and operating plans.

AREAS OF CONTROVERSY AND UNRESOLVED ISSUES

PROVIDING ADDITIONAL REGIONAL ECOSYSTEM RESTORATION NEEDS

Although the recommended plan provides a significant increase in freshwater needed for the restoration of the central Everglades and Florida Bay, additional actions are needed to further reduce undesirable discharges of freshwater from Lake Okeechobee to the St. Lucie and Caloosahatchee

Estuaries such as the completion of the Indian River Lagoon South and C-43 CERP projects and additional storage associated with other CERP components that would be cost shared with the SFWMD. Additionally, the Seminole Tribe of Florida and the Miccosukee Tribe of Indians of Florida have voiced concerns about conditions on Tribal lands in the western Everglades and the lack of progress on CERP components or other initiatives that would benefit those areas.

PROVIDING ADDITIONAL WATER FOR OTHER WATER-RELATED NEEDS

During the CEPP study, agricultural and municipal/industrial water supply stakeholders expressed concerns about the lack of progress on CERP projects intended to increase supplies of water for these users. To address this concern, the modeled operations of the recommended plan were optimized to improve water supply performance, including increasing the amount of water made available by the project for consumptive use allocation in LECSA 2 (Broward County) and LECSA Area 3 (Miami-Dade County) without reducing the beneficial effects on the natural system. In addition, the recommended plan maintains water supply for agricultural users in the LOSA and the Seminole Tribe of Florida. The Corps and the SFWMD will undertake updated project assurances and Savings Clause analyses, if necessary, for the implementation phases that are selected to be included in each PPA.

SYSTEM-WIDE OPERATIONS AND THE WRDA 2000 SAVINGS CLAUSE

CEPP study planners modeled and evaluated system-wide operations changes envisioned in the CERP to evaluate hydrologic conditions in, discharges to, and deliveries from the St. Lucie and Caloosahatchee Estuaries, Lake Okeechobee, WCA 3A, WCA 3B, WCA 2A, WCA 2B, ENP, Biscayne Bay, and Florida Bay. Some stakeholders expressed concerns that system-wide operations modeled and evaluated involve changes to current approved operating plans and that the quantity of water available for irrigation and water supply had been reduced by intervening changes, including the Lake Okeechobee Regulation Schedule (adopted in 2008) and the Everglades Restoration Transition Plan (ERTP, 2012). Furthermore, modeling results for the recommended plan indicate that some of the water utilized by water users in the LOSA will be transferred to WCA 3 and further south as a result of CEPP implementation. To address the requirements of the WRDA 2000 Savings Clause, the recommended plan identifies an additional source of water of comparable quantity and quality available to replace the water that will be transferred to WCA 3. However, this replacement source is dependent on implementation of another CERP project (Indian River Lagoon-South - C-44 Reservoir/STA). This transfer, if actualized, would not occur until the C-44 Reservoir, the canal connecting it to the C-23 Canal, and the A-2 FEB are built and operating. Since recommended plan implementation involves other system-wide operations changes, water managers for the Corps and the SFWMD will continue to evaluate system-wide operations as conditions change, such as Herbert Hoover Dike rehabilitation and implementation of other CERP projects including the Indian River Lagoon - South project to determine if changing conditions warrant changes to system-wide operations. Under Corps regulations, such operations changes require notifying the public, evaluating the effects of proposed alternatives, preparation and coordination of proposed revisions to water control manuals, and other requirements, as applicable.

WATER QUALITY AND EFFECTS ON STATE FACILITIES

The recommended plan depends on water quality treatment facilities owned and operated by the SFWMD (STAs 2 and 3/4) and is integrated with the yet-to-be constructed A-1 FEB included in SFWMD's "Restoration Strategies" project. To achieve restoration objectives for WCA 3A, the recommended plan involves discharges from these STAs to WCA 3A. Concerns were expressed about the effects of the new discharges on water quality and native flora and fauna in WCA 3A. Discharges into WCA 3A must meet State water quality standards before discharges to un-impacted areas occur. To ensure that the recommended plan meets State water quality standards, NPDES discharge permits and Everglades Forever Act Watershed permits with associated effluence limits will govern the Stormwater Treatment Area discharges from State facilities.

The recommended plan also increases flows into Shark River Slough in ENP subject to the limits for total phosphorus contained in Appendix A of the 1991 Settlement Agreement for U.S. vs. SFWMD (Case No. 88-1886-Civ-Moreno) and in accordance with State water quality standards. Since the compliance determination calculation is inversely proportional to flow, increases in flow will lower the compliance limit. State and Federal water managers expressed concerns that the recommended plan may increase the probability of exceeding the compliance limit and agreed to consider re-evaluating the Shark River Slough compliance calculation. Based upon current and best available technical information, the Federal parties believe at this time that the State Restoration Strategies, implemented in accordance with the State issued Consent Order and other joint restoration projects, are sufficient and anticipated to achieve water quality requirements for existing flows to the Everglades.

EFFECTS ON ENDANGERED SPECIES

To achieve restoration objectives, the recommended plan increases the amount of water delivered into areas inhabited by endangered species, including the critically-endangered CSSS. USFWS supports the recommended plan and is independently developing measures, outside the scope of CEPP, to improve the number and distribution of sparrows, but expressed concerns about operations during nesting periods and effects on sparrow habitat. During the detailed design phase, USFWS will provide separate consultation document(s) which may authorize incidental take, and provide applicable RPMs and TC). Upon completing ESA Section 7 consultation for each PPA, the Corps will undertake the agreed-to avoidance and minimization measures and implement any applicable TCs.

EFFECTS OF INVASIVE SPECIES ON THE SOUTH FLORIDA ECOSYSTEM

South Florida contains numerous harmful invasive plant and animal species that have the potential to significantly alter ecological communities throughout the region. Concerns have been expressed that hydrologic restoration efforts to improve the greater Everglades, including the CEPP, may be ineffectual if invasive plant and animal species continue to spread and overtake natural communities of plants and animals. Scientists generally agree that restoring natural system processes and managing those areas provide greater resilience to threats posed by invasive species.

CLIMATE CHANGE

Although the magnitude of the effects of climate change, including rising sea levels, temperature changes, and changing rainfall patterns is uncertain, it is generally acknowledged that climate change will affect both natural system and human environmental conditions in south Florida during the next century. Although the CERP was formulated in 1999 to address declining conditions in the greater Everglades ecosystem and restoration of ecological functions without the benefit of the current level of understanding about possible climate change effects, scientists and agency water managers agree that implementation of the plan will provide an important adaptation response for both the natural system and the human environment considering future climate change scenarios. As the mean tide level increases, the additional water from CEPP will provide a buffer of freshwater that will limit salinity related impacts to freshwater wetland vegetation, reduce peat soil degradation, and impede saltwater intrusion into the groundwater aquifer. The effects of sea level change have been analyzed per Engineering Circular 1165-2-212. This analysis looked at the effect of sea level change on the benefits predicted for the recommended plan. The results indicate that within a 50-year planning horizon the average annual net project benefits are likely to be reduced by less than 8 percent in comparison to the projected net annual average project benefits estimated assuming no sea level rise. This relatively moderate decrease in average annual project benefits occurs largely because of closely matching habitat losses that would occur under the future without project condition.

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1.0 INTRODUCTION

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The Everglades ecosystem has been altered from 120 years of highly effective efforts to drain water off the land. As a result, south Florida, including the remaining Everglades ecosystem, no longer exhibit the functionality, richness, and spatial extent that historically defined the pre-drainage system. Direct land impacts due to development and farming of natural areas has reduced the spatial extent by almost 50% and the ecosystem of south Florida has been largely impacted as a result of water management activities intended to control flooding and provide water supply to those developed and agricultural areas (**Figure 1-1**).

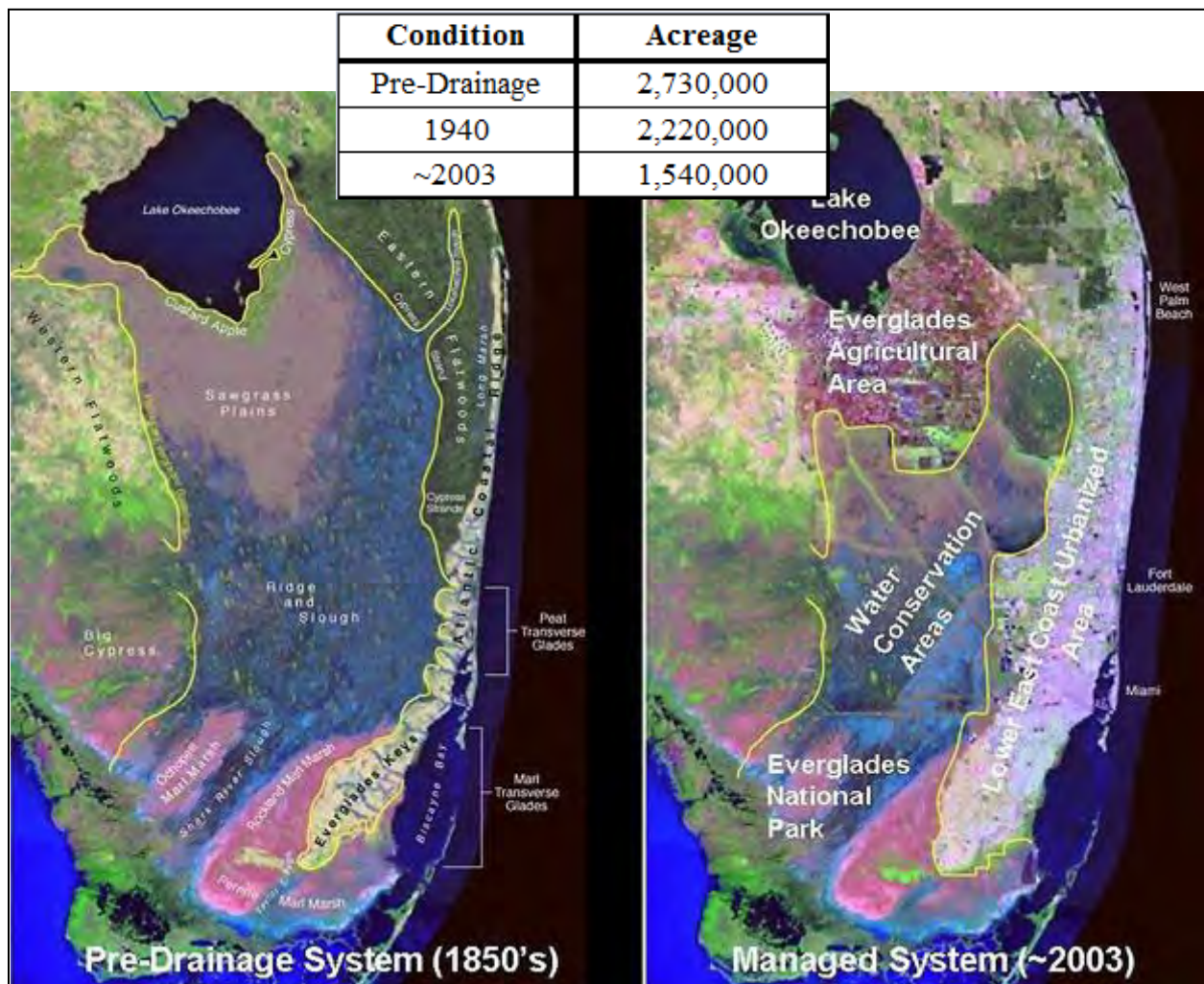


Figure 1-1. Land Changes in the Everglades System

Water that once flowed from Lake Okeechobee south through the Everglades, down Shark River Slough (SRS), and to the Southern Estuaries has been impounded in the lake and discharged to the Northern Estuaries (i.e., Caloosahatchee and St. Lucie Estuaries) via regulatory releases through the C-43 and C-44 canals. Prolonged high volume discharges of water from Lake Okeechobee to the Northern Estuaries coupled with excessive nutrient concentrations in Lake Okeechobee water and downstream basin water have resulted in great damaging effects on the plants and animals inhabiting these areas. The damage

can take years to recover and negatively affects the economy of the area. Conversely, the reduction in flows that traditionally reached the Everglades have resulted in landscape pattern changes, peat loss, tree island losses and flora and fauna changes within the greater Everglades landscape and negative changes in salinity patterns and its resultant effects on estuarine species and habitats in Florida Bay.

1.1 PROJECT PURPOSE AND NEED

The Central Everglades Planning Project (CEPP) is encompassed in the Comprehensive Everglades Restoration Plan (CERP), which was approved by Congress as a framework for the restoration of the natural system under Section 601 of the Water Resources Development Act of 2000 (WRDA 2000). The CERP, as documented in the 1999 Central and Southern Florida (C&SF) Project Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement (Yellow Book), consists of 68 different components. The purpose of the CERP is to modify structural and operational components of the C&SF Project to achieve restoration of the Everglades and the south Florida ecosystem, while providing for other water-related needs such as urban and agricultural water supply and flood protection. The 68 components identified in the Yellow Book will work together to benefit the ecological structure and function of more than 2.4 million acres of the south Florida ecosystem by improving and/or restoring the proper quantity, quality, timing and distribution of water in the natural system. The CERP will also address other concerns such as urban and agricultural water supply and maintain existing levels of service for flood protection in those areas served by the project. The CERP components were originally planned for implementation over an approximate 40 year period. The CERP is designed to achieve more natural flows by re-directing current flows that are currently discharged to the Atlantic Ocean and Gulf of Mexico, to a more restored flow of water that is distributed throughout the system similar to pre-drainage conditions (**Figure 1-2** and **Figure 1-3**).

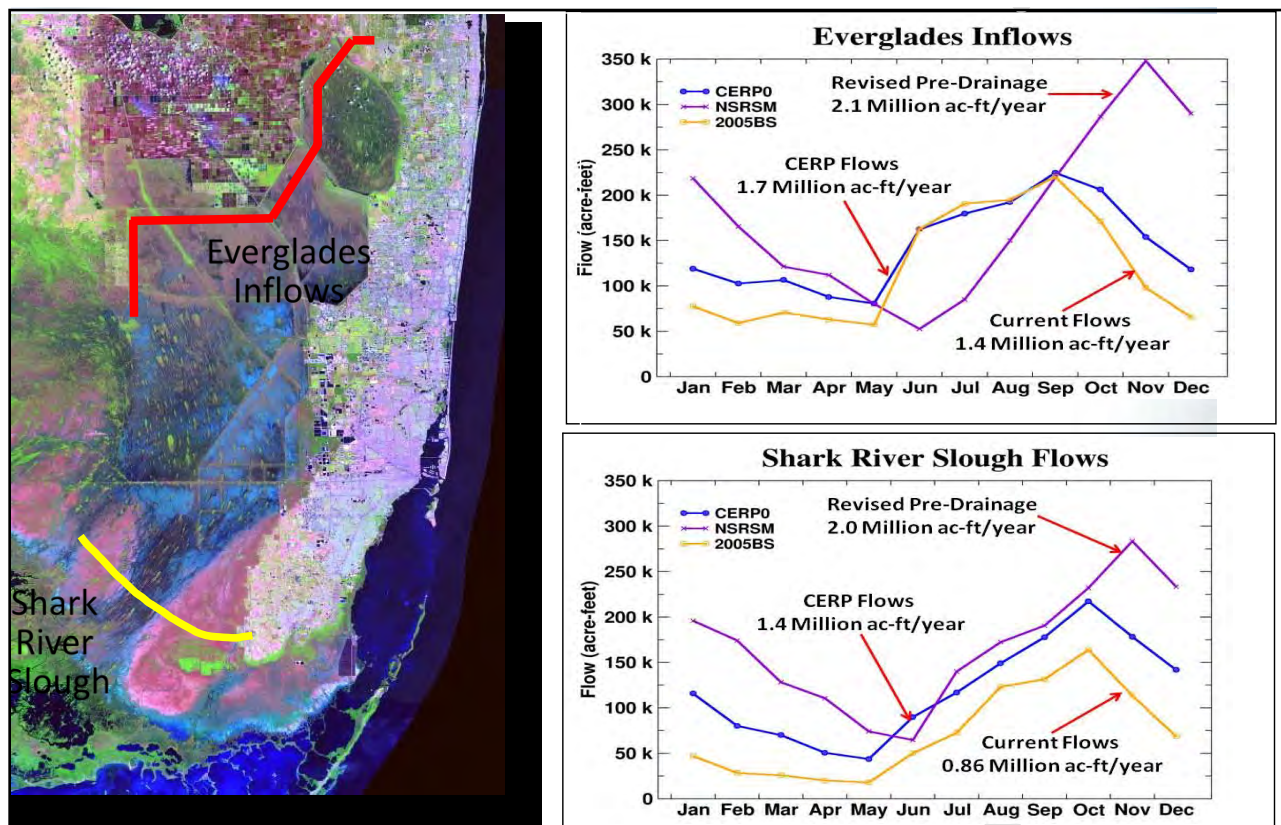


Figure 1-2. Water Flow Changes in the Everglades System

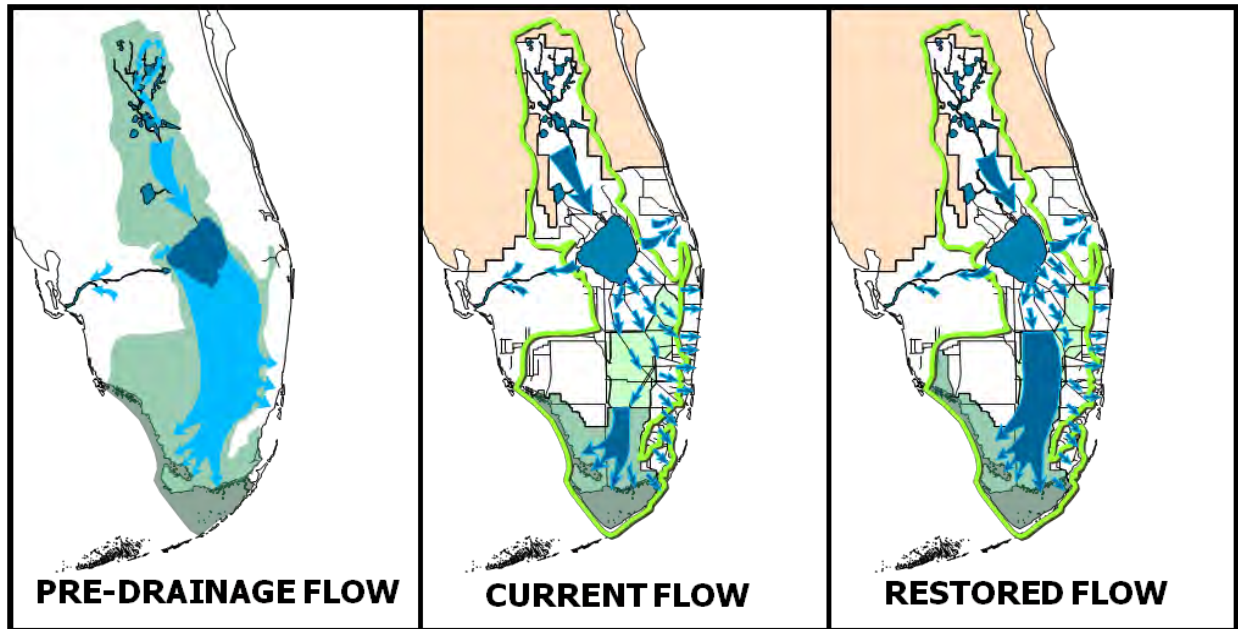


Figure 1-3. Pre-drainage, Current, and Restored Flows to Illustrate CERP Restoration

Since the CERP was approved, three projects were authorized in the 2007 WRDA and proceeded into construction (Indian River Lagoon-South, Picayune Strand, and Site 1 Impoundment) and a fourth project, Melaleuca and Other Exotic Plants Biological Controls, was implemented under the programmatic authority in WRDA 2000. Despite this progress, ecological conditions and functions within the central portion of the Everglades ridge and slough community continue to decline due to lack of sufficient quantities of freshwater flow into the central Everglades and timing and distribution problems. To respond to this concern, the U.S. Army Corps of Engineers (USACE) and the South Florida Water Management District (SFWMD) initiated the CEPP in November 2011 to evaluate alternatives for restoring ecosystem conditions in the central portion of the Everglades and opportunities for providing for other water-related needs in the region.

The purpose of the CEPP is to improve the quantity, quality, timing and distribution of water flows to the Northern Estuaries, central Everglades (Water Conservation Area 3 [WCA 3] and Everglades National Park [ENP]), and Florida Bay while increasing water supply for municipal, industrial and agricultural users. Too much water from Lake Okeechobee during the wet season, and too little water during the dry season impacts salinity levels within the Northern Estuaries, stressing estuarine ecosystems. Construction and operation of the WCAs compartmentalized a significant extent of the historical Everglades landscape and in turn degraded the structure and function of the remaining system. As a result, the Everglades are approximately half their original size, water tables are lowered, wetlands altered, freshwater flows diverted, water quality degraded, and habitats invaded by non-native plants and animals. All of these impacts are caused directly or indirectly by changes in hydrology. Changes in hydrology have led to the degradation of the historic slough, tree island and sawgrass mosaic that previously characterized much of the study area, as well as the marl prairies that exist in the southern portion of the area in ENP. The changes in the landscape pattern have had adverse effects on wildlife. Changes in hydrology of the freshwater systems have led to effects on the estuarine and marine environments of Florida Bay. Alterations in seasonal inflow deliveries to Florida Bay have resulted in extreme salinity fluctuations. The already degraded state of the Everglades will continue to worsen in the absence of increased water deliveries, improved water timing and restored distribution. Redirecting

a portion of the approximately 1.7 billion gallons of water per day on average that is discharged to the Atlantic Ocean and the Gulf of Mexico is essential to meeting the quantity, quality, timing and distribution of water required to realize a portion of the benefits envisioned in the CERP.

1.2 SCOPE OF STUDY

The CEPP is composed of increments of project components that were identified in the CERP, reducing the risks and uncertainties associated with project planning and implementation. The term “increment” is used to underscore that this study will formulate portions (scales) of individual components of the CERP. It is envisioned that later studies will investigate additional scales of components of the CERP to expand upon this initial “increment” to achieve the level of restoration envisioned for the CERP. This study approach is consistent with the recommendations from the National Research Council to utilize Incremental Adaptive Restoration to both achieve timely, meaningful benefits of the CERP and to lessen the continuing decline of the Everglades ecosystem.

Prior planning efforts and the development of scientific goals and targets for the CERP have led to a determination that some components are interdependent features that necessitate formulation from a systems approach. Recently authorized CERP projects generally do not greatly depend upon or influence other CERP projects. However, the components in the central part of the Everglades (interior CERP projects) are hydrologically connected from Lake Okeechobee to Florida Bay, and the downstream areas are reliant on the upstream areas for flows. These interdependencies require system plan formulation and analysis in order to optimize structural and operational components, rather than formulating separable components that may not be compatible when looking at them cumulatively.

The scope of the CEPP considered increments of the following components that were part of the CERP:

- Everglades Agricultural Area Storage Reservoirs (G)
- Modified Holey Land Wildlife Management Area Operation Plan (DD)
- Flow to Northwest and Central WCA 3A (II)
- WCA 3 Decompartmentalization and Sheetflow Enhancement (AA, QQ and SS)
- Dade-Broward Levee/Pennsuco Wetlands (BB)
- Bird Drive Recharge Area (U)
- L-31N Improvements for Seepage Management and S-356 Structures (V and FF)
- Everglades Rain-Driven Operations (H)

Since approval of the CERP in WRDA 2000, important advances in scientific understanding and evaluation tools have occurred that will contribute towards restoration success. Information from paleo-ecological indicators and pre/post drainage information gives us a better understanding of the evolution of the Everglades ecosystem. More recently, extensive planning and scientific investigations conducted as part of Restoration Coordination and Verification (RECOVER), adaptive monitoring and assessment, and formulation and evaluation of the first and second generation CERP projects has greatly increased scientific knowledge and understanding of the historic system, the current system, and the actions needed to restore the ecosystem. Application of this knowledge has improved the capability to plan and design for restoration of the desired central Everglades ecosystem.

1.3 STUDY AREA

The study area for the CEPP encompasses the Northern Estuaries (St. Lucie River and Indian River Lagoon and the Caloosahatchee River and Estuary), Lake Okeechobee, the Everglades Agricultural Area

(EAA), the Water Conservation Areas (specifically WCAs 2 and 3); ENP, the Southern Estuaries (specifically focused on Florida Bay), and portions of the Lower East Coast (LEC) (See foldout map at end of section and **Table 1-1**). Adjacent areas were also evaluated. For purposes of this study, the term Greater Everglades is defined as the region encompassing WCA 3 and ENP.

Table 1-1. Description of the CEPP Study Area

CEPP Study Area Region	Description of the Study Area Region
Lake Okeechobee	Lake Okeechobee is a large, shallow lake (surface area 730 square miles) 30 miles west of the Atlantic coast and 60 miles east of the Gulf of Mexico. It is impounded by a system of levees, with 6 outlets: St. Lucie Canal eastward to the Atlantic Ocean, Caloosahatchee Canal/River westward to the Gulf of Mexico, and four agricultural canals (West Palm Beach, Hillsboro, North New River and Miami). The lake is surrounded by the 143 mile long Herbert Hoover Dike. The lake has many functions, including flood risk management, urban and agricultural water supply, navigation, recreation, fisheries, and wildlife habitat. It is critical for flood control during wet seasons and water supply during dry seasons. Agriculture in the Lake Okeechobee Service Area (LOSA), including the EAA, is the predominate user of lake water. The lake is an economic driver for both the surrounding areas' and south Florida's economy.
Northern Estuaries	Lake Okeechobee discharges into the 2 Northern Estuaries. The St. Lucie Canal flows eastward into the St. Lucie Estuary, which is part of the larger Indian River Lagoon Estuary. The Caloosahatchee Canal/River flows westward into the Caloosahatchee Estuary and San Carlos Bay, which are part of the larger Charlotte Harbor Estuary. The St. Lucie and Caloosahatchee estuaries are designated Estuaries of National Significance, and the larger Indian River Lagoon and Charlotte Harbor estuaries are part of the U.S. Environmental Protection Agency (USEPA)-sponsored National Estuary Program. The landscape includes pine-flatwoods, wetlands, mangrove forests, submerged aquatic vegetation, estuarine benthic areas (mud and sand) and near-shore reefs.
Everglades Agricultural Area	The EAA is approximately 630,000 acres in size and is immediately south of Lake Okeechobee. Much of this rich, fertile land is devoted to sugarcane production, and is crossed by a network of canals that are strictly maintained to manage water supply and flood protection. The landscape includes natural and man-made areas of open water such as canals, ditches, and ponds, wetlands, and lands associated with agricultural and urban use. Within the EAA there is approximately 45,000 acres of stormwater treatment areas (STAs) and the Holey Land and Rotenberg Wildlife Management Areas.
Water Conservation Areas	WCA 2 and, WCA 3 (the largest of the three) are situated southeast of the EAA and are approximately 1,328 square miles. The WCAs extend from EAA to ENP. They provide floodwater retention, water supply for urban and agricultural uses, and are the headwaters of ENP. The landscape includes open water sloughs, sawgrass marshes, and tree islands.
Everglades National Park	ENP was established in 1947, covering ~2,353 square miles (total elevation changes of only 6 feet from its northern boundary at Tamiami Trail south to include much of Florida Bay). The landscape includes sawgrass sloughs, tropical hardwood hammocks, mangrove forest, lakes, ponds, and bays.
Florida Bay	Florida Bay is a shallow estuarine system (average depth less than 3 feet) comprising a large portion of ENP. It is the main receiving water of the greater Everglades, heavily influenced by changes in timing, distribution, and quantity of freshwater flows into the Southern Estuaries. The landscape includes saline emergent wetlands, seagrass beds, and mangrove forests.
Lower East Coast	The LEC encompasses Palm Beach, Broward, Monroe and Miami-Dade Counties. Water levels in this area are highly controlled by the C&SF water management system to provide flood damage reduction and sufficient water supply to minimize the risk of detrimental saltwater intrusion. Biscayne Bay and the contiguous water bodies of Card, Little Card, and Barnes Sounds and Manatee Bay lie along the southeastern mainland boundary of the LEC and receive their freshwater supplies as inflows of surface and groundwater that are

CEPP Study Area Region	Description of the Study Area Region
	dependent on water table stages east of L-31 N. The CEPP is focused on the portions of the LEC adjacent to the natural areas and susceptible to seepage.

1.4 PROBLEMS AND OPPORTUNITIES

Current operations of the C&SF Project involve water supply and flood releases to manage stage levels in Lake Okeechobee, the WCAs, and the Everglades. Prolonged high volume discharges of water from Lake Okeechobee to the Northern Estuaries coupled with excessive nutrient concentrations in Lake Okeechobee water and downstream basin water have resulted in damaging effects on the plants and animals inhabiting these areas. System changes have resulted in point source peak flows that are higher just prior to and/or following major rain events, and flow rates that decline more abruptly during the end of the wet season. Due to limited storage capacity and water quality treatment requirements, flows to the Everglades from Lake Okeechobee have shifted from primarily wet season flows in response to rainfall to controlled dry season deliveries in response to urban and agricultural water demands. The impoundment of the natural system, construction of drainage canals and conveyance features, and current C&SF operations have disrupted the annual pattern of rising and falling water depths in the remaining wetlands. These hydrologic changes have contributed to degradation and loss of valuable tree islands. The current system is now too wet in some areas and too dry in others.

Additionally, the conversion of natural areas for urban and agricultural uses and the network of C&SF Project canals have altered the natural system, causing complete shifts in vegetative communities and loss of fish and wildlife resources. The result is reduced water storage capacity in the remaining natural system and an unnatural mosaic of impounded, fragmented, over-inundated and over-drained marshes.

1.4.1 Lake Okeechobee and the Northern Estuaries

Drainage for urban and agricultural development in the Caloosahatchee and St Lucie basins has increased the volume and altered the timing of local basin discharges to the river and estuary. In many cases, these increased flows precede regulatory releases from Lake Okeechobee and introduce large amounts of undesirable floodwaters westward to the Caloosahatchee River and Estuary, and eastward to the St. Lucie River and Estuary and southern Indian River Lagoon. Both Northern Estuaries can suffer from insufficient dry season flows, but this is a chronic phenomenon in the Caloosahatchee Estuary. Changes in the quantity, quality, timing and distribution of freshwater entering the estuaries lead to abnormal salinity fluctuations. Submerged aquatic vegetation in these estuaries are stressed, and in some areas have been reduced or eliminated by salinity fluctuations, turbidity, sedimentation, nutrient enrichment, and severe algal blooms. A reduction in the size and health of submerged aquatic vegetation (SAV) beds affects the location, abundance, and species richness of fisheries in the estuary. Severe algal blooms can result in ulcerated fish and fish kills. Flows less than 450 cubic feet per second (cfs) in the Caloosahatchee River Estuary are considered undesirable since these flow levels allow salt water to intrude, raising salinity above the tolerance limits for communities of submerged aquatic plants (tape grass [*Vallisneria americana*]), in the upper estuary. The distribution of oysters in these estuaries has been severely limited because of the freshwater pulses that cause low salinity conditions and degradation of substrate needed for colonization and growth. Based on the salinity tolerances of oysters, flows less than 350 cfs in the St. Lucie Estuary result in higher salinities at which oysters are susceptible to increased predation and disease. Submerged aquatic vegetation and oyster reefs are important habitats for fish and other organisms and contribute to ecological values. Estuaries also contribute socio-economic value via fisheries and recreation. For further information on where target

flows are measured with respect to regional hydrologic modeling, please refer to **Appendix G (Benefit Model)**.

1.4.2 Water Conservation Area 3

In response to expansive sheetflow from Lake Okeechobee, seasonal rainfall and periodic fire, the pre-drainage landscape of WCA 3 consisted of a complex mosaic of vegetative habitats interspersed on the flat peat bed that had accumulated for 5,000 years. Construction and operation of the C&SF Project has had unintended and adverse effects on the ecosystems of WCA 3 which continues to decline.

The northern end of WCA 3A has been over-drained and the natural hydroperiods for WCA 3A have been shortened. Hydrologic changes have resulted in the loss of the ridge and slough landscape that was characteristic of the area historically and prior to construction of the C&SF Project. This has resulted in a loss of land surface elevations, principally through soil oxidation and peat fires, as shown in **Figure 1-4**. This figure displays a minimum and maximum estimation of change in elevation as a difference in land surface elevations from 1946 to the land surface elevations surveyed in 1996 (Scheidt, et al. 2000). Since the 1946 peat thickness was reported in 2-foot intervals, soil volume differences from 1946 to 1996 are presented as a range. Calculation of soil loss during that 50-year period indicate that northern WCA 3A lost between 39% and 65% of its organic soils.

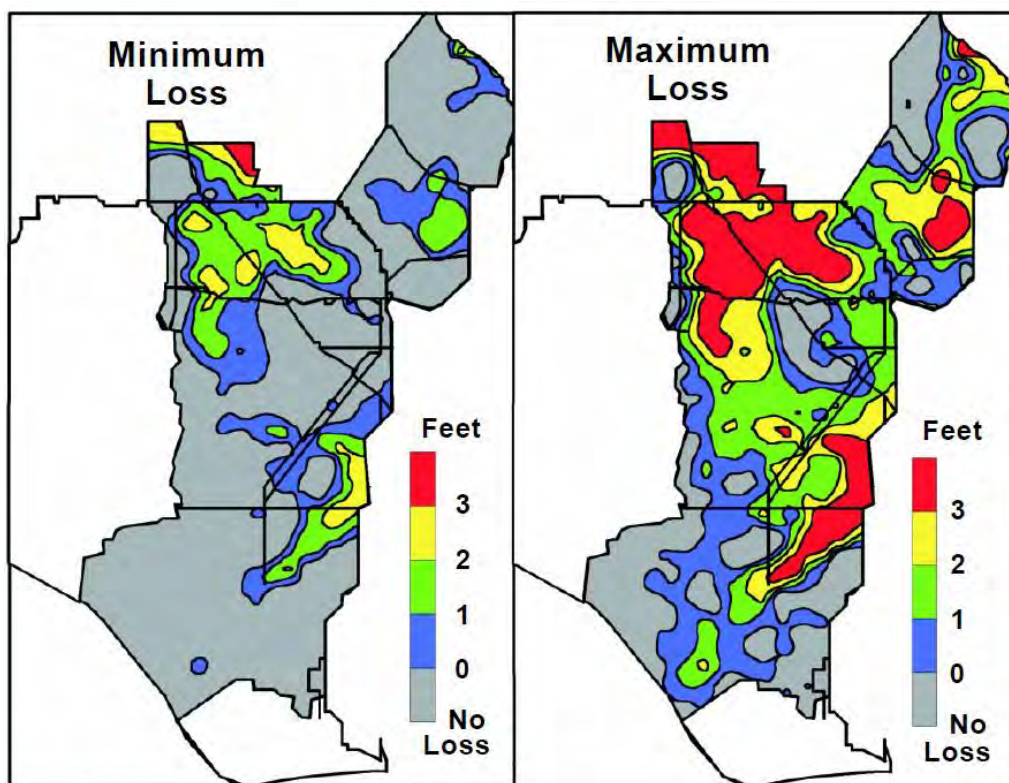


Figure 1-4. Soil Loss (Feet) from 1946 to 1996 for the Everglades (Source Scheidt et. al. 2000)

Currently, northern WCA 3A is largely dominated by sawgrass, cattail and scattered shrubs, and lacks the natural structural diversity of plant communities seen in central and western WCA 3A as can be seen in **Figure 1-5** and **Figure 1-6**.

Northern WCA 3A has lost the landscape pattern characteristic of the ridge-slough-tree island mosaic as can be seen in **Figure 1-6**. The vegetation image compared to the image on the right side of the figure showing historic ridge and slough patterning clearly displays the impacts caused by lack of sheetflow, water depths and inundation durations. Decreased hydroperiods in northern WCA 3A have allowed major peat fires that have changed much of the ridge and slough topography in northern WCA 3 into cattail, willow, or sawgrass mix (Rutchev 2010).

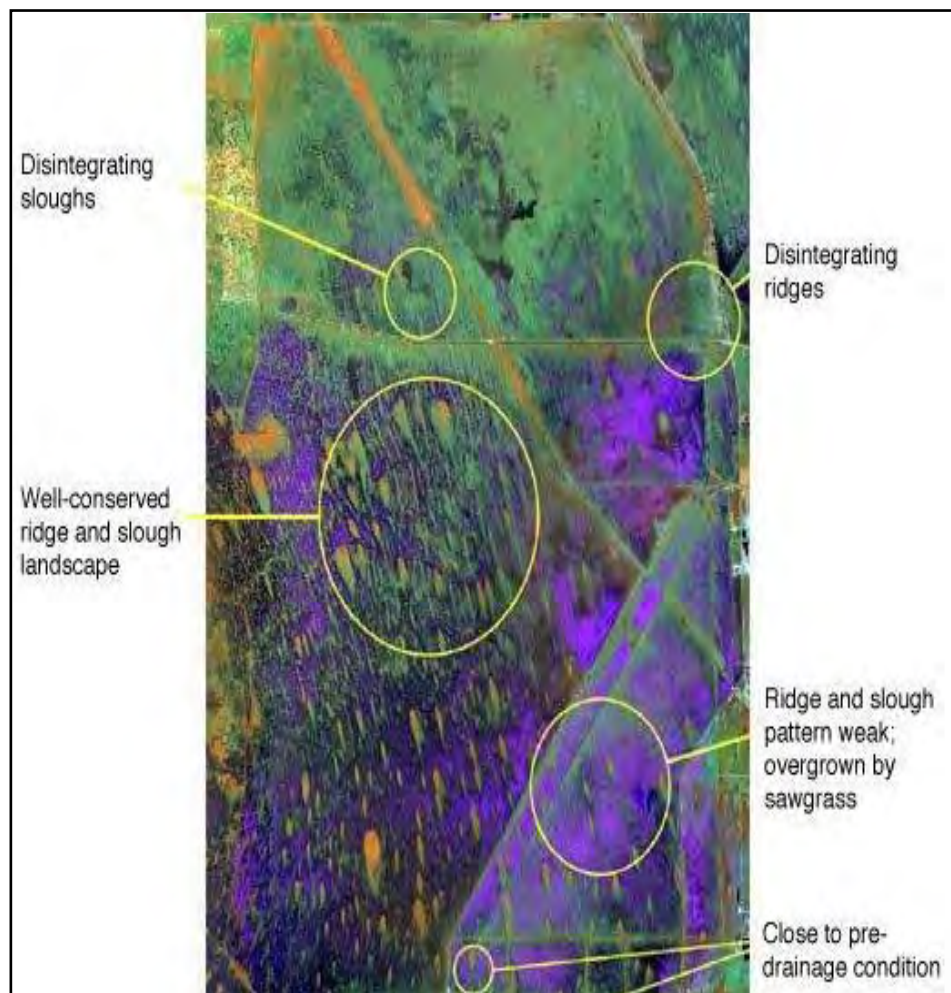


Figure 1-5. WCA 3A and 3B Ecological Conditions

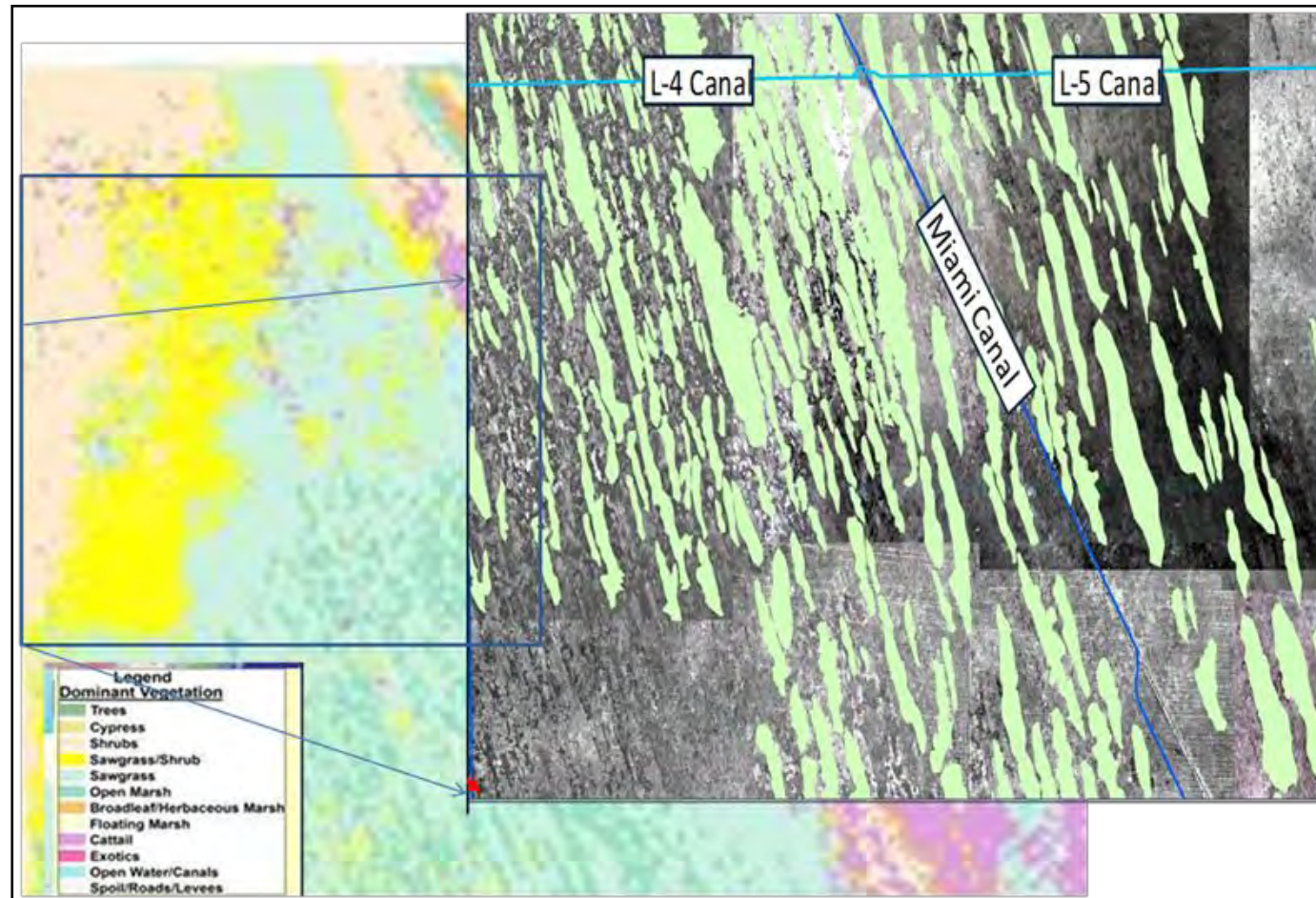


Figure 1-6. Dominant Vegetation and Current and Historic Landscape Patterns in Northern WCA 3A. The image in the background (left) shows the 2004 dominant vegetation in northern WCA 3A. The image in the foreground (right) is a zoomed-in image of the area with a shading representing locations of historic ridges that are no longer apparent in the 2004 vegetation.

Vegetation and patterning in the central portion of WCA 3A resembles the pre-drainage conditions most closely (McVoy, et al. 2011) and represents some of the best examples of Everglades habitat left in south Florida. This region of the Everglades appears to have changed little since the 1950s (which was already post-drainage) and contains a mosaic of tree islands, wet prairies, sawgrass stands, sawgrass ridges, and aquatic sloughs similar to those reported by Loveless (1959). The southern portion of WCA 3A is primarily affected by high water, lack of seasonal variability and prolonged periods of inundation created by impoundment structures (i.e., the L-67A/C and L-29 levees).

Increased hydroperiods within southern WCA 3A have negatively impacted tree islands and caused fragmentation of the sawgrass ridges, again resulting in the loss of historic landscape patterning.

Within WCA 3B, the ridge-slough-tree island structure has been severely compromised by the virtual elimination of overland sheetflow since the construction of the L-67 Canal/Levee system in the early 1960s. WCA 3B has become primarily a rain-fed compartment, experiencing very little overland flow; it has largely turned into a sawgrass monoculture, where relatively few sloughs or tree islands remain. **Figure 1-7** shows tree island loss from 1940 to 1995 in WCA 3 (Rutchey 2010).

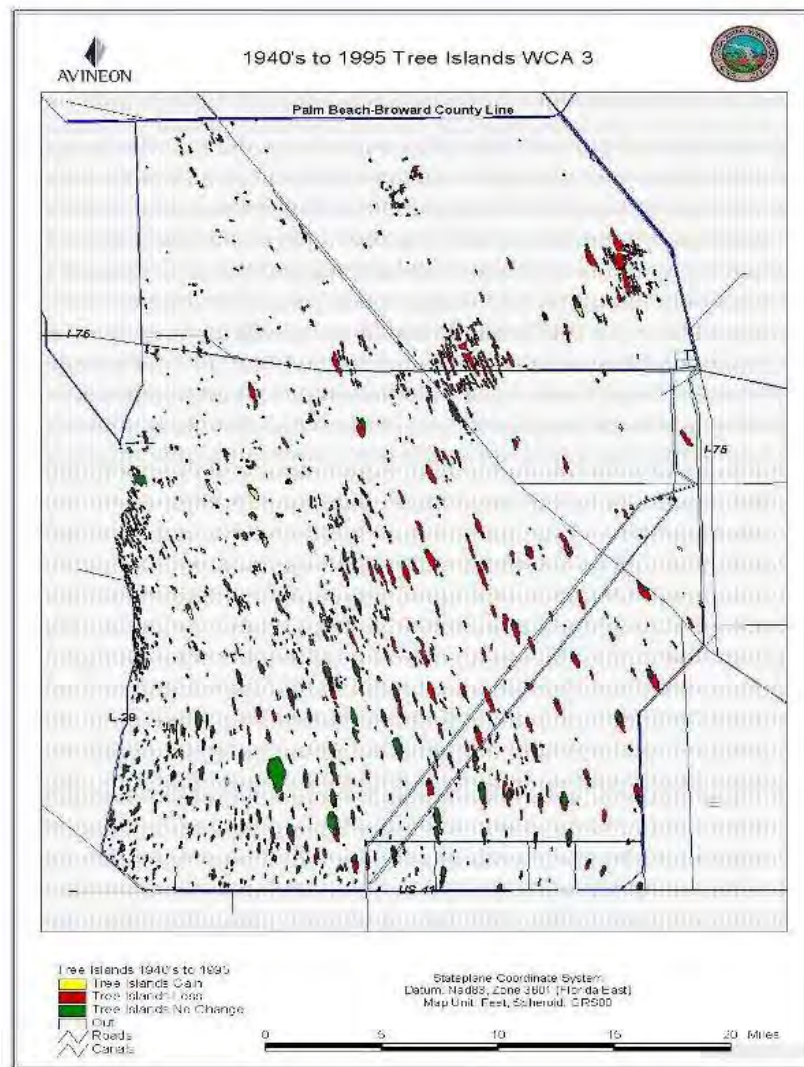


Figure 1-7. Tree Island Loss in WCA 3 from 1940 to 1995

1.4.3 Everglades National Park

ENP experiences many of the same issues that occur within WCA 3. One significant problem is the extreme dry downs that occur during many dry seasons. Although typically there is reduced rainfall during the dry season, the historic Everglades system did not experience water levels that fell below ground surface for long periods. Currently, the limited capability to store and treat Lake Okeechobee outflows for delivery to the Everglades, current C&SF operations, and water loss through seepage along the eastern levees cause these extreme dry downs to occur, resulting in substantial peat subsidence and muck fires. The USEPA found that in the 50 years from 1946-1996, more than 3 feet of peat soil was lost from the Northeast Shark River Slough (NESRS) and eastern WCA 3B due to soil oxidation and peat fires (Scheidt et al. 2000). The subsidence and fires damage the substrate, limit water retention, and alter vegetative communities. The dry downs have reduced the number of prey species that used to be available in the deepwater refugia, causing detriment to breeding populations of wading birds.

1.4.4 Florida Bay

Florida Bay is a shallow estuarine system comprising a large portion of ENP. Freshwater inflow to Florida Bay has decreased in volume, and has changed in timing and distribution during the twentieth century because of water management practices. This has resulted in increased salinities in the bay (Rudnick et al. 2005). Hydrologic alteration began in the late 1800s but accelerated with construction of drainage canals by 1920, the Tamiami Trail by 1930, and the C&SF Project and the South Dade Conveyance System from the early 1950s through 1980 (Light and Dineen 1994). The magnitude of this salinity increase, as well as the amount of freshwater inflow loss associated with this salinity change, has been estimated by Marshall et al. (2009) and Marshall and Wingard (2012). Bay salinity has increased by 5 parts per thousand (ppt) to 20 ppt across a wide range of bay sites. These studies also estimated that pre-drainage flows to the bay down Taylor Slough were roughly 4 times greater than present flows and these flows down SRS were roughly 2 times greater than present flows. Associated pre-drainage stages were about 30% higher in SRS than present and more than double current stages in Taylor Slough. Decreased input of freshwater flow from the Everglades and associated increases in salinity are thought to be the primary causes of ecological changes within the bay including mass mortality of turtle grass (*Thalassia testudinum*) and reductions in fish (e.g. spotted seatrout, *Cynoscion nebulosus*) and catches of pink shrimp (*Farfantepenaeus duorarum*) (Rudnick et al. 2005).

1.4.5 Water Supply

The C&SF project is a multi-purpose project that includes providing water supply to meet municipal, industrial, and agricultural uses. Drainage, water supply, and flood protection afforded by the C&SF Project have provided for the growth of south Florida's population. In south Florida's LEC, groundwater from the surficial aquifer system is the predominant source of water for municipal and industrial uses. User's reliance on water from alternative sources such as the Floridan aquifer, reuse and other sources has grown significantly and is expected to increase because of population growth and possible rainfall decreases and evapotranspiration increases due to climate change. Lake Okeechobee is an important source of water to both natural and developed areas, particularly during low rainfall years. The growing demand for dependable water for agriculture, industry, and municipal water supply at a reasonable cost could exceed the limits of readily accessible sources during the planning horizon. When the needs of the region's natural systems are factored in, conflicts for water among users will become more severe.

1.4.6 Recreation

Tourism is a "critical industry", as identified by the Governor's Commission for a Sustainable South Florida Initial Report (1995). A healthy ecosystem and its attendant tourism are the mainstays of the regional economy, as reflected by the relative domination of economic activity there in the services,

retail trade, and fisheries industries. Many Floridians also visit the natural areas regularly to enjoy a variety of outdoor activities, primarily hunting and fishing. The ability to sustain the region's economy and quality of life depend, to a great extent, on the success of the efforts to protect and better manage the region's water resources. A stable and healthy environment will directly benefit the local economy through increases in tourism and dollars generated by the residents who enjoy outdoor activities.

1.5 PURPOSE: OBJECTIVES AND CONSTRAINTS

1.5.1 CERP and CEPP Goals and Objectives

Section 601(h) of WRDA 2000 states “[t]he overarching objective of the Plan is the restoration, preservation, and protection of the South Florida Ecosystem while providing for other water-related needs of the region, including water supply and flood protection”. These same objectives apply to the CEPP study efforts (Table 1-2).

Table 1-2. Goals and Objectives of CERP and CEPP

CERP Goal: Enhance Ecological Values	
CERP Objective	CEPP Objective
Increase the total spatial extent of natural areas	No corresponding CEPP objective; consider this objective in future increments
Improve habitat and functional quality	Restore seasonal hydroperiods and freshwater distribution to support a natural mosaic of wetland and upland habitat in the Everglades System
	Improve sheetflow patterns and surface water depths and durations in the Everglades system in order to reduce soil subsidence, the frequency of damaging peat fires, the decline of tree islands, and salt water intrusion
	Reduce high volume discharges from Lake Okeechobee to improve the quality of oyster and SAV habitat in the northern estuaries
Improve native plant and animal species abundance and diversity	Reduce water loss out of the natural system to promote appropriate dry season recession rates for wildlife utilization
	Restore more natural water level responses to rainfall to promote plant and animal diversity and habitat function
CERP Goal: Enhance Economic Values and Social Well Being	
Increase availability of fresh water (agricultural/municipal & industrial)	Increase availability of water supply
Reduce flood damages (agricultural/urban)	No corresponding CEPP objective; consider this objective in future increments
Provide recreational and navigation opportunities	Provide recreational opportunities
Protect cultural and archeological resources and values	Protect cultural and archeological resources and values

1.5.2 Constraints

Project constraints were recognized to ensure that the proposed project would not reduce the level of service for flood protection, protect existing legal users, and meet applicable water quality standards for the natural system. When a project is expected to result in an elimination or transfer of an existing legal source of water, the Project Implementation Report (PIR) shall include an implementation plan that ensures a new source of water of comparable quantity and quality is available to replace the source that is being transferred or eliminated. Implementation of the project will not reduce the levels of service for flood protection within the areas affected by the project.

WRDA 2000 requires the inclusion of “Savings Clause” analyses within each CERP PIR. The “Savings Clause” protects existing legal sources of water supply, such as water for municipal and agricultural uses, and ensures that CERP implementation does not reduce the level of service for flood protection. In accordance with Section 601(h)(4) and (5) of WRDA 2000 the following are constraints for CEPP implementation:

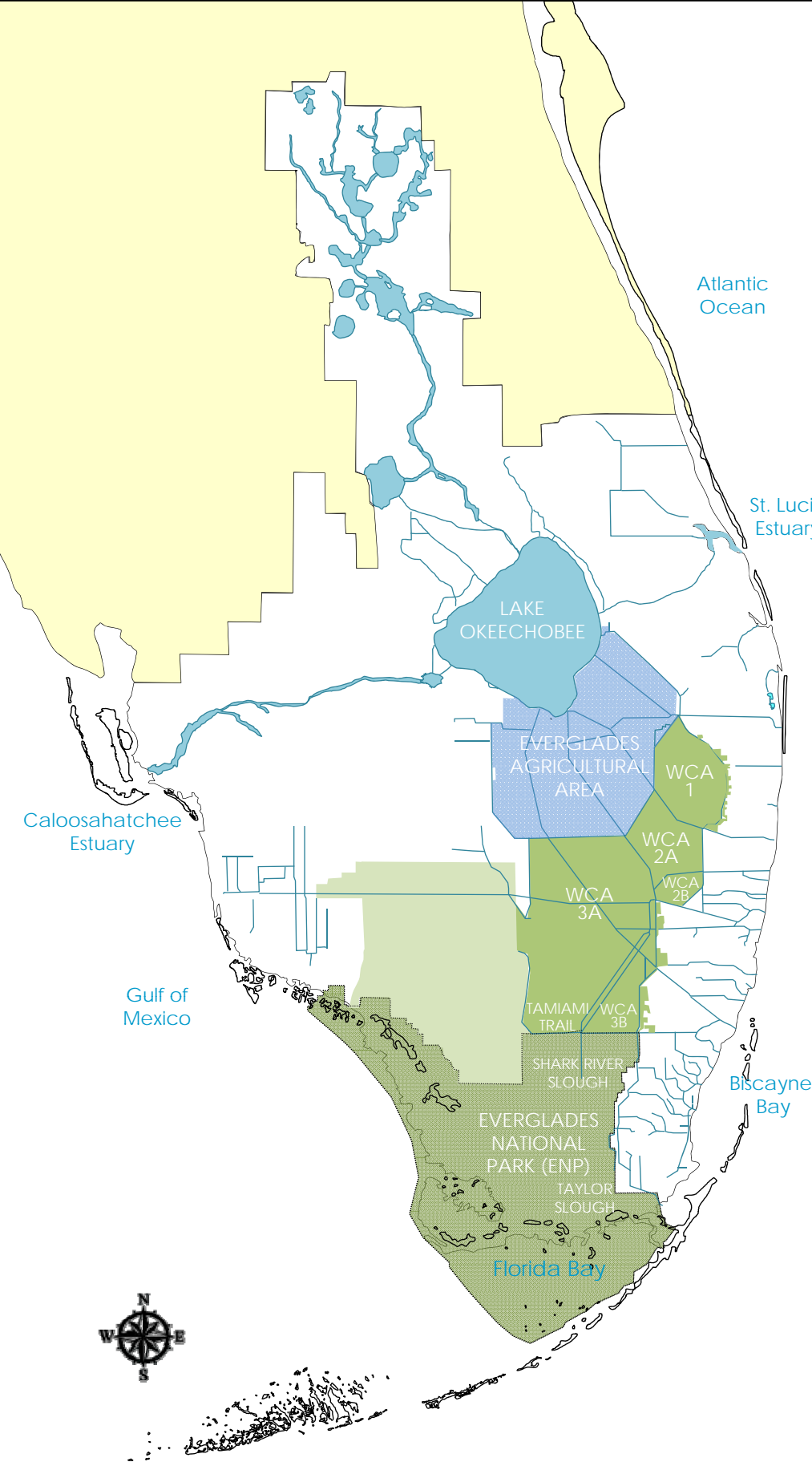
- Avoid reduction in the existing level of service for flood protection caused by Plan implementation
- Provide replacement sources of water of comparable quantity and quality for existing legal sources that could experience water supply reductions caused by Plan implementation
- Meet applicable Water Quality Standards

1.6 REPORT AUTHORITY

The WRDA of 2000 approved the CERP as a framework for modifications to the C&SF Project in Section 601(b)(1)(A). The CEPP PIR will be submitted in compliance with Section 601(d) WRDA 2000, titled 'Authorization of Future Projects'.

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NORTHERN ESTUARIES: Too much water from Lake Okeechobee during the wet season, and too little water during the dry season impacts salinity levels, stressing estuarine ecosystems



WCA 3: Too dry in WCA 3B and Northern WCA 3A; too wet (ponding) in Southern WCA 3A



WCAs: Disrupted hydrologic conditions lead to topographic changes, with a decline in the ridge and slough system and tree islands



TAMIAMI TRAIL: Barriers reduce southerly flows into Everglades National Park resulting in ponding in southern WCA 3A and drier conditions in ENP



FLORIDA BAY: Lack of adequate freshwater flows reaching the Southern Coastal System results in higher salinity levels in southern estuaries

CENTRAL EVERGLADES PLANNING PROJECT (CEPP)
STUDY AREA

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2.0 EXISTING AND FUTURE WITHOUT CONDITIONS

Please open the foldout figure at the end of this section to reference while reading.

This section provides a description of existing and future without (FWO) project conditions within the study and a definition of the FWO project condition and how and why it is developed.

2.1 “WITH” AND “WITHOUT” COMPARISONS

The U.S. Water Resources Council’s *Principles and Guidelines* provide the instructions and rules for Federal water resources planning. One *Principles and Guidelines* requirement is to evaluate the effects of alternative plans based on a comparison of the most likely future conditions with and without those plans in place. In order to make this type of comparison, descriptions (often called forecasts) must be developed for two different future conditions: the FWO project condition and the future with project condition. Note that the project referred to in this context is any one of the alternative plans that have been considered in the study. The FWO project condition describes what is assumed to be in place if none of the study’s alternative plans are implemented. The FWO project condition is the same as the alternative of “no action” that is required to be considered by the Federal regulations implementing the National Environmental Policy Act (NEPA) of 1969. For consistency of the report, the **No Action Alternative** is referred to as the **FWO** for the remainder of the report. The future with project condition describes what is expected to occur as a result of implementing each alternative plan that is being considered in the study. The differences between the future without project condition and the future with project condition are the effects of the project.

2.2 PLANNING HORIZON

The planning horizon encompasses the Planning Study period, construction period, economic analysis period, and the effective life of the project. The time frame used when forecasting future with and without project conditions while considering impacts of alternative plans is called the period of economic analysis. It may also be referred to as simply the period of analysis. It is the period of time over which scientists think extending the analysis of the plan impacts is important. This time period is frequently confused with the planning horizon, which is a longer and more encompassing concept. **Figure 2-1** shows that the period of analysis is part of the planning horizon.

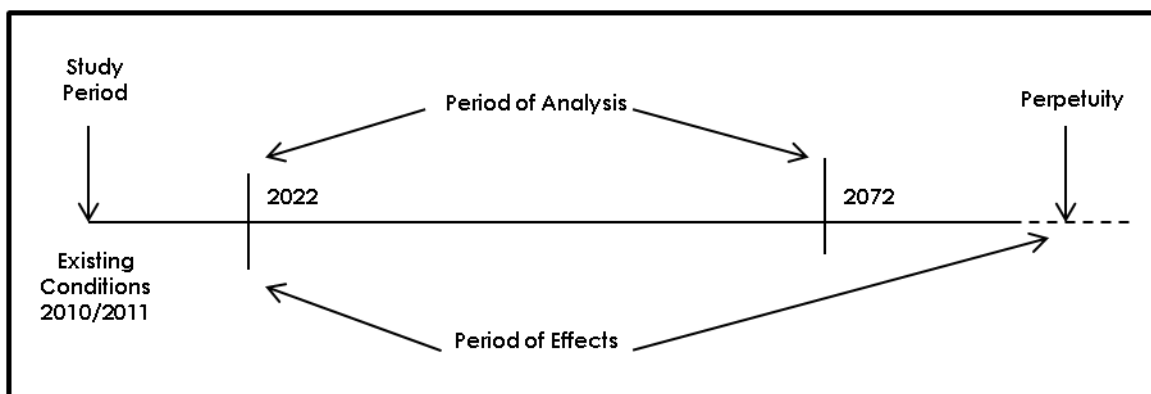


Figure 2-1. Planning Horizon

The period of analysis for water resources projects usually falls between 50 and 100 years. Even if project structures last more than 100 years, there is too much inherent uncertainty to reliably forecast conditions and impacts beyond 100 years. The base year for the period of analysis for the Central

Everglades Planning Project (CEPP) is 2022. The base year assumes an unconstrained implementation timeline in which CEPP will be authorized, designed, and constructed. By incorporating a 50-year period of analysis to reflect beneficial and adverse effects of the project through time, the period of analysis for the proposed project will be 50 years, ending in the year 2072.

The typical period of analysis for Comprehensive Everglades Restoration Plan (CERP) studies differs from traditional studies because of the programmatic requirement to calculate system-wide benefits. In order to accurately predict system needs and project operations for the entire system, all CERP projects have utilized the same ending date for the period of analysis as the most current version of the plan (i.e. the April 1999 “Final Integrated Feasibility Report and Programmatic Environmental Impact Statement” used 2050).

Accounting for the beneficial and adverse effects of CEPP through time is largely based on hydrologic modeling and performance measure evaluation. Extending the ending date out to 2072 will not substantially change the outcome of the analysis since future conditions assume that land use and water supply are fixed at existing condition levels. Land use is fixed since development in the CEPP benefit area (natural areas) is prohibited and potential increases to public water supply allocations in general, have been capped by State rule at the 2006 actual withdrawals (per the Lower East Coast (LEC) water supply plan). The operations projected in the absence of a project would be similar to 2050 estimates, as would the non-CEPP projects that are being implemented since most of these are expected to be complete well prior to 2050. The latest and best available data was used to project the future conditions, including rainfall patterns. Based on the assumptions used for future forecasting, there is little reason to believe that hydrologic conditions in the central Everglades would be substantially different between 2050 and 2072.

2.3 EXISTING AND FORECASTED ECOLOGICAL DESCRIPTION/SETTING

The following describes a summary of the existing and FWO project conditions within the study area. Existing and FWO project conditions are further documented in **Appendix C.1**.

Lake Okeechobee is the largest lake in the southeastern United States and is a central part of the south Florida watershed. Lake Okeechobee receives water from a 5,400 square mile watershed that includes four distinct tributary systems: Kissimmee River Valley, Lake Istokpoga-Indian Prairie/Harney Pond, Fisheating Creek, and Taylor Creek/Nubbin Slough. With the exception of Fisheating Creek, all major inflows to Lake Okeechobee are controlled by gravity-fed or pump-driven water control structures. Lake Okeechobee provides water supply to urban areas, agriculture, and downstream estuarine ecosystems during the dry season (November-May) and is used for flood control during the wet season (June-October). In the Lake Okeechobee Service Area (LOSA), the Okeechobee Utility Authority is the only remaining public water supply (PWS) utility using water directly from Lake Okeechobee. Clewiston, South Bay, Belle Glade, and Pahokee have discontinued the use of Lake Okeechobee as their supply source and use Floridan aquifer water treated by reverse osmosis for all of their PWS since 2008. The Okeechobee Intercoastal Waterway (OIWW) provides economically and politically important commerce between the eastern and western coasts of Florida. The waterway connects the Atlantic Intracoastal Waterway to the Gulf Intracoastal Waterway and is a congressionally authorized project, with depths and operations required for efficient navigation on the system. The authorized Central and Southern Florida (C&SF) project depths for Lake Okeechobee navigation are based on 12.56 feet (ft) National Geodetic Vertical Datum (NGVD).

Under pre-drainage conditions, Lake Okeechobee is thought to have been eutrophic (Steinman et al. 2002) and was considerably deeper and larger (spatially) than it is today (Aumen 1995). Outflows from the lake were largely restricted to sheet flow to the south and east. A southern marsh comprised the northern headwater of the Florida Everglades, with the lake often supplying water during periods of high lake levels or as a result of tropical storms. The historic high and low stages for the lake are estimated at approximately 22.5 ft and 19 ft, respectively (Wright 1911). Historic observations indicate the presence of a substantial sawgrass community located along the western side of the lake suggesting a historic eight month hydroperiod for the area during which soils were saturated with water. Historically, stages within the lake may have risen around two feet above the marsh ground elevation in the wet season and may have fallen up to a foot by the end of the dry season (McVoy et. al. 2005).

Currently, Lake Okeechobee differs from the historic lake in size, range of water depth and connection with other parts of the regional ecosystem. Connecting Lake Okeechobee to the Caloosahatchee River and construction of the St. Lucie Canal in the early 1900s greatly reduced system-wide water storage and sheetflow to the south during drier periods (NRC 2007). Construction of Herbert Hoover Dike (HHD) around the lake reduced the size of Lake Okeechobee's open-water zone by nearly 30 percent, resulting in considerable reductions in average water levels, and produced a new littoral zone within the dike that is only a fraction of the size of the natural one (Aumen 1995, Havens and Gawlik 2005). Today, the lake has a surface area of 730 square miles and is extremely shallow. The lake has an average depth of 8.6 ft (average stages 14.11 ft NGVD) based on the period of record from 1972 to 2012). Composition of vegetative communities within the remaining littoral zone of the lake has changed. They remain essential for the ecological health of the Lake but are stressed by extreme high and low lake levels and by the spread of exotics. Lake Okeechobee has also been the recipient of increasingly excessive inputs of nutrients primarily from agricultural activities in the watershed (Flaig and Havens 1995, Havens et al. 1996). The sustained influx of nutrients has resulted in dramatic undesirable changes in water quality. In the open water or pelagic region of the lake, large algal blooms have occurred which can result in lower dissolved oxygen levels and fish kills. Vast quantities of soft organic, nutrient-laden sediments have accumulated which are easily re-suspended causing Lake Okeechobee to become turbid. Plants have been impacted and in turn, those organisms that utilize plant communities as a food source for habitat have been affected.

The St. Lucie River, which is part of the Indian River Lagoon ecosystem, is located on the east coast of Florida. The St. Lucie River is approximately 35 miles long and has two major forks, the North and the South, that flow together and then eastward to the Indian River Lagoon and Atlantic Ocean at the St. Lucie Inlet. Historically, the St. Lucie River system was a freshwater stream flowing into the Indian River Lagoon. An inlet was dug in the late 1800s by local residents to provide direct access from the Indian River Lagoon to the Atlantic Ocean, thus changing the St. Lucie from a river to an estuary. The St. Lucie Estuary is now connected to Lake Okeechobee by the C-44 canal constructed in the early 1900s. The C-44 canal discharges into the St. Lucie Estuary via the S-80 lock and flow control structure. Other major canals constructed in the watershed include the C-23, C-24, and C-25 canals.

The Caloosahatchee River and Estuary is located on the west coast of Florida. The Caloosahatchee River is the major source of freshwater for the Caloosahatchee Estuary. Alterations to the Caloosahatchee River and watershed over the past century have resulted in a major change in freshwater inflow to the estuary. The Caloosahatchee River was originally a shallow, meandering river with headwaters in the proximity of Lake Hicpochee, near Lake Okeechobee. The Caloosahatchee River is now connected to Lake Okeechobee by the C-43 canal constructed in the early 1900s. Today, the river extends from Lake Okeechobee to San Carlos Bay. The river now functions as a primary canal (C-43) that conveys both

runoff from the Caloosahatchee watershed and releases from Lake Okeechobee. The canal has undergone numerous alterations including channel enlargement, bank stabilization, and a series of three lock and dam structures. The final downstream structure, W.P. Franklin Lock and Dam (S-79), demarcates the beginning of the estuary and acts as a barrier to salinity and tidal action, which historically extended farther east to near the LaBelle area.

Major modifications to the hydrology of the St. Lucie and Caloosahatchee watersheds through water management, including water releases from Lake Okeechobee, along with land-use transformations, increased development, and dredging for navigation, have resulted in alterations within the estuaries. Alterations in the quantity, quality, timing and distribution of fresh water entering the estuary have resulted in adverse ecological impacts in the estuaries. As a result of channelization (C-43 and C-44) and operation of water control structures (S-79 and S-80) freshwater flows into the estuaries tend to be excessive in the wet season and occasionally (St. Lucie Estuary) or chronically (Caloosahatchee) insufficient in the dry season. The estuaries have lost large acreages of both submerged aquatic vegetation (SAV) and oysters due to large fluctuations in salinity caused by excessive freshwater during wet times and a lack of base flow during extremely dry years. There is also a problem with re-colonization in areas where salinity conditions are favorable, due to the lack of suitable substrate needed to support benthic fauna and flora. This substrate problem includes both large areas of thick organic mucky sediment which is especially a problem in the St. Lucie Estuary as well as lack of hard bottom substrate needed for oyster colonization. The natural ability of the estuaries to filter nutrients has also been impacted contributing to degraded water quality.

Undesirable flood control discharges from Lake Okeechobee would still occur in the future scenario. These may be partially offset by future optimization of Lake Okeechobee regulation schedules and risk reduction actions related to HDD combined with possible increases in lake storage. Local, State and Federal wetland regulatory programs would likely limit impacts to high value, estuarine wetlands, and compensatory mitigation would be required to offset any loss of wetland function or value that may occur. Any future effects from local stormwater runoff and resulting eutrophication would likely be offset by stormwater facility construction and/or best management practices.

The remaining portion of the Greater Everglades wetlands includes a mosaic of interconnected freshwater wetlands and estuaries located primarily south of the Everglades Agricultural Area (EAA). A ridge and slough system of patterned, freshwater peat lands extends throughout the Water Conservation Areas (WCAs) into Shark River Slough in Everglades National Park (ENP). The ridge and slough wetlands drain into tidal rivers that flow through mangrove estuaries into the Gulf of Mexico. Higher elevation wetlands that flank either side of Shark River Slough are characterized by marl substrates and exposed limestone bedrock. Those wetland areas located to the east of Shark River Slough include the drainage basin for Taylor Slough, which flows through an estuary of dwarf mangrove forests into northeast Florida Bay. The Everglades wetlands merge with the forested wetlands of Big Cypress National Preserve to the west of WCA 3.

Declines in ecological function of the Everglades have been well documented. In the pre-drainage system, the inundation pattern supported an expansive system of freshwater marshes including long hydroperiod sawgrass “ridges” interspersed with open-water “sloughs”, higher elevation marl prairies on either side of Shark River Slough, and forested wetlands in the Big Cypress marsh. Rainfall and seasonal discharge from Lake Okeechobee resulted in overland surface flows (sheet flow) which helped to maintain the microtopography, directionality, and spatial extent of ridges and sloughs. Accretion of peat soils typical of the ridge and slough landscape required prolonged flooding, characterized by 10 to

12 month annual hydroperiods, and ground water that rarely dropped more than one foot below ground surface (Tropical BioIndustries 1990). The depths, distributions and duration of surface flooding largely determined the vegetation patterns, as well as the distribution, abundance and seasonal movements, and reproductive dynamics of all of the aquatic and many of the terrestrial animals in the Everglades (Kushlan 1989, Davis and Ogden 1994, Holling et al. 1994, Walters and Gunderson 1994).

Construction of canals and levees by the C&SF project resulted in the creation of artificial impoundments and has altered hydroperiods and depths within the study area. For example, northern WCA 3A has been over drained and its natural hydroperiod shortened while the eastern and southern portion of WCA 3A is primarily affected by high water and prolonged periods of inundation. The result has been substantially altered plant community structures, reduced abundance and diversity of animals and spread of non-native vegetation. The once vast, naturally connected landscape has been cut into a mosaic of various-sized habitat patches. The ridge and slough habitat has become severely degraded in a number of locations and is being replaced with a landscape more uniform in terms of topography and vegetation with less directionality (NRC 2012). The canals adjacent to the project area likely serve as an effective barrier to wildlife movement, interfering with or preventing life functions of many native wildlife species.

The remaining portions of the Everglades are stressed and exhibit levels of reduced aquatic function. The overall negative ecological trends in the remaining portions of the Everglades are expected to continue into the future, with additional loss of resources through landscape alterations and degradation of habitat. The effects of the existing infrastructure and future water management practices will continue to cause dry downs in the natural system. The threat of extreme fires will persist, destroying peat that is necessary for plant growth and water retention. Although less extreme, soil subsidence will also continue as dry downs, particularly during periods of extreme drought, contribute to further soil oxidation. Droughts may increase in frequency and intensity as a result of climate change as well. Unnatural shorter or longer hydroperiods will likely continue to cause detriment to remaining tree islands. The overall spatial extent of WCA 3 and ENP is not expected to decline, as these areas are publicly-owned and protected from development; however, current problems plaguing the areas are expected to continue and worsen in some areas. Future rates of sea level change are expected to result in significant impacts on coastal canals and communities, with loss of flood protection and increased saltwater intrusion being the primary effects. Coastal ecosystems and estuaries are expected to be adversely affected and require additional deliveries of freshwater to maintain desirable salinity patterns and healthy ecosystems. Climate change also has the potential to change temperature and precipitation in the Everglades.

2.4 COMPARISON OF EXISTING AND FUTURE WITHOUT PROJECT CONDITIONS

Table 2-1 provides a comparison of existing and FWO project conditions. Existing and FWO project conditions are further documented in **Appendix C.1**. Sections within **Appendix C.1** are included for reference in **Table 2-1**.

Table 2-1. Existing Conditions and Future Without Project Conditions

Conditions	Existing Conditions	Future Without Project Conditions
Vegetative Communities (Sections C.1.1.1 and C.1.3.1)	Sawgrass prairie, slough vegetation, tree islands, spike rush and beak rush flats, mangroves, freshwater wetlands, muhly prairie, cypress stands, native dominated forested wetlands, hydric hammocks and exotic-dominated forests.	Possible future development, changes in availability and distribution of freshwater and further disruption of natural sheet flow from discontinuities in hydrology due to possible construction of levees, roads, canals, etc. could exacerbate the changes occurring in the natural sawgrass, marl prairie, tree island, and mangrove ecotones.
Fish and Wildlife Resources (Sections C.1.1.2 and C.1.3.2)	A great diversity of fish and wildlife species occur throughout south Florida including freshwater and saltwater species. Fish and wildlife resources include aquatic macroinvertebrates, small freshwater marsh fishes, larger predatory sport fishes, amphibians and reptiles, colonial wading birds and mammals.	Declining environmental trends from existing C&SF drainage structures would continue to cause stress on the ecosystem. Disruption of the natural hydrology has resulted in changes in aquatic vegetation communities, and disruption of aquatic productivity and function. These changes have had repercussions throughout the food web, including wading birds, raptors, larger predatory fishes, reptiles, and mammals. These detrimental effects are likely to continue.
Invasive and Nuisance Species (Sections C.1.1.3 and C.1.3.3)	Existing resources indicate 163 species of non-native plants have been documented to occur within the project area; 123 of the plant species are considered invasive or noxious weeds. Existing information indicates 89 non-native animal species have been documented to occur within the project area.	It is expected that anthropogenic effects would continue to negatively impact the project area. New invasions and the expansion of invasive plant and animal species currently present would continue in the future. Native nuisance species such as cattail would persist and expand in the project area.
Threatened and Endangered Species (Sections C.1.1.4 and C.1.3.4)	A total of 40 Federally protected species occur or have the potential to occur within the project area. Species include but are not limited to the Florida panther, Florida manatee, Everglade snail kite, wood stork, American alligator, American crocodile, and Eastern indigo snake. Designated critical habitat for the American crocodile, Everglade snail kite, West Indian manatee, small tooth sawfish, and Cape Sable seaside sparrow also occurs within the project area. Many state listed species also occur throughout the project study area.	Existing Federal regulations such as the Endangered Species Act, Marine Mammal Protection Act and Fish and Wildlife Coordination Act, along with similar state regulations should be sufficient to preserve the continued existence of most endangered plant and animal species in the proposed project area. Given the expected decline of the system, there would likely be adverse effects on many threatened and endangered species that live solely within the greater Everglades; however, some of these effects would potentially be partially mitigated by development and implementation of species recovery plans and other public and private efforts.
Essential Fish Habitat (Sections C.1.1.5 and C.1.3.5)	The project is located in areas designated as Essential Fish Habitat for corals and live bottom habitat, and is habitat for numerous species of fish and invertebrates. The absence of freshwater flows and/or the release of high level freshwater discharges into estuarine systems and coastal areas currently promote unfavorable conditions.	The Magnuson-Stevens Fishery Conservation and Management Act should be sufficient to maintain existing fisheries. Current disruptions caused by flood control regulatory freshwater releases would continue to cause harm to estuarine systems in coastal areas. Potential negative effects to active fisheries could occur as a result of unregulated agricultural runoff and other secondary effects of development.

Conditions	Existing Conditions	Future Without Project Conditions
Climate (including Sea Level Rise) (Sections C.1.1.6 and C.1.3.6)	<p>The project area is characterized by a subtropical climate with distinct wet and dry seasons, high rates of evapotranspiration and floods, droughts, and hurricanes. The climate represents a major physical driving force that sustains the Everglades while creating water supply and flood control issues in the agricultural and urban segments. Of the 53 inches of annual average rain in south Florida, 75 percent falls during the wet season (May – October). Multi-year high and low rainfall periods often alternate on a time scale approximately on the order of decades. Average annual temperature for the southern Everglades is 76°F (24° C).</p>	<p>Climate change is expected to alter rainfall and evapotranspiration patterns over the next 100 years. U.S. Army Corps of Engineers (USACE) sea level change projections for the period from 2015 to 2065 for Key West, Florida and the broader south Florida area for historic, intermediate and high rates of future sea level change are +4 inches, +10 inches and +26 inches, respectively http://publications.usace.army.mil/publications/eng-circulars/EC_1165-2-212.pdf. Some examples of sea level change impacts in the future would be continued saltwater intrusion, reduced freshwater supply, retreating shoreline, and habitat transition. Flood damage reduction may also decline as a result of sea level rise. Most coastal flood control structures are gravity driven. Discharge capability of these structures may be reduced. The regional hydrologic models used to simulate with- and without project conditions require climatic and tidal data as boundary conditions. Given the uncertainty in future climatic conditions, the historic climate conditions used in the period of record are assumed to represent conditions that are expected to occur in the study area in the future. The model tidal boundary used in the regional hydrologic model was developed using historic tidal data from two primary (Naples and Virginia Key) and five secondary National Oceanic and Atmospheric Administration stations (Flamingo, Everglades, Palm Beach, Delray Beach, and Hollywood Beach). Simulation model tidal boundary conditions that reflect future sea level change were not available for the range of potential sea level rise expected. However, the impact of sea level change on project benefits is assessed for the FWO and with project conditions per USACE guidance Engineering Circular 1165-2-212 (see Section 6.0 and Annex I).</p>
Geology and Soils (Sections C.1.1.7 and C.1.3.7)	<p>The regional geology of EAA, WCA 3 and ENP consists of (from youngest to oldest) recent fill material, undifferentiated sandy, clay materials, and limestone. Recent fill material consists of poorly graded gravel, sand, silt and minor shell. Layers of peat are embedded within the clay layers. Miami Limestone represents the upper portion of the Biscayne Aquifer. South Florida is underlain by Cenozoic age rocks to a depth of approximately 5,000 ft below land surface with various percentages of sand, limestone, clay and dolomite. The marl soils are typically characterized as silts with high concentrations of lime. Marl soils form under shallow water</p>	<p>Based on current land use indicators, the landscape of south Florida would be developed consistent with County Growth Management Plans. While the majority of development is expected to occur on previously farmed lands, some wetland soils located in the area could be altered as a result of potential development. Wetland soils would be drained and/or displaced with fill materials to support the urban development. Existing C&SF drainage structures will continue to maintain reduced hydroperiod in many locations, continuing peat soil loss by oxidation and lightning-induced fires.</p>

Conditions	Existing Conditions	Future Without Project Conditions
	conditions and are an important constituent of the whole ecosystem, typically having standing water for short periods of time and are associated with thick algal mats and periphyton.	
Municipal and Industrial (M&I) Water Supply/ Demand (Sections C.1.1.11 and C.1.3.11)	Well fields in the surficial aquifer are the primary source of municipal water supplies and are recharged by surface water, rainfall, and the WCAs. The WCAs maintain groundwater levels and canal stages in the coastal area for purposes of public water supply, irrigation (i.e. agricultural, industrial, landscape), and maintain a freshwater head along the LEC to slow saltwater intrusion. The South Florida Water Management District (SFWMD) adopted a restricted allocation area rule for the Everglades and Loxahatchee River Water Bodies in 2007. The rule, in general, caps consumptive use withdrawals from the Everglades to actual use as of April 1, 2006. The actual demand as of 2010 was 839 million gallons per day (MGD) for public water supply from all sources. Like public water supplies, industrial demands dependent on the surficial aquifer system have also been capped.	In the LEC, groundwater from the surficial aquifer system is the predominant source of water for M&I uses. This trend is expected to continue in the future. Since the Restudy, M&I users reliance on water from alternative sources such as the Floridan aquifer, reuse and other sources has grown significantly. Use of these alternative sources to meet a portion (10-15%) of future demands will continue in the future. Economic forecasts have changed since the Restudy, decreasing the population projections. Since adoption of the rule restricting allocations, the SFWMD has issued 20-year permits allocating 996 MGD from the surficial aquifer system for public water supply as of 2010. The 2050 demands contemplated in the Restudy without project condition were 1,276 MGD, which are much higher than the 20-year permits issued by the SFWMD allocating 996 MGD from the surficial aquifer system as of 2010. Like public water supplies, industrial demands are turning to alternative sources of water than the surficial aquifer system. The projected industrial demands in 2030 from the surficial aquifer, including thermoelectric, are 12 MGD.
Flood Control (Sections C.1.1.10 and C.1.3.10)	Areas may become flooded during heavy rainfall events due to antecedent conditions that cause saturation and high runoff from developed areas.	Flood damage reduction needs have increased since the original C&SF Project was constructed and will likely continue to increase in the future. As agricultural and urban development continues, the volume, duration, and frequency of floodwaters may increase, and the actual level of flood damage reduction may decline in some areas. Flood damage reduction may also decline as a result of sea level change. Most coastal flood control structures are gravity driven. Discharge capability of these structures may be reduced. Potential future sea level change scenarios are not included in the CEPP FWO modeling.
Water Quality (Sections C.1.1.12 and C.1.3.12)	Existing water quality conditions within most of the study area (Lake Okeechobee, coastal estuaries, EAA, WCAs and ENP) are impaired mostly related to nutrient concentrations. The Florida Department of Environmental Protection (FDEP) is in the process of implementing numeric nutrient criteria. Where water bodies are impaired, FDEP develops total maximum daily load (TMDL) limits, which when enforced will improve water quality conditions. Total phosphorus concentrations	Implementation of water quality TMDL's and associated basin management action plans (BMAPs) within the study area should result in improved water quality conditions. The SFWMD Restoration Strategies water quality treatment plan will be fully in place by 2025. Compliance with the 2012 Consent Order water quality based effluent limits (WQBELs) is expected after 2025 when the SFWMD has completed implementation of the Restoration Strategies water quality treatment plan. The NPDES permit that accompanied the 2012 Consent Order also requires that the Restoration

Conditions	Existing Conditions	Future Without Project Conditions
	and loads to the Everglades Protection Area (EPA) (WCAs, ENP) have been the subject of ongoing litigation between State, Federal and Tribal parties. The 2012 Consent Order and associated National Pollutant Discharge Elimination System (NPDES) permits require the SFWMD to construct additional water treatment facilities in order to meet discharge criteria in the WCAs. Additional discussion of TMDLs and water quality is included in Appendix C.1 and Annex F .	Strategies plan be implemented and specifies that the WQBEL is effective immediately. Effects on water quality from agricultural activities should be reduced as land use near urban areas converts to residential and commercial development. Water quality in urban areas should improve somewhat as stormwater controls are retrofit in areas that undergo redevelopment.
Air Quality (Sections C.1.1.14 and C.1.3.13)	Existing air quality in the affected environment is good to moderate. All areas of Florida, except one, are now attainment areas. Orange County, Duval County, the Tampa Bay area including Hillsborough and Pinellas Counties, and Southeast Florida including Miami-Dade, Broward, and Palm Beach Counties continue to be classified by the United States Environmental Protection Agency (USEPA) as attainment/maintenance areas for the pollutant ozone and a portion of Hillsborough County is a non-attainment area for lead.	It is anticipated that increased population and economic expansion in southeast Florida will result in an increase in ozone and other air quality pollutants. It is possible that Miami-Dade, Broward, and Palm Beach Counties may be classified as air quality non-attainment zones. This is more likely to occur if air quality standards become more stringent by 2050.
Hazardous, Toxic and Radioactive Waste (HTRW) (Sections C.1.1.15 and C.1.3.14)	Lands potentially used for this project are very likely to have a past or present agricultural land use. Activities conducted over the past 100 years are likely to have resulted in the presence of some HTRW materials on some of this land. State and Federal databases include information on the known HTRW contamination sites. Phase I and II environmental site assessments will be used to identify unknown HTRW sites as well as test cultivated areas for the presence of residual agricultural chemicals.	In the absence of the project, potential project lands would likely continue to be farmed. This would likely result in continued minor HTRW contamination associated with storing and applying agricultural chemicals as well as petroleum products. Cultivated soils would continue to have agricultural chemicals applied which may accumulate in the soils depending upon the properties of chemicals. Should the subsequent land owner opt to change the land use to something other than agriculture, they would have to meet all applicable Federal and State regulatory levels for that land use, which may require remediation of residual agricultural chemicals.
Cultural Resources (includes Culturally Significant and Historic Properties) (Sections C.1.1.16 and	Several thousand cultural resources exist within south Florida. Due to the existence of known cultural resources within previously surveyed portions of the study area, there is a high probability of unrecorded resources within the project area of potential effect. Further cultural resources investigations will need to be conducted for this project in order to assess effects to significant historic properties. Lands leased to the Miccosukee Tribe of Indians of Florida are experiencing long-term high water staging in the southern part of WCA 3A,	Two significant cultural resource sites (8PB16039 and 8PB16040) will potentially be adversely affected if agricultural practices continue within the A-2 footprint. Cultural resources within ENP will continue to be managed under the Park's established management plan. Cultural resources within WCA 3 and EAA A-2 will continue to be managed by the District in consultation with the Florida State Bureau of Archaeological Research. Investigations mandated in the August 2012 Programmatic Agreement for the Everglades Restoration Transition Plan (ERTP) will be completed by ca. 2016. Climate change as described in Appendix C.1 will potentially affect

Conditions	Existing Conditions	Future Without Project Conditions
C.1.3.15)	which may affect culturally significant sites.	cultural resources in the future.
Populations (Sections C.1.1.17 and C.1.3.16)	From 1950 to 2000, Florida achieved dynamic change in population. In relation to the remainder of the United States, Florida outgrew the other states by almost 500 percent. This growth can be attributed to Florida's desirable climate and historically low property costs. With population expansion comes the myriad of challenges related to infrastructure, land use/pattern changes, water demand, environmental impacts, depletion of resources, and health and human safety issues.	It is expected that the study area will continue to grow both in population and in associated infrastructure and commercial development. Both Florida and the region are expected to grow at a rate exceeding the national growth rate, but the growth rate is expected to diminish in the future. Counties that have traditionally grown at a rate exceeding the state growth rate will slow and other counties will likely experience more intense population growth.
Economy (Sections C.1.1.17 and C.1.3.16)	Generally, a strong wholesale and retail trade, government and service sectors characterize Florida's economy. Compared to the national economy, the manufacturing sector has played less of a role in Florida, but high technology manufacturing has begun to emerge as a significant sector over the last decade. Employment in the LEC when compared to employment in the rest of Florida and the region shows a greater emphasis toward service or tourism related industries.	Future economic growth within the study area is expected to remain consistent with the population growth of the area, while maintaining a mix of service, retail, and administrative jobs. Also to be expected is a shift of income and employment from Miami-Dade County to the surrounding counties of Broward and Palm Beach.
Agriculture (Sections C.1.1.18 and C.1.3.17)	Agricultural production is an important sector of the state's economy. Despite continued urban expansion, agriculture throughout south Florida remains a valuable industry and employer. South Florida is a major source of nuts and vegetables, tropical fruits (melons and berries), sugarcane, and other crops.	Agriculture is considered fully developed in most areas of south Florida, where permitted acres and cropping practices are not projected to change significantly. Other field crops, sod, and greenhouse/nursery are expected to increase slightly over the planning horizon, while other fruits and nuts and vegetables, melons, and berries are expected to fall slightly.
Study Area Land Use (Sections C.1.1.18 and C.1.3.17)	The existing use of land within the study area varies widely from agriculture to high-density multi-family and industrial urban uses to natural areas for conservation. A large portion of south Florida remains natural, although much of it is disturbed land.	Urban or commercial development should occur within major urban service areas located within the project area. Agriculture is expected to remain a strong economic force, yet conceding some ground to urban development and restoration efforts.
Recreation (Sections C.1.1.20 and C.1.3.18)	Many areas throughout south Florida are used for recreational activities including hunting, camping, bicycling, hiking, horseback riding, canoeing, boating, swimming, and freshwater and saltwater fishing.	Ecosystems support a significant amount of outdoor recreation in the LEC. A significant portion of the expenditures comes from tourists. All of the areas throughout south Florida are expected to have significant increases in demands for selected recreation activities with a commensurate need to increase development of the region's recreational resources and facilities. Recreational activities that are projected to have a lack of supply as a result of increased demands include hunting, camping, bicycling, hiking, horseback

Conditions	Existing Conditions	Future Without Project Conditions
		riding, canoeing, boating, scuba and snorkeling, and freshwater and saltwater fishing.
Noise (Sections C.1.1.21 and C.1.3.19)	Within natural areas, external sources of noise are limited. Existing sources of noise are mainly limited to recreational users including air boats, off road vehicles, swamp buggies, and motor boats. Existing sources of noise outside of the rural communities are limited to vehicular traffic, agricultural vehicles, etc. Within urban areas, existing sources of noise include noise associated with transportation arteries, operations of construction and landscaping equipment, and operations at commercial and industrial facilities.	Sources of noise associated with surrounding land use are expected to be similar to those described in existing conditions. Noise impacts will change in areas where land use is projected to change from agriculture to residential/commercial. Within rural municipalities and urban areas, sound levels would be expected to be of greater intensity, frequency, and duration as areas are further developed from agricultural to residential/commercial due to increased noise from traffic, construction associated with development, and increased operations at commercial and industrial facilities.
Aesthetics (Sections C.1.1.22 and C.1.3.20)	Natural areas within south Florida are comprised of a variety of wetlands, sawgrass marshes, wet prairies, and tree islands. The land is very flat, with slight topographic rises on some tree islands. Much of the visible topographic features are a result of human development, such as canals and levees. Views of much of the area offer pleasant perspectives of the Everglades and tree islands.	Urbanization is expected to occur in the future, resulting in a potential loss of opportunity to aesthetically view open agricultural and natural areas due to build-out.

2.5 STRUCTURAL AND OPERATIONAL ASSUMPTIONS IN THE FUTURE WITHOUT PROJECT CONDITION

The FWO project condition for CEPP assumes the construction and implementation of authorized CERP and non-CERP projects, and other Federal, State or local projects constructed or approved under existing governmental authorities that occur in the CEPP study area. Construction has begun on the first generation of CERP projects already authorized by Congress. These include the Indian River Lagoon (IRL-S) Project, the Picayune Strand Restoration Project, and the Site 1 Impoundment Project. The second generation of CERP projects, authorized in the Water Resources Reform and Development Act (WRRDA) of 2014, include the Biscayne Bay Coastal Wetlands (BBCW) Project, Broward County Water Preserve Areas (WPA) Project, the Caloosahatchee River (C-43) West Basin Storage Reservoir, and the C-111 Spreader Canal Western Project. The first generation and second generation of authorized CERP projects listed here were previously referenced as the CERP “Band 1” Projects in the 2005 CERP Master Implementation Sequencing Plan (MISP), with the “Band 1” list also originally including the Acme Basin B, Loxahatchee River Watershed, and the EAA Storage Reservoir (Part 1) CERP projects. Non-CERP projects included within the FWO project condition consist of the SFWMD Restoration Strategies, C&SF Canal-51 West End Flood Control Project, the C-111 South Dade Project, the Kissimmee River Restoration Project, Modified Water Deliveries (MWD) to ENP Project, and the Department of Interior (DOI) Tamiami Trail Modifications Next Steps (TTNS) Project. **Table 2-2** summarizes the status of non-CERP projects, CERP projects and operational plans assumed to differ between the existing condition baseline (ECB) and FWO project condition. Project features listed in **Table 2-2** were represented in the hydrologic model simulation of the FWO project condition unless otherwise noted in **Sections 2.5.1** through **2.5.15**. The ECB and FWO project condition assumptions, which were established early during the CEPP preliminary screening process (prior to February 2012), were not modified during the CEPP formulation process in order to maintain a consistent set of base conditions for screening and alternative evaluation purposes. Following identification of the recommended plan in June 2013, the base condition assumptions were subsequently revisited and updated to represent the most current information for the analysis of Savings Clause requirements and Project-Specific Assurances in **Annex B**.

Table 2-2. Status of Non-CERP Projects, CERP Projects, and Operations Plan for Existing and Future Without Project Conditions

Category	Existing Condition	Future Without Project Condition
Status of Non-CERP Projects	Modified Water Deliveries to ENP Project (MWD) features, including the S-355A and S-355B gated spillways, 4-mile degrade of L-67 Extension Levee, 8.5 Square Mile Area Flood Mitigation Project have been constructed and are operational.	Construction completed and features operated: C-111 South Dade (Contracts 8 and 9); C&SF C-51 West End Flood Control Project; Kissimmee River Restoration; SFWMD Restoration Strategies (Central Flow Path features); DOI TTNS Project (5.5 miles of additional bridges); Seepage Barrier Near the L-31 N Levee (Miami-Dade Limestone Products Association) MWD Project features including existing condition components plus Tamiami Trail Modifications (1-mile eastern bridge) are constructed. However no operational changes for the L-29 Canal stage, G-3273 constraint, or the S-356 pump station were represented in the CEPP FWO project condition.
Status of CERP Projects	No completed projects. Construction in progress.	Construction completed and features operated: IRL-S Project; Picayune Strand Restoration Project; Site 1 Impoundment Project; BBCW Project; Broward County WPA Project; Caloosahatchee River (C-43) West Basin Storage Reservoir; C-111 Spreader Canal Western Project.

Category	Existing Condition	Future Without Project Condition
Operations Plan for WCA 3A, ENP and the SDCS	Interim Operational Plan (IOP) (2002, 2006); L-29 Canal maximum operational stage limit: 7.5 ft NGVD; G-3273 constraint: 6.8 ft NGVD	ERTP (2012); L-29 Canal maximum operational stage limit: 7.5 ft NGVD; G-3273 constraint: 6.8 ft NGVD

2.5.1 Lake Okeechobee Operations

The CEPP existing condition and FWO project condition assumption for the operation of Lake Okeechobee is the 2008 Lake Okeechobee Regulation Schedule (2008 LORS) (USACE 2007). When it was approved in April 2008, the 2008 LORS was identified as an interim schedule. USACE expects to operate under the 2008 LORS until there is a need for revisions due to the earlier of either of the following actions: (1) system-wide operating plan updates to accommodate CERP Band 1 Projects, or (2) completion of sufficient HHD remediation for reaches 1, 2, and 3, and associated culvert improvements, as determined necessary to lower the Dam Safety Action Classification (DSAC) rating from Level 1. Until a new operating schedule is developed under a future study, the 2008 LORS is the best estimate for operations in the FWO project condition.

2.5.2 Herbert Hoover Dike

The HHD surrounds Lake Okeechobee, which is 720 square miles in size. The HHD was first authorized in 1930 and built by hydraulic dredge and fill methods. HHD has 143 miles of embankment with 5 spillway inlets, 5 spillway outlets, 32 Federal culverts, 9 navigation locks and 9 pump stations. There are structural integrity concerns with the embankment and internal culvert structures that resulted in a DSAC risk rating of Level 1. DSAC Level 1 represents the highest USACE dam risk of failure rating and requires remedial action. The Major Rehabilitation Report (MRR) from 2000 divided the 143 mile dike into eight (8) Reaches with the initial focus on Reach 1. The current approved and planned remediation measures will address the highest points of potential failure in the system based on known areas of concern. These efforts are intended to lower the DSAC rating from Level 1. The CEPP FWO project condition will assume the planned remediation of HHD will lower the DSAC risk rating and be completed by 2022. The following text provides the basis for this assumption.

Historically, the majority of embankment and foundation issues have occurred in Reaches 1, 2, and 3 related to one of the following primary potential failure modes: internal erosion through the embankment, and internal erosion through the foundation. The additional failure modes associated with the culvert structures are: internal erosion along the conduits, and internal erosion into the conduits.

Current approved HHD remediation measures consist of a cutoff wall in Reach 1 which was completed in 2013 and 32 culvert replacements or removals around the lake that are scheduled for completion in 2019. Planned remediation measures consist of a cutoff wall and/or seepage management system in Reaches 2 and 3. These planned measures are dependent on the results of the ongoing Dam Safety Modification Study (DSMS) and can be implemented by 2022. These remediation measures will not resolve all issues with the dam, nor will all current design criteria be met. To assess other issues and address additional future modifications to HHD, a comprehensive potential failure mode analysis and risk assessment are being performed on the entire HHD system as part of the DSMS. The DSMS is scheduled for completion with report approval in 2015.

Prior to the 2008 LORS, Lake Okeechobee operated under the Water Supply and Environmental Regulation Schedule (WSE). The 2006-2008 LORS study was initiated because of adverse environmental impacts that WSE had on the lake ecology. Dam safety was later added as a performance criterion since lowering of the lake, as the LORS study was pursuing, is one of the basic Interim Risk Reduction Measures implemented for deficient dams until appropriate remediation is effectuated. The WSE held Lake Okeechobee stages approximately 1.0 – 1.5 ft higher than the 2008 LORS under wet conditions. Studies for the remediation of HHD are based on the 2008 LORS, which was used as the basis for the development of the Standard Project Flood (SPF) condition. The SPF is the design condition used for the risk assessment and remediation to address internal erosion failure modes.

2.5.3 SFWMD Restoration Strategies Project

The SFWMD is required to meet a numeric discharge limit, referred to as the WQBEL, which is contained in the NPDES permit for discharges from the stormwater treatment areas (STAs) into the EPA. The WQBEL was developed to assure that such discharges do not cause or contribute to exceedances of the 10 parts per billion (ppb) total phosphorus (TP) criterion (expressed as a long-term geometric mean [LTGM]) established under 62-302.540, Florida Administrative Code (F.A.C.). The TP criterion is measured at a network of stations across the EPA marsh and is intended to prevent imbalances of aquatic flora and fauna. The WQBEL is measured at the discharge points from each STA and requires that the total phosphorus concentration in STA discharges shall not exceed: 1) 13 ppb as an annual flow weighted mean in more than three out of five water years on a rolling basis; and 2) 19 ppb as an annual flow-weighted mean in any water year. Excess phosphorus discharged into the EPA has caused ecological impacts within the Everglades.

To address water quality concerns associated with existing flows to the EPA, the SFWMD, FDEP, and USEPA engaged in technical discussions starting in 2010. The primary objectives were to establish a WQBEL that would achieve compliance with the State of Florida's numeric phosphorus criterion in the EPA and to identify a suite of additional water quality projects to work in conjunction with the existing Everglades STAs to meet the WQBEL. Based on this collaborative effort, a suite of projects has been identified that would achieve the WQBEL. The Restoration Strategies Regional Water Quality Final Plan (SFWMD 2012) describes those resulting projects and the evaluation tools and assumptions that were utilized in the technical evaluation. The projects have been divided into three flow paths (Eastern, Central and Western), which are delineated by the source basins that are tributary to the existing Everglades STAs. The identified projects primarily consist of flow equalization basins (FEBs), STA expansions, and associated infrastructure and conveyance improvements. The primary purpose of FEBs is to attenuate peak stormwater flows prior to delivery to STAs and provide dry season benefits, while the primary purpose of STAs is to utilize biological processes to reduce phosphorus concentrations in order to achieve the WQBEL. The Eastern Flow Path contains STA-1E and STA-1W. The additional water quality projects for this flow path include an FEB in the S-5A Basin with approximately 45,000 acre-feet (ac-ft) of storage and an STA expansion of approximately 6,500 acres (5,900 acres of effective treatment area) that will operate in conjunction with STA-1W. The Central Flow Path contains STA-2, and STA-3/4. The additional project is an FEB with approximately 60,000 ac-ft of storage that will attenuate peak flows to STA-3/4, and STA-2. The Western Flow Path contains STA-5, Compartment C and STA-6. An FEB with approximately 11,000 ac-ft of storage and approximately 800 acres of effective treatment area (via internal earthwork) within STA-5 are being added to the Western Flow Path. Based on the CEPP project objectives, only the Central Flow Path features are included in the CEPP modeling representation of the FWO project conditions. The FEB located within the Central Flow Path will be located on the A-1 Talisman site.

2.5.4 Caloosahatchee River (C-43) West Basin Storage Reservoir Project

The Caloosahatchee River (C-43) West Basin Storage Reservoir Project is a CERP project located within Hendry County (USACE 2010). The project was authorized in WRRDA 2014. The purpose of the project is to improve the timing, quantity, and quality of freshwater flows to the Caloosahatchee River and Estuary. The project provides approximately 170,000 ac-ft of above-ground storage volume in a two-cell reservoir. Major features of the project include external and internal embankments, and environmentally responsible design features to provide fish and wildlife habitat such as littoral areas in the perimeter canal and deep water refugia within the reservoir. The project contributes toward the restoration of ecosystem function in the Caloosahatchee Estuary by maintaining a desirable minimum flow of freshwater to the estuary during the dry season. The project also contributes to a reduction in the number and severity of events where harmful amounts of freshwater from basin runoff and Lake Okeechobee are discharged to the estuary. These two primary functions help to moderate unnatural changes in salinity that are detrimental to estuarine communities.

2.5.5 Indian River Lagoon-South Project

The IRL-S Project is a CERP Project that is located within Martin and St. Lucie Counties (USACE 2004a). The purpose of the project is to improve surface-water management in the C-23/C-24, C-25, and C-44 basins for habitat improvement in the St. Lucie River Estuary and southern portions of the Indian River Lagoon. Project features include the construction and operation of four above ground reservoirs to capture water from the C-44, C-23, C-24, and C-25 canals for increased storage (130,000 acre-ft), the construction and operation of four STAs to reduce sediment, phosphorous, and nitrogen to the estuary and lagoon, the restoration of over 90,000 acres of upland and wetland habitat, the redirection of water from the C-23/24 basin to the north fork of the St. Lucie River to attenuate freshwater flows to the estuary, muck removal from the north and south forks of the St. Lucie River and middle estuary. The project is expected to provide significant water-quality improvement benefits to both the St. Lucie River and Estuary and Indian River Lagoon by reducing the load of nutrients, pesticides, and suspended materials from basin runoffs.

2.5.6 Operations at Southern WCA 3A, ENP, and the South Dade Conveyance System

The 2006 IOP for Protection of the Cape Sable seaside sparrow was the governing regulation schedule for the project area at the start of the CEPP planning process. In addition, existing hydrologic conditions within the project area are a result of IOP operations from 2002 to 2012. Therefore, for planning purposes, the existing condition includes IOP as the operational plan. The current approved operational plan for southern WCA 3A, ENP, and the SDCS as of October 2012 is known as the ERTF. It superseded the 2006 IOP and is intended to be a transitional plan to be used until completion of the final operational plan for the MWD and C-111 South Dade Projects. The final operational plan for these two projects has not yet been developed. Therefore, for planning purposes, the CEPP FWO project condition includes ERTF as the operational plan. The ERTF contains an operational constraint at gage G-3273 of 6.8 ft NGVD and a maximum operational stage limit of 7.5 ft NGVD in the L-29 borrow canal. The CEPP alternatives will consider and potentially include higher stages in the L-29 borrow canal.

2.5.7 Modified Water Deliveries Project

The 1989 Everglades National Park Protection and Expansion Act (Public Law 101-299) directed the Secretary of the Army, in consultation with the Secretary of the Interior, to construct modifications to the C&SF to improve water deliveries to ENP, and, to the extent practicable, take steps to restore the natural hydrological conditions within the park. Construction of modifications to the C&SF project as authorized in the 1989 Act are justified by the environmental benefits to be derived by the Everglades ecosystem in general and by the Park in particular and shall not require further economic justification.

The goal of the MWD Project is to improve water deliveries into ENP and, to the extent practicable, take steps to restore the natural hydrologic conditions within ENP.

The following MWD features have been constructed or are in progress.

1. Conveyance and Seepage Control Features
 - a. Spillway Structure S-355 A and B in the L-29 Levee - complete, no operational permit;
 - b. S-333 and S-334 Modifications - complete;
 - c. Tigertail Camp Raising - complete;
 - d. Osceola Camp Elevation Evaluation - complete;
 - e. S-331 Command and Control - complete;
 - f. Pump Station S-356 – complete (temporary pump station), no operational permit;
 - g. Degradation of 9 miles of the L-67 Extension Canal and Levee - 4 miles complete.
2. Flood Mitigation for 8.5 Square Mile Area
 - a. Perimeter Levee - complete;
 - b. Seepage Collector Canal - complete;
 - c. Pump Station S-357 - complete;
 - d. Detention Area - complete;
 - e. Seepage Collection Addition – construction in progress (complete May 2014).
3. Tamiami Trail Modifications
 - a. One Mile Bridge Construction - complete;
 - b. Road Reconstruction and Resurfacing Construction (to accommodate maximum stages in the L-29 Canal up to 8.5 feet NGVD) - construction complete (December 2013).
4. Project Implementation Support
 - a. Monitoring and Mitigation – ongoing;
 - b. Technical and Project Management Support – ongoing;
 - c. G-3273 Relaxation and S-356 Pump Station Test (planning for the G-3273/S-356 field test has started but is not complete, and necessary approvals (including FDEP) have not been attained).

The 1989 Act requires the project to be constructed “*generally as set forth*” in a General Design Memorandum (GDM), which was completed by the USACE in 1992. Most of the structural features contained in the 1992 GDM and subsequent revisions are complete or under construction and nearing completion. However, some features originally included in the MWD 1992 GDM, including features to provide hydrologic connectivity between WCA 3A and WCA 3B and complete degradation of the L-67 Extension Levee and adjacent canal, have not been completed for various reasons, including operational (water level) constraints within WCA 3B, lowered MWD maximum operational stages for the L-29 Canal (9.7 ft NGVD was assumed with the 1992 GDM), and potential water quality concerns. In March 2012, ENP Superintendent requested Army concurrence that “remaining unconstructed features” should be deleted and the determination made that the MWD project is complete. The superintendent requested that features needed to accommodate additional restoration flows should be examined under the ongoing CEPP. The U.S. Army Corps of Engineers (USACE) continues to work with the DOI on evaluating, based on a technical analysis, whether the constructed features and the features currently under construction satisfy the goals of the statute.

Following completion of the ongoing MWD construction for Tamiami Trail modifications and the 8.5 Square Mile Area seepage collection addition, water levels in the L-29 Canal adjacent to the Tamiami Trail may be raised up to 8.5 feet NGVD following development and NEPA assessment of an operational plan to integrate the completed MWD features. The ongoing CEPP envisions a significant increase in flow and modified flow-path to ENP to include an additional bridging (2.6 miles) of Tamiami Trail not envisioned as part of the 1992 GDM.

For CEPP planning purposes, the MWD Project is assumed to be complete upon completion of those features currently under construction. In the absence of a final operational plan for the MWD Project, the modeling of operations for the CEPP FWO project condition assumes the L-29 borrow canal maximum operational limit at 7.5 ft NGVD and the G-3273 constraint at 6.8 feet NGVD as per 2012 ERTF operations, and the S-356 pump station is not operated. The one mile MWD eastern MWD Tamiami Trail bridge is represented in the Regional simulation Model for the Glades and Lower East Coast Service Area (RSM-GL) simulation of the FWO condition.

2.5.8 Site 1 Impoundment Project

The purpose of the Site 1 Impoundment Project is to capture and store excess surface water runoff from the Hillsboro watershed as well as releases from the Arthur R. Marshall Loxahatchee National Wildlife Refuge (LNWR) and Lake Okeechobee (USACE 2006). Located in the Hillsboro Canal Basin in southern Palm Beach County, the project will supplement water deliveries to the Hillsboro Canal by capturing and storing excess water currently discharged to the Intracoastal Waterway. These supplemental deliveries will reduce demands on LNWR. Project features include a 1,660 acre above ground storage reservoir, an inflow pump station, discharge gated culvert, emergency overflow spillway, and a seepage control canal with associated features. Project features will also provide groundwater recharge, help reduce seepage from adjacent natural areas and prevent saltwater intrusion by releasing impounded water back to the Hillsboro Canal when conditions dictate.

2.5.9 Picayune Strand Restoration Project

The Picayune Strand Restoration Project involves the restoration of natural water flow across 85 square miles in western Collier County that were drained in the early 1960s in anticipation of extensive residential development (USACE 2004b). This subsequent development dramatically altered the natural landscape, changing a healthy wetland ecosystem into a distressed environment. The Picayune Strand Restoration Project will restore wetlands in Picayune Strand (Southern Golden Gate Estates) and in adjacent public lands by reducing over-drainage, while restoring a natural and beneficial sheetflow of water to the Ten Thousand Islands National Wildlife Refuge. Project features include plugging 48 miles of canals (with more than 100 plugs to block the flow), 260 miles of road removal, and the addition of pump stations (3) and spreader swales to aid in rehydration of the wetlands. The Picayune Strand Restoration Project is located west of the RSM-GL hydrologic model domain.

2.5.10 Broward County Water Preserve Areas Project

The Broward County WPA Project is a CERP project that is located within the study area of CEPP (USACE 2012a). The project was authorized in WRRDA 2014. Three impoundment areas will be constructed to reduce seepage, provide groundwater recharge, provide water supply to urban areas, and help prevent saltwater intrusion. Pollution load reduction targets necessary to protect water quality within the receiving waters are included in the design. The three project features consist of the WCA 3A/3B Levee Seepage Management system designed to reduce seepage by allowing higher water levels within the L-33 and L-37 borrow canals; the C-11 Impoundment in western Broward County, which will collect direct runoff from the western C-11 drainage basin, thereby reducing the S-9 pumping into WCA 3A and the C-

9 Impoundment, located in the western C-9 Basin, designed to store runoff from the C-9 drainage basin and divert water from the western C-11 Basin and aid to reduce seepage. Once constructed, the Broward County WPA will reduce storm water deliveries to WCA 3, thereby increasing the overall quality of water available for delivery to ENP.

2.5.11 Tamiami Trail Modifications: Next Steps Project

The DOI, through the National Park Service (NPS) and ENP, completed a study to evaluate the feasibility of additional Tamiami Trail bridge length, beyond that to be constructed pursuant to the MWD Project to restore more natural water flow to ENP and Florida Bay and for the purpose of restoring habitat within ENP (NPS 2010). This study was authorized by the 2009 Omnibus Appropriations Act passed by Congress on March 10, 2009. The TTNS approved plan called for 5.5 miles of bridging and downstream flow enhancements which would be in addition to the 1-mile bridge authorized by the MWD Project and currently under construction. The remaining unbridged sections of roadway would be elevated to allow a design high water stage of 9.7 ft NGVD in the L-29 borrow canal and to improve distribution of downstream flows. This road height is expected to accommodate the maximum potential range of future stage increases envisioned by CERP without damage to the road. The project was authorized by Congress in the Consolidated Appropriations Act, 2012. The DOI is preparing an implementation strategy. Preliminary indications from the DOI are that the proposed western bridging along Tamiami Trail will be included in the initial DOI implementation increment.

The FWO project condition assumes that additional bridging and road elevation will be accomplished under DOI authority. Since a final operational plan for the MWD Project has not been completed, for planning purposes, the CEPP FWO project condition will assume the 7.5 ft NGVD operational constraint in the L-29 borrow canal that is associated with ERTF will remain in place. CEPP alternatives will identify if and how much bridging and roadway raising are needed to convey CEPP flows. No additional Tamiami Trail bridges, corresponding to the TTNS project features, were represented in the RSM-GL simulation of the CEPP FWO project condition due to uncertainty regarding the implementation sequence and schedule for the TTNS bridges.

2.5.12 Seepage Barrier near the L-31N Levee

As mitigation for a Section 404 permit, the Miami-Dade Limestone Products Association (Association) constructed a 1,000 foot long, 18 foot deep slurry wall to reduce seepage between ENP and rock mine properties to the east of ENP. In July 2012, the Association completed construction of a 2 mile long, 35 foot deep seepage wall in this same location south of Tamiami Trail. Although results appear promising, further analysis for CEPP is necessary to determine the extent to which the 2 mile long, 35 foot deep seepage wall will reduce seepage to the east, or whether the Association will construct an additional wall if tests determine the current wall is ineffective. The association also may construct an additional 5 miles of seepage wall south of the 2-mile seepage wall if permitted. Since the capability of the seepage wall to mitigate seepage losses is under ongoing analysis, CEPP will not include any length and depth of seepage wall in the FWO project condition. The CEPP alternative plans will have to identify and develop the total amount and types of seepage management needed for the volume and distribution of water that the plans would deliver from WCA 3B and/or ENP. Consistent with these assumptions, no seepage or slurry wall was represented in the RSM-GL simulation of the FWO project condition.

2.5.13 Biscayne Bay Coastal Wetlands Project

The BBCW is a CERP project. The project was authorized in WRRDA 2014. The purposes of the BBCW project is to rehydrate wetlands and reduce point source discharge, improve water quality and provide more natural timing and quantity of water to Biscayne Bay (USACE 2012b). The project would replace

lost overland flow and partially compensate for the reduction in groundwater seepage by redistributing available surface water entering the area from regional canals. The BBCW Project features were not explicitly included in the CEPP modeling representation of the FWO project condition since these features along the coast in Miami-Dade County were not considered significant for CEPP formulation.

2.5.14 C-111 Spreader Canal Western Project

The C-111 Spreader Canal Western Project is a CERP project that is located within the study area of CEPP (USACE 2009). The project was authorized in WRRDA 2014. It will improve quantity, timing and distribution of water delivered to Florida Bay via Taylor Slough; improve hydroperiods and hydropatterns in the Southern Glades and Model Lands (located in southeastern Miami-Dade County adjacent to the eastern boundary of ENP) to restore historic vegetation patterns; and to return coastal salinities to historical recorded conditions though the redistribution of water that is currently discharged to the Atlantic Ocean and Gulf of Mexico. These objectives will be realized through the creation of a hydrologic ridge between Taylor Slough and the C-111 Canal, to reduce seepage loss from Taylor Slough and its headwaters. SFWMD has implemented the features of this project. Information gained from the C-111 Spreader Canal Western Project will be used for the planning and design of a spreader canal system to replace the existing C-111 Canal (C-111 Spreader Canal Eastern Project).

2.5.15 C-111 South Dade Project

The C-111 South Dade County 1994 Integrated General Reevaluation Report and Environmental Impact Statement (EIS) was published in May 1994 (USACE 1994). This report described a conceptual plan for five pump stations and levee-bounded retention/detention areas to be built west of the L-31N Canal, between the proposed S-332B and S-332D pump stations, to control seepage out of ENP while providing flood mitigation to agricultural lands east of C-111 Canal. The original and current configuration of these structural features is further discussed in the description of IOP Alternative 7R, within the 2006 IOP Final Supplemental EIS (USACE 2006). Operational guidance for the new S-332DX1 structure was included in the E RTP Final EIS (USACE 2012c).

For the FWO project condition, the USACE assumed the C-111 South Dade Project will be completed with Contract 8 (C-111 North Detention Area) and Contract 9 (L-31W canal plugs). The FWO project operations of the C-111 South Dade project features are assumed consistent with E RTP. The FWO project condition assumes no inflows to the C-111 North Detention Area from the 8.5 Square Mile Area detention Area, consistent with MWD 2011 8.5 Square Mile Area Interim Operating Criteria.

2.6 NATIVE AMERICANS

There are two Federally recognized tribes within Florida: the Miccosukee Tribe of Indians of Florida and the Seminole Tribe of Florida. Living tribal members today still recall growing up on tree islands in the Everglades and living the lives their ancestors did 100 years before. Tribal members born before big gaming in 1979 recall selling their beadwork or patchwork, wrestling alligators and dancing for tourists to bring in money to support their families. These people have lived in the heart of the Everglades since the 1830s, well before the first efforts to drain the land began in the 1880s, and have seen first-hand the impact of those efforts on their homes and livelihood (<http://www.seminole.com/History/>). Refer to the Native American sections in **Section 5, Appendix C.1 (Sections C.1.2 and C.1.4)** and **Appendix C.5** for more information concerning the Tribes.

Today, members of Miccosukee Tribe of Indians of Florida have administration of four reservations all located within the CEPP study area: the Tamiami Trail (Forty-Mile-Bend) Miccosukee Tribe of Indians of Florida's Trail Reservation, the Alligator Alley Miccosukee Reservation, the Krome Avenue Miccosukee




Reservation, and the Dade Corners Reservation. The Miccosukee Tribe of Indians of Florida also has a perpetual lease from the State of Florida for nearly 190,000 acres in WCA 3A. The Tribe is authorized to use this land for such purposes as hunting, fishing, trapping, and frogging. Members of the Seminole Tribe of Florida have several reservations in the State of Florida as well as an easement in WCA 3A for such purposes as hunting, trapping, fishing and frogging. Of particular note in regard to this project implementation report are the Big Cypress, Immokalee, Hollywood, and Coconut Creek reservations as these reservations are all located within the CEPP study area (**Figure C.1-17 Appendix C.1**).

The Seminole Tribe of Florida has surface water entitlement rights pursuant to the 1987 Water Rights Compact between the Seminole Tribe of Florida, the State of Florida, and the SFWMD (Pub. L. No. 100-228, 101 Stat. 1566 and Ch 87-292 Laws of Florida as Codified in section 285.165, Florida Statutes.) Additional documents addressing the Water Rights Compact entitlement provisions have since been executed. Two of the Seminole Tribe of Florida's reservations rely on Lake Okeechobee as a secondary irrigation supply source for their surface water entitlement, with specific volumes of water identified for this purpose for the Seminole Tribe of Florida's Big Cypress Reservation and an operational plan addressing water shortage operations for the Brighton Reservation, located northwest of Lake Okeechobee.

Members of both Tribes continue to rely upon the Everglades, the largest portion of the CEPP planning area, to support their cultural, medicinal, subsistence, and commercial activities. The specific issues impacting each tribe have been different over the last few decades, but they are all related to impacts due to man-made changes to the Everglades ecosystem. The Miccosukee Tribe of Indians of Florida's focus has been on the detrimental ponding of water on tribal property in WCA 3A, which affects subsistence practices and increases inundation risks to islands utilized by the Tribe. The Miccosukee Tribe of Indians of Florida has also voiced concerns with regards to the impacts of nutrient pollution on the system. The Seminole Tribe of Florida's focus has been on the detrimental drainage of water from the western basin and their Big Cypress Reservation, in addition to the impacts of nutrient pollution on the delicate Everglades system.

CENTRAL EVERGLADES
PLANNING PROJECT
(CEPP) GENERAL
PROJECT AREA

LEGEND

-  Structure or Cluster of Structures (pumps, weirs, culverts)
-  STAs
-  State-owned Land

Future Without Project Conditions –
Other Related Projects and Operations:

Projects (Non-CERP& CERP)

1. Modified Water Deliveries to ENP Components: Tamiami Trail Modifications (1-mile eastern bridge); 8.5 SMA;
2. C-111 South Dade (contracts 8 & 9)
3. Kissimmee River Restoration
4. SFWMD Restoration Strategies (Central Flow Path)
5. DOI/Tamiami Trail Modifications (5.5 miles of bridges)
6. CERP Indian River Lagoon
7. CERP Picayune Strand Restoration
8. CERP Site 1 Impoundment
9. CERP Broward County Water Preserve Areas
10. CERP C-43 West Basin Storage Reservoir
11. CERP C-111 Spreader Canal Western Project

Operations

- Everglades Restoration Transition Plan (ERTP) 2012
- L-29 Canal Maximum Operational Limit
- G-3273 Constraint

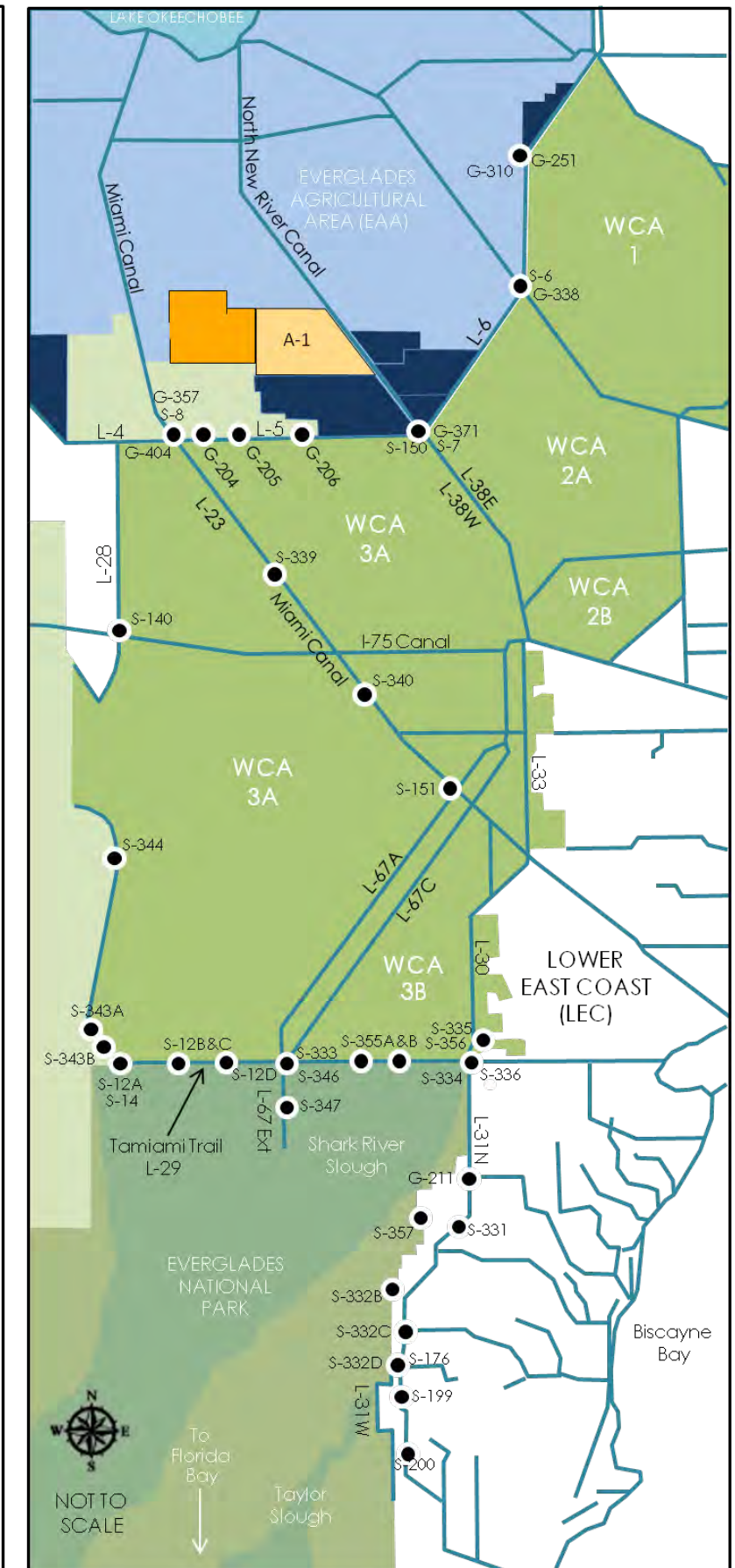
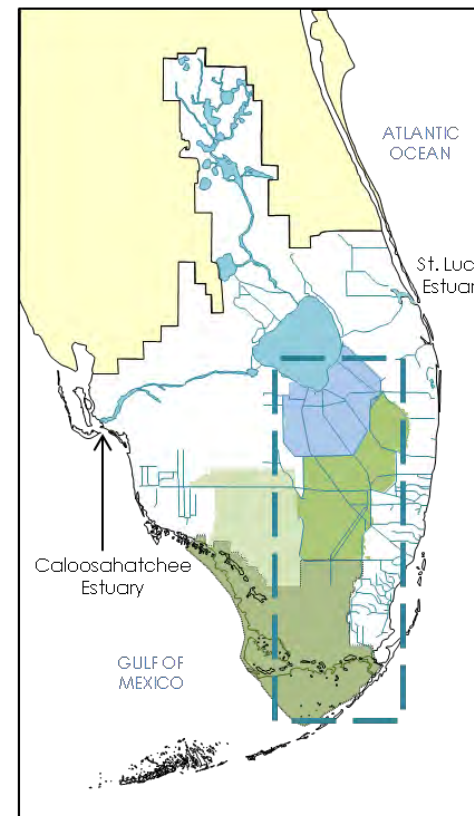


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3.0 FORMULATION OF ALTERNATIVE PLANS

3.1 PLAN FORMULATION CONCEPTS

The Central Everglades Planning Project (CEPP) incorporates twelve years of updated science, new information, and improved hydrologic modeling tools since authorization of the Comprehensive Everglades Restoration Plan (CERP) in 2000. This new science reveals that certain key attributes of quality, quantity, timing and distribution are needed to achieve restoration of the Everglades. See **Section 3.1.2** for more detail. These attributes affect the formulation strategy of CERP features being addressed in this study.

The overall intent for formulating CEPP alternative plans is to reduce regulatory freshwater discharges from Lake Okeechobee that are currently contributing undesirable conditions in the Northern Estuaries (Caloosahatchee and St. Lucie) and redirect this water southward through the Everglades Agricultural Area (EAA). These environmentally beneficial releases from Lake Okeechobee will restore a more natural mosaic of habitat conditions in Water Conservation Area 3 (WCA 3), Everglades National Park (ENP), and Florida Bay. See **Figure 3-1** and foldout Figure in back of this section.

CEPP ECOSYSTEM RESTORATION PLANNING FRAMEWORK

- CERP, including CEPP, intends to achieve more natural flows by re-directing flows currently discharged to the Atlantic Ocean and Gulf of Mexico, to a more restored flow of water that is distributed throughout the system similar to pre-drainage conditions.
- Plan formulation conceptually follows the natural **southerly flow of water** and pursues alternatives that **improve ecological conditions compared to the future-without project conditions** while respecting **constraints** (e.g., water quality, flood control, and water supply/groundwater levels/saltwater intrusion, habitat for endangered and threatened species and others)
- Efforts supported by:
 - **Hydrologic models** that predict flows based on regional parameters (e.g., topography, vegetation, location and operation of infrastructure, etc.)
 - **Ecological models with performance measures** related to **target water flows, depths, durations, and quality** for **healthy habitats** and **predictive flows for alternatives based on hydrologic modeling**
 - **RECOVER with system-wide targets for indicator species and related habitat conditions**
 - **Adaptive Management** to monitor plan implementation in **short and long term**; includes strategies to reduce uncertainties over time, to effectively respond to unknowns, and to modify implementation as more is learned about the system

CEPP AND RELATED CONDITIONS IN THE SOUTH FLORIDA ECOSYSTEM

Managed water delivery system with competing needs leads to (1) hydrological changes (water volumes/velocities/depths, durations); (2) either too much or too little water; (3) unintended stress to the natural system.


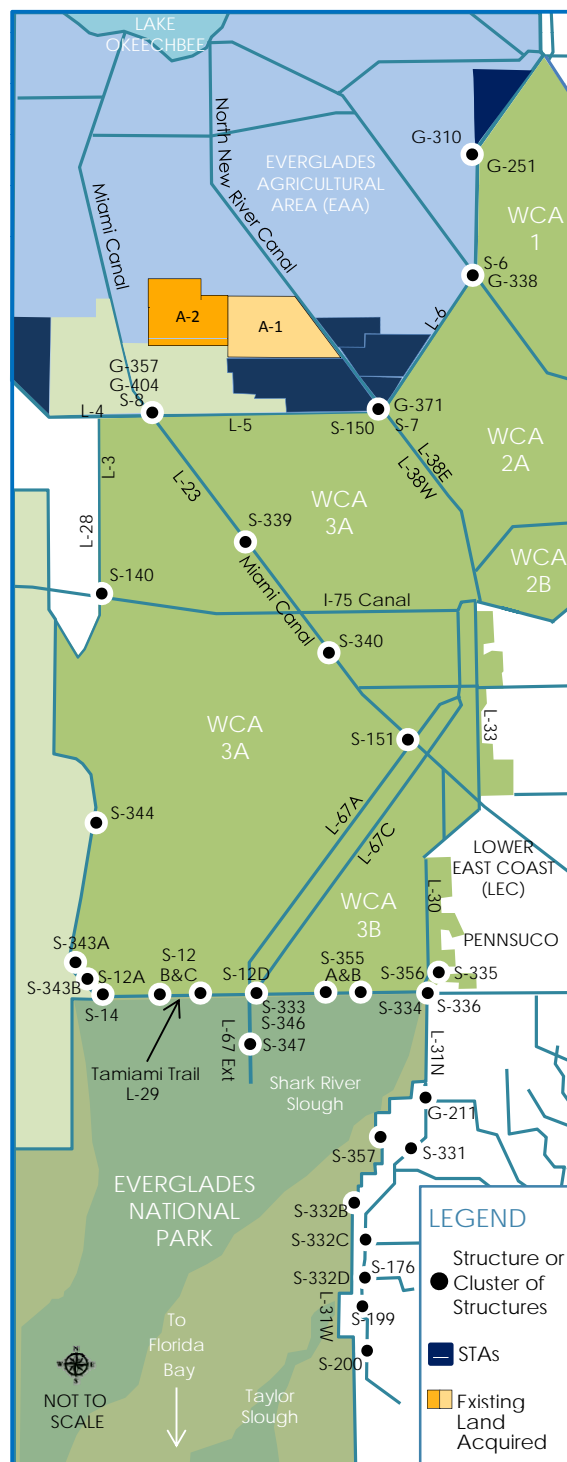
REGION	HABITAT AFFECTED	REPRESENTATIVE DEPENDENT SPECIES
NORTHERN ESTUARIES (St. Lucie and Caloosahatchee)  <p>High volume flows to estuaries due to regulatory releases (flood control):</p> <ul style="list-style-type: none"> ▪ Resultant salinity fluctuations stress estuarine systems ▪ Increased turbidity, nutrients, and sedimentation. <p>Dry season estuarine conditions also are exacerbated due to flows needed for water supply and lake ecology.</p>	<ul style="list-style-type: none"> ▪ Estuarine salinity levels ▪ Submerged Aquatic Vegetation (SAV) 	<p>Lifecycle Needs (nesting, birthing, foraging, growing)</p> <ul style="list-style-type: none"> ▪ Shellfish ▪ Oysters ▪ Marine Fish
GREATER EVERGLADES (WCAs, ENP, Shark River Slough, Taylor Slough) <p>Low volume/velocity of surface and groundwater, & disruptions to southerly flow due to infrastructure (e.g., levees) causes:</p> <ul style="list-style-type: none"> ▪ Peat oxidation and subsidence ▪ More intense fires ▪ Loss of ridge and slough topographic conditions ▪ Loss in slough vegetation 	<p>GENERAL</p> <ul style="list-style-type: none"> ▪ Overdrying : N. WCA 3A, WCA 3B, & ENP Shark River Slough ▪ Ponding : S. WCA-3A <p>SPECIFICALLY</p> <ul style="list-style-type: none"> ▪ Ridge & Slough System ▪ Tree Islands ▪ Marsh ▪ Periphyton 	<p>Lifecycle Needs (nesting, birthing, foraging, growing)</p> <ul style="list-style-type: none"> ▪ Alligators ▪ Crocodiles ▪ Wading Birds ▪ Snail Kite ▪ Fish
SOUTHERN COASTAL SYSTEM <p>Low volume, and resultant low velocity flows of surface and groundwater, leads to higher salinity levels in Florida Bay.</p>	<ul style="list-style-type: none"> ▪ Bay salinity levels (not enough freshwater flows) ▪ Submerged Aquatic Vegetation (SAV) ▪ Mangroves 	<p>Lifecycle Needs (nesting, birthing, foraging, growing)</p> <ul style="list-style-type: none"> ▪ Shellfish ▪ Oysters ▪ Marine Fish

Figure 3-1. Planning Framework Used for CEPP



The plan formulation framework for this study required a sequential analytical screening process to develop alternative plans. This process resulted in a limited, yet refined final array of alternatives to be evaluated in detail in **Section 4** of this report. The plan formulation concepts include:

- Incorporating an incremental approach to restoration of the Everglades
- Considering updated scientific knowledge
- Using interdependent but discrete geographic sub-regions to formulate alternative plans
- Incorporating an alternative development strategy that combines management measures into components, options, and ultimately alternative plans

3.1.1 Incremental Implementation

It is important to view the incremental implementation of CERP from the perspective of Everglades restoration goals and updated science of the natural Everglades ecosystem. This study incorporates the National Research Council (NRC) recommendation that the implementation of CERP projects should provide some immediate restoration benefits while addressing scientific uncertainties. This study is not a “comprehensive” solution leading to the end state resolution of problems existing in the Everglades ecosystem, but will provide meaningful progress towards restoration of the CEPP study area while greatly reducing the potential for further degradation. The planning and design of project features will incorporate, to the extent practical, flexibility and robustness to ensure compatibility with future Everglades restoration efforts.

3.1.2 Updated Science

Expertise offered by project delivery team (PDT) scientists and both Tribes of south Florida contributed to the formulation of CEPP, consisting collectively of decades if not centuries of scientific knowledge of the Everglades, Lake Okeechobee, and the estuaries. Specifically, in the twelve years since the formulation of CERP published studies have identified needs within these ecosystems in order to achieve a more natural, restored state resembling recent pre-drainage centuries. For example, paleoecological studies have revealed, with reasonable agreement among scientists, the quantity of water necessary flowing through the Everglades and into the receiving bays to achieve diversity and distributions of species that resemble the historic ecosystems. These studies estimate that the northern inflow to the Everglades was an average of two million acre-feet (ac-ft) annually. Further research has determined that in order to restore habitat features such as slough-ridge-tree island topography, which are essential to support the historic suite of species and contribute to the historic hydrologic timing and distribution patterns, water should flow uninhibited and parallel to the ground surface rather than ponding in areas where flow is impeded by structures (McVoy et al. 2011; RECOVER 2011, Section 1.1). The flow rate of the water should reach at least 2.5 centimeters per second (cm/s) during high volume precipitation events to drive restoration of the historical ridge and slough landscape patterns and tree islands (RECOVER 2011, Section 1.4), and water levels must have natural variation and cycling during events such as El Nino and La Nina. The decadal oscillation cycles and sea surface temperatures seem to be very important to tree island development and health, as well as for other important features of the system such as the ridges, sloughs, and receiving bays (RECOVER 2011).

The increased scientific understanding of the greater Everglades system and its attributes allows for a more refined formulation in the central Everglades planning process through an awareness of the complex characteristics and timing that support a healthy ecosystem. The modeling strategy for CEPP incorporates this new information into computer models used to guide plan formulation.

3.1.3 Plan Formulation Strategy

The plan formulation process applied during CEPP analyzed the environmental effects and benefits of the project alternatives through qualitative and quantitative comparisons between the future without (FWO) project condition and the future with project condition. The FWO project condition describes what is assumed to be in place if none of the study's alternative plans are implemented. The FWO project condition for CEPP assumes the construction and implementation of authorized CERP and non-CERP projects, and other Federal, State or local projects constructed or approved under existing governmental authorities that occur in the CEPP study area, as described in **Section 2** of this report. The future with project condition describes what is expected to occur as a result of implementing each alternative plan that is being considered in the study. Based on this formulation and evaluation approach, the CEPP alternatives were analyzed as the next-added increment of CERP projects to be added to a system of projects identified as likely to have been implemented prior to implementation of the CEPP project. The CEPP alternatives were formulated, evaluated, and justified based on the ability of the CEPP alternatives: (1) to contribute to the goals and purposes of the CERP Plan, and (2) to provide benefits that justify costs on a next-added basis.

The Everglades is a complex ecosystem comprising multiple physical and biological elements whose functions and responses are highly interdependent. The Everglades lie at the center of the complex South Florida regional water management system in which water distributed to any part of the system affects many others. In order to achieve incremental restoration of the central Everglades ecosystem, management measures and components cannot be evaluated in isolation, but must be combined and evaluated. The CEPP formulation and modeling strategies acknowledge that the storage and conveyance of water, distribution of water, and seepage management are interacting, interdependent elements that must work together to move restoration forward.

The plan formulation strategy for CEPP consisted of multiple formulation phases that followed the natural southerly flow of water from Lake Okeechobee through the Everglades ecosystem to Florida Bay. The strategy involves the formulation of interdependent management measures and components that serve to restore the central portions of the Everglades including WCA 3 and ENP, while improving the northern and southern estuary ecosystems and increasing water supply for municipal and agricultural users. The plan formulation process used data and findings developed in previous plan formulation efforts including CERP planning and restoration initiatives, such as the EAA Reservoir project, WCA 3 Decompartmentalization and Sheetflow Enhancement project (Decomp), and the ENP Seepage Management project. CEPP used a sequential analytical screening process that increasingly became more comprehensive and detailed as plan formulation progressed.

The plan formulation was conducted from a spatial perspective (**Figure 3-2**). The study area was divided into four sub-regions recognizing that physical and environmental boundaries create distinctive water management issues. This allowed for the development and screening of alternatives, by sub-region, to proceed from upstream to downstream in an orderly and systematic manner to assist in the development and screening of alternatives.

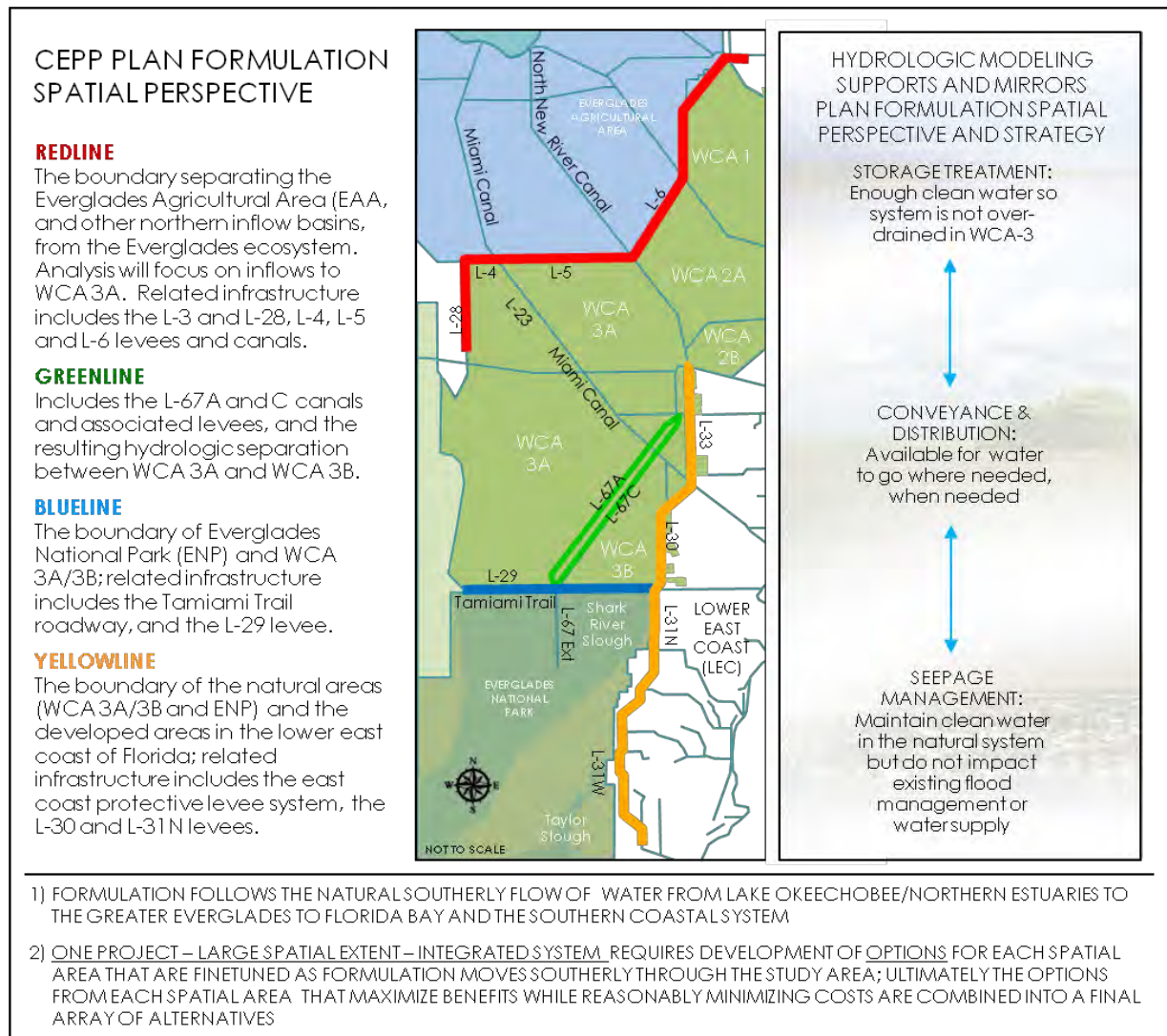


Figure 3-2. Spatial Perspective of Plan Formulation

3.1.4 Alternative Development and Evaluation Overview

Following this spatial perspective, CEPP alternative development began with an initial screening to identify feasible management measures (structural and non-structural features or activities that address one or more planning objectives). Retained management measures underwent a rigorous screening analysis to evaluate, optimize, refine, and finally group into components (i.e. one or more management measures that can be implemented at a specific geographic site) and options (i.e. a grouping of one or more components that function together to provide a sub-regional restoration approach to address objectives and avoid constraints). The term “option” is used to signify that these sub-regional solutions are not complete alternatives. Combining options from the screening of treatment and storage, distribution and conveyance, and the resulting seepage management analysis ultimately led to a limited number of discrete alternative plans that were considered in the final array and underwent a comprehensive system-wide evaluation.

Multi-Criteria Decision Analysis (MCDA) was used to organize the formulation and selection of options which were included in the final array of alternatives. The MCDA was used to support an inclusive and transparent evaluation process for selecting options. The criteria utilized for MCDA were specific to the phase and location of plan formulation. The analysis provided a normalized and aggregated evaluation

score for project options, which prioritized achievement of project objectives, simultaneously considering costs, constraints, and other important considerations. For the cost portion, a parametric capital cost evaluation tool was used for all screening-level costs to provide quick estimates. See **Appendix B** for details.

The evaluation scores were compared to costs to ensure that cost-effective plans (plans with the lowest cost per output) were included in the final array. Because all alternatives contain the same cost assumptions and requirements for lands, easements, rights-of-way, relocation, disposal, preconstruction engineering and design, and construction management; these costs were not developed for the project configurations for the screening analysis, nor included in the MCDA. The product of MCDA is a list of viable, well-vetted, and cost-effective options for each sub-region of the project, to be refined and combined into the final array of alternatives.

3.2 SCREENING

3.2.1 Screening of Storage and Treatment (North of the Redline)

Increasing the volume of water provided to the Everglades ecosystem is essential to meeting CEPP objectives of restoring seasonal hydroperiods and re-establishing appropriate dry season recession rates. Providing storage and treatment will serve to both increase water volume and improve the timing of water deliveries to the Everglades. Additional storage will also reduce the frequency of damaging high water volume discharges to the Northern Estuaries and utilization of operational flexibility within the existing 2008 Lake Okeechobee Regulation Schedule (LORS) will improve availability of water to EAA consistent with CEPP objectives. In order to meet CEPP objectives (**Section 1, Table 1-2**), water will be redirected from Lake Okeechobee through the EAA (instead of discharged to the Northern Estuaries), stored, treated, and delivered to the Everglades.

Establishing the existing quantity of water currently entering WCA 3A (existing water budget) and quantifying potential new water that CEPP could capture from excess water currently discharged from Lake Okeechobee to the Northern Estuaries was a prerequisite to determining how much storage and treatment was needed. The CEPP formulation efforts initially quantified existing flows entering WCA 2A and the northern and northwestern portions of WCA 3A, identified by a transect known as the “Red line”. See **Figure 3-3** and foldout Figure in back of this section. Sources of water include runoff from EAA, the C-139 and C-139 Annex Basins, and discharges from Lake Okeechobee. Proposed non-CEPP projects, including the South Florida Water Management District’s (SFWMD) Restoration Strategies project, will ensure that water considered part of the existing water budget will undergo treatment to meet applicable water quality standards. A significant percentage of the existing inflows to WCA 2A from STA-2 and WCA 1 are subsequently discharged to eastern WCA 3A through the S-11 gated spillways. Since STA-2 outflows may be affected by the CEPP storage within the EAA and since STA-2 outflows contribute to WCA 3A inflows, STA-2 discharges were included in CEPP quantification of existing water. The total volume of water currently entering WCA 2A and WCA 3A across the “Red line” is approximately one million ac-ft on an average annual basis, based on hydrologic modeling for a historical climatologic period from 1965 to 2005.

To quantify the maximum potential water available to CEPP, a FWO condition baseline scenario was evaluated with the CEPP hydrologic modeling tools to identify water discharged from Lake Okeechobee in excess of defined target flows for the Northern Estuaries. Over 500,000 ac-ft of excess water is discharged to the Northern Estuaries on an average annual basis under the current 2008 Lake Okeechobee Regulation Schedule (LORS). The CEPP formulation examined scenarios that used a portion of this water, subject to the project objectives and constraints.

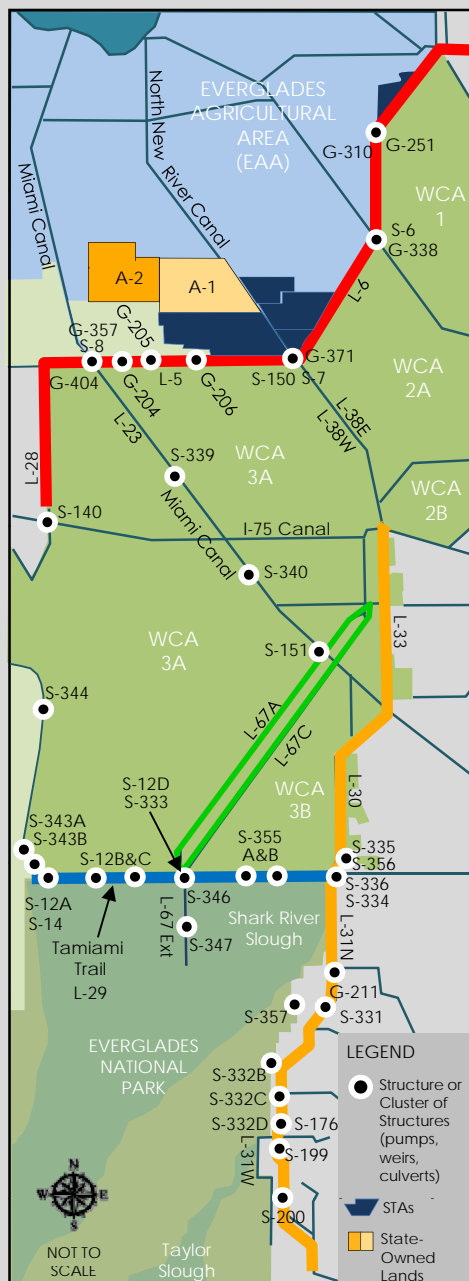
STORAGE & TREATMENT MEASURES/COMPONENTS/OPTIONS EAA – North of the Redline

PURPOSE

Increase the quantity of water that can be delivered from Lake Okeechobee and the Everglades Agricultural Area (EAA) to WCA 3A within state water quality standards with improved seasonal timing.

CEPP OBJECTIVES

- 1 Restore seasonal hydroperiods & freshwater distribution to support a natural mosaic of wetland/upland habitat in Everglades system.
- 3 Reduce water loss out of natural system to promote appropriate dry season recession rates for wildlife utilization.
- 5 Reduce high volume discharges from Lake Okeechobee to improve quality of oyster & SAV habitat in northern estuaries.
- 6 Increase availability of water supply to the Lake Okeechobee Service Area.



1 SCREEN MANAGEMENT MEASURES 3.2.1.1

- 1 Identify available "new" water (water budget)
- 2 Canvass CERP efforts for measures and identify new measures
- 3 Determine consistency with CEPP objectives
- 4 Screen & optimize configurations of measures (sizes, locations, combinations) based on:
 - Operational flexibility
 - Environmental effectiveness
 - Human health and safety
 - Constructability
 - Land available
 - Cost

RESULT

Storage

- Above-ground Storage Reservoirs
- Lake Okeechobee Operations
- Flow Equalization Basin (FEB)

Treatment

- Stormwater Treatment Areas (STAs)

2 LOCATE MANAGEMENT MEASURES 3.2.1.2

- 1 Identify Region – north, south, east, west of Lake Okeechobee based on:
 - Inflow
 - Linkage to flow areas
 - Land available
 - Suitable substrate
 - Existing infrastructure

RESULT

South of Lake - EAA

- 2 Identify Footprint based on:
 - Infrastructure
 - Socio-political & environmental concerns
 - Hydrology
 - Construction efficiency

RESULT

- Existing lands acquired by the State of Florida (A1 & A-2)
- Future Without Project Condition indicates an FEB on A-1

3 FORMULATE OPTIONS 3.2.1.3

- 1 **Reservoir Sizing and Operations Screening (RESOPS)** model to predict benefits attributed to configurations
- 2 **Lake Okeechobee Operations (LOOPS)** model to determine optimal configurations with changes to Lake Okeechobee operations

RESULT

27 options of 9 storage and treatment configurations and 3 Lake Okeechobee operational measures

DEEP RESERVOIR

- (6' Deep) Reservoir (24,000 ac) w/STA (4,000 ac)
- (6' Deep) Reservoir (11,000 ac) w/STA (17,000 ac)
- (12' Deep) Reservoir (24,000 ac) w/STA (4,000 ac)
- (12' Deep) Reservoir (21,000 ac) w/STA (7,000 ac)
- (12' Deep) Reservoir (17,000 ac) w/STA (11,000 ac)

OTHER

- FEB (28,000 ac)
- STA (28,000 ac)
- Shallow (4' Deep) Reservoir (24,000 ac) w/STA (4,000 ac)
- Shallow (4' Deep) Reservoir (14,000 ac) w/STA (14,000 ac)

4 EVALUATE OPTIONS 3.2.1.4

- 1 Multi-Criteria Decision Analysis (MCDA)
 - LEVEL 1** CEPP Objectives
 - Additional Flow to Everglades
 - Everglades Dry Standard
 - Estuary condition
 - Increased Water Available (Water Supply)
 - LEVEL 2** Other Important Considerations
 - Lake Water Levels
 - Adaptability (Robustness & Future CERP Increment Compatibility)
 - On-site Habitat (Wildlife Utilization, Vegetation, Hydrology)

- 2 Cost-Effectiveness Evaluation

- Two cost-effective options:
 - (12') Reservoir (21,000 ac) w/STA (7,000 ac)
 - FEB (28,000 ac)

RESULT

28,000-ac FEB reasonably maximizes benefits while minimizes costs

Flow Equalization Basin (FEB) is an above-ground impoundment that would provide surface water storage, flow equalization, and also some limited water quality improvement function

Figure 3-3. Storage and Treatment North of the Redline

3.2.1.1 Screening of Storage and Treatment Management Measures

Management measures were compiled from previous CERP planning efforts and new measures were identified for CEPP. See **Appendix E.1.1** and **Appendix E.1.2** for details of storage and treatment measures. These measures were screened with criteria established specifically for CEPP:

- **Effectiveness:** ability to meet objectives and avoid constraints
- **Operational Flexibility:** ability to adapt to changing conditions
- **Environmental Effects:** avoidance of negative impacts
- **Constructability:** feasibility of construction
- **Human Health and Safety:** avoid or minimize risks
- **Land Availability:** sufficient or suitable property for construction and operation
- **Efficiency:** relative cost effectiveness in meeting downstream objectives

An array of 13 distinct management measures was identified with multiple size and configuration potentials for each measure. The primary factors in eliminating management measures were if the measures did not sufficiently address project objectives or would result in unacceptable environmental impacts. Cost estimates were not generated for infeasible measures; consequently, no measures were eliminated solely based on high capital cost. Several management measures were evaluated based on a qualitative cost effectiveness of the measure in relation to other measures. The application of the screening criteria to the 13 management measures resulted in 4 management measures retained for configuring size, locations, and combinability (**Table 3-1**). **Appendix E, Table E-1.1**, identifies all measures and the reasons for elimination.

Table 3-1. Retained Storage and Treatment Management Measures

Storage Management Measures	Treatment Management Measures
<ul style="list-style-type: none"> • Above-Ground Storage Reservoir • Lake Okeechobee Operational Changes • Flow Equalization Basin (FEB) 	<ul style="list-style-type: none"> • Stormwater Treatment Area (STA)

3.2.1.2 Locations of Storage and Treatment Management Measures

Identifying an acceptable storage and treatment location governs the range and scale of management measures that could be considered. A siting analysis was conducted with two primary considerations, identifying the regional geographic location and the specific footprint. See **Appendix E.1.2.1** for details of siting analysis.

The regional location for suitable storage and treatment measures was determined by identifying locations that could meet project objectives and areas that could maximize use of existing infrastructure. CERP included storage components to be located north of Lake Okeechobee (North of Lake Okeechobee Storage Reservoir), east of Lake Okeechobee (C-44 Basin Storage Reservoir), west of Lake Okeechobee (C-43 Basin Storage Reservoir), and south of Lake Okeechobee (Everglades Agricultural Storage Reservoirs). Building off CERP's recommended plan, CEPP identified EAA as the location with the greatest potential for minimizing costs by using existing infrastructure capacity (STAs and canals) and publicly owned land, which also provides a source of inflow and linkage to targeted flow areas.

After considering the possible regional geographic areas, the specific location for the storage and treatment measures within EAA was selected based upon the factors identified in **Table 3-2**.

Table 3-2. Siting Criteria for Locating Storage and Treatment Features within the EAA

Infrastructure	Socio-Political and Environmental	Hydrology	Construction Efficiency
<ul style="list-style-type: none"> • Use of existing major canal networks (Miami Canal, Bolles & Cross Canal and North New River Canal) • Proximity to move water from water source (Lake Okeechobee) • Proximity to existing public works (STAs, existing pump stations, roads, minor canal networks) 	<ul style="list-style-type: none"> • Avoid unwilling sellers, eminent domain authority • Minimize impacts to local tax rolls • Use lands already acquired for purpose of environmental restoration • Minimize effects on Cultural Resources • Use previously impacted lands 	<ul style="list-style-type: none"> • Reduce regulatory releases to the Northern Estuaries • Hydraulic connection to Lake Okeechobee with flexibility to manage high water levels • Improve the timing of environmental deliveries to the WCAs 	<ul style="list-style-type: none"> • Topography • Muck depths • Construction and maintenance access • Seepage Management • Availability of construction material

The storage and treatment management measures south of Lake Okeechobee are recommended to be located on and maximize the usage of A-1 and A-2 Compartments of EAA land south of Lake Okeechobee that are owned by the State of Florida (**Figure 3-4**). The identified project lands are located between and adjacent to the North New River and Miami Canals, which reduces the need to construct any additional conveyance features to move water from Lake Okeechobee to the project components and the WCAs. The project lands are adjacent to existing water quality treatment facilities (STA 3/4 and STA 2) that are currently being used for environmental purposes, creating a unique ability to optimize Central and South Florida (C&SF) Project operations. The FWO includes a Flow Equalization Basin (FEB) on the 15,000 acre A-1 footprint that is being financed, constructed, and operated by SFWMD as part of the Restoration Strategies water quality compliance remedy. However, the formulation of management measures assumed the State A-1 facility could be modified and integrated with the Federal CEPP project features as long as project constraints for water quality and water supply were not violated. The A-1 FEB, and all projects required for the State's Restoration Strategies, are independent State facilities and are not CEPP components or features; therefore, the State's Restoration Strategies features will not be incorporated as a Federal CEPP project feature. Any CEPP features that require modifications to the State's Restoration Strategies may require modifications to: (1) the State permits authorizing the Restoration Strategies, and (2) Federal permits, such as Clean Water Act (CWA) 404 permits, both of which may require additional consultation under the Endangered Species Act (ESA) or analysis under the National Environmental Policy Act (NEPA). Additionally, any modifications to the State Restoration Strategies that would impair the usefulness of any Federal project, including all CERP/CEPP features, may also require a 33 USC Section 408 permit from the USACE.

The siting analysis identified the 28,000 acre A-1 and A-2 footprints as being the largest, most efficient footprint for this increment of CEPP. The CERP identified the need for 360,000 ac-ft of water storage in EAA and the new science demonstrates that the need for flows passing through EAA is even higher than envisioned in CERP. This suggests that storage greater than 360,000 ac-ft, and necessary treatment, is likely needed if CERP goals and objectives are going to be fully achieved. The entire footprint of the A-1 and A-2 compartments was used to configure the storage and treatment component to maximize additional flows to the Everglades. During CEPP formulation, the State decided to use the A-1 parcel for another priority effort (Restoration Strategies). Because their project on the A-1 site was complementary and compatible with CEPP, the formulation of CEPP continued to include this parcel of land.

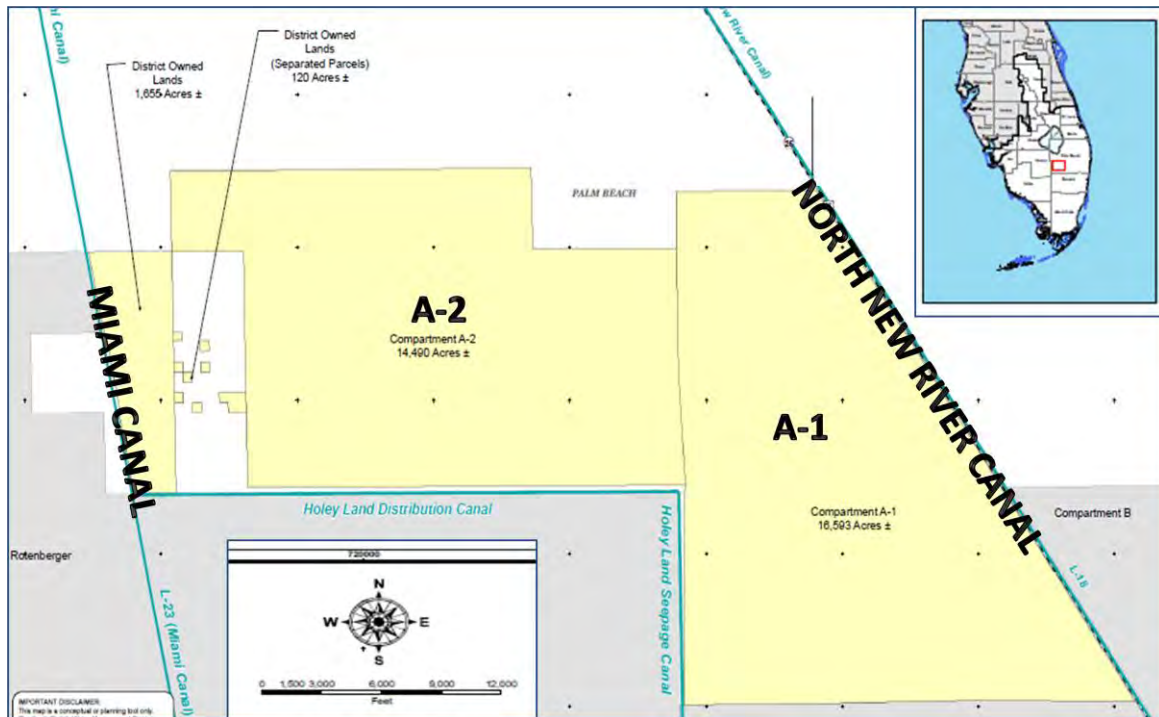


Figure 3-4. Location of Land within the EAA for Quantity/Quality Management Measures

3.2.1.3 Formulation of Storage and Treatment Options

The Reservoir Sizing and Operations Screening (RESOPS) model was used to quickly predict water deliveries, timing of flow, and reduction in discharge to the Northern Estuaries for thousands of scales and configurations of management measures. See **Appendix E.1.3 and E.1.4** for details.

The combinations of storage and treatment management measures for the options modeled for the A-1/A-2 footprint included:

- STA only: emergent and submerged marsh treatment facility.
- FEB: 4 foot depth emergent marsh storage with limited treatment capability.
- Shallow reservoirs (4 foot depth) with added STA capacity combinations
- Deep reservoirs (6 foot and 12 foot depth) with added STA capacity combinations
- FEB with added STA capacity combinations.

In addition to determining the configuration of storage and treatment management measures on the site footprint, consideration was given to incorporating assumed operational flexibility in Lake Okeechobee (within the existing 2008 LORS) when additional storage capacity is available by using the Lake Okeechobee Operations Screening (LOOPS) model. More specifically, the LOOPS screening modeling included proposed revisions to the 2008 LORS flow chart guidance of maximum allowable discharges, which are dependent on the following criteria: class limits for Lake Okeechobee inflow and climate forecasts, including tributary hydrologic conditions, seasonal climate outlook, and multi-seasonal climate outlook; stage level, as delineated by the Regulation Schedule management bands; and stage trends (whether water levels are receding or ascending). The 2008 LORS Regulation Schedule management bands and sub-bands were not modified, consistent with the original modeling intent to remain within the operational flexibility available in the 2008 LORS. Most of the 2008 LORS refinements applied in the CEPP modeling lie within the bounds of the operational limits and flexibility available in

the current 2008 LORS, with the exception of the adjustments made to the class limits for the Lake Okeechobee inflow and climate forecasts. Under some hydrologic conditions, the class limit adjustments made to the Lake Okeechobee inflow and climate forecasts reduced the magnitude of allowable discharges from the Lake, thereby resulting in storage of additional water in the Lake in order to optimize system-wide performance and ensure compliance with Savings Clause requirements. These class limit changes represent a change in the flow chart guidance that extends beyond the inherent flexibility in the current 2008 LORS. However, the determination that the proposed adjustments to the Regulation Schedule class limits were outside of the operational flexibility available in the 2008 LORS was not established during the CEPP formulation effort, and this determination was ultimately made following completion of the hydrologic modeling effort and shortly prior to identification of the recommended plan. Throughout the subsequent description of the CEPP formulation process, the proposed revisions to Lake Okeechobee operations are therefore denoted as “within the assumed operational flexibility of the 2008 LORS” (or similar), consistent with the information available during CEPP formulation.

Nine highly functioning combinations of storage and treatment measures were identified with three different Lake Okeechobee operational measures. These resulting 27 storage and treatment options (See **Table 3-3**) were evaluated using MCDA.

Table 3-3. Resulting 27 Storage and Treatment Options

Storage and Treatment Configuration	Lake Okeechobee Operations
FEB	<ul style="list-style-type: none"> • Water Supply Optimized • Estuarine Performance optimized • Lake Okeechobee Performance Optimized
28,000 acres	
4 ft Shallow Storage & STA	
24,000 acre Reservoir & 4,000 acre STA	
14,000 acre Reservoir & 14,000 acre STA	
6 ft Deep Storage & STA	
24,000 acre Reservoir & 4,000 acre STA	
11,000 acre Reservoir & 17,000 acre STA	
12 ft Deep Storage & STA	
24,000 acre Reservoir & 4,000 acre STA	
21,000 acre Reservoir & 7,000 acre STA	
17,000 acre Reservoir & 11,000 acre STA	
STA	
28,000 acres	

3.2.1.4 Evaluation Criteria and Results of Options Analysis

A MCDA and a cost-effectiveness evaluation were used to evaluate the 27 options that resulted from the preliminary screening of storage and treatment measures in EAA. There were two levels of criteria evaluated (**Table 3-4**): Level 1 corresponded to the primary objectives of CEPP and Level 2 was used to ensure other important considerations were included in determination of what options were carried forward. See **Appendix E.1.4** and **E.1.5** for detailed criteria description, evaluation tools used, scoring methodology and results.

Table 3-4. Level 1 and Level 2 Screening Criteria for Storage and Treatment Options

Level 1 – Criteria Based on CEPP Objectives
<ul style="list-style-type: none"> • Additional Flow to Everglades: Volume of additional average annual flow delivered to WCA 3A by reducing in-lake triggered high discharges to the Northern Estuaries. • Everglades Dry Standard Score: Numeric (1-100) score determined by comparing magnitude and timing of water flows that will be provided by CEPP vs. Everglades target restoration flows, especially during the dry season, with higher scores given to options that provide the most restoration-like flows. • Estuary condition: Reduction in high flows to the St. Lucie and Caloosahatchee Estuaries. • Increased Water Availability (Water Supply): Total cutback volumes (water demand not met) for the eight worst drought years during the 41-year period of analysis.
Level 2 – Other Important Considerations
<ul style="list-style-type: none"> • Lake Okeechobee: Ability of the options to maintain lake water stages within the preferred ecological stage envelope range of 12.5 – 15.5 ft, and to minimize the occurrence of both extreme high lake stage events above 17 ft and extreme low lake stage events below 10 ft (National Geodetic Vertical Datum, NGVD 1929). • Adaptability (Robustness and Future Compatibility): Robustness was defined as the ability to function effectively in the face of variability and uncertainty of future events. Future compatibility is the efficiency of using the project configuration to complement future CEPP increments. • On-site Habitat: Potential for wetland and aquatic wildlife within storage and treatment footprint based on three criteria (Wildlife Utilization, Vegetation, Hydrology).

3.2.1.5 Results of Storage and Treatment Options Screening Analysis

The screening effort resulted in two cost-effective measures with large differences in costs. Other measures were screened out due to their scoring on the screening criteria, where measures did not deliver as much water or did not deliver the water in the dry season when it is most needed by the ecosystem. See **Appendix E.1.5**, for costs and scoring results. The evaluation of Level 1 criteria led to the identification of two options and Level 2 criteria supported the outcome/conclusions. The two remaining options are as follows:

- A 28,000 acre FEB, which included the A-1 and A-2 parcels, with Lake Okeechobee operations optimized for agricultural water supply in the EAA is the least cost option at an expected cost range of \$360-550 million. This option is estimated to provide approximately 200,000 ac-ft of additional water annually to the Everglades system.
- A 12-foot deep reservoir, also with Lake Okeechobee operations optimized for agricultural water supply in the EAA, provides the greatest benefits to the Everglades. This reservoir is sized at 21,000 acres with an additional 7,000 acre STA to handle the water stored that would exceed the treatment limitations of the existing STA system. This configuration provides the greatest benefits to the Northern Estuaries and delivers up to 240,000 ac-ft of additional water to the Everglades rather than 200,000 ac-ft. The cost (nearly \$2 billion) increased between 400-600% over the FEB while providing only slightly greater benefits (~20%). The 12-foot reservoir configuration was eliminated from further consideration due to excessive cost and low economic efficiency.

3.2.1.6 Storage and Treatment Option Conclusion

The option recommended in the final array of alternatives is a 28,000-acre FEB (14,000 acres will be constructed and operated by the State as part of the State's Restoration Strategies) that reasonably maximizes benefits while minimizing costs.

The FEB on the EAA Compartment A-2 footprint will be operated in a mutually beneficial, integrated fashion with the State Restoration Strategies (water quality compliance remedy) on the A-1 footprint (**Figure 3-5**). This option maximizes the use of previously acquired real estate, while utilizing existing State-owned infrastructure. This option is dependent upon the State constructing the A-1 FEB, use of the excess storage and treatment capability of the A-1 FEB, use of the G-370 and G-372 structures as well as utilization of available excess treatment capacity in STA 3/4 and STA 2 when not needed to treat EAA local basin runoff. The State of Florida's compliance remedy has been sized to handle peak runoff rates and the associated treatment requirements. Thus, the State facilities will not be operating continually at the peak rate and will have capacity to accept and treat additional water from Lake Okeechobee during off-peak times. CEPP formulation considers potential benefits from using the excess capacity in the State facilities (A1-FEB, STA 3/4, and STA-2). CEPP proposes primarily utilizing the State facilities approaching and after the peak of the wet-season when capacity is available.

This option uses the assumed flexibility within the existing 2008 Lake Okeechobee Regulation Schedule, with operations optimized for water supply (**Table 3-3** and **Appendix E, Figure E-7**). The intent of the operations optimized for water supply was to maintain existing levels of service, and no improvement in agricultural water supply was identified. This option can provide approximately 200,000 ac-ft per year of additional water flow to the Everglades across the Redline, water which is currently being discharged to the Atlantic Ocean and Gulf of Mexico via the St. Lucie and Caloosahatchee Estuaries. This is nearly 2/3 of the overall water that CERP envisioned providing to the natural system.

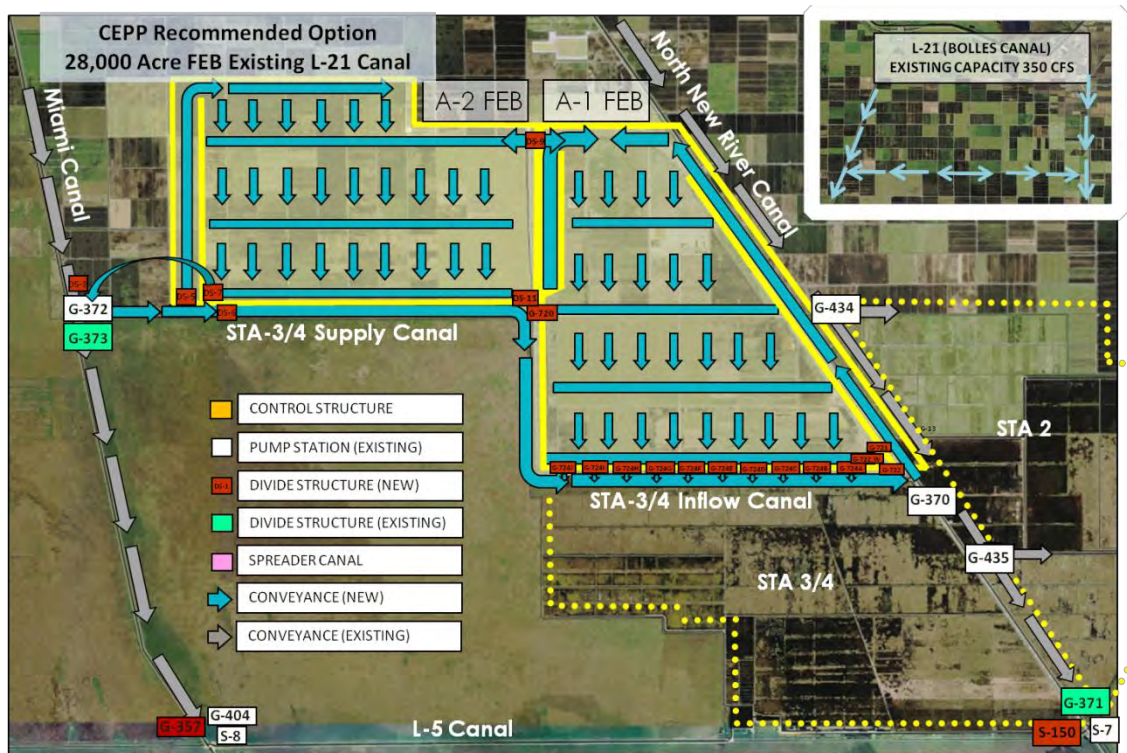


Figure 3-5. Conceptual Integrated FEB on A-1/A-2 used during Screening

3.2.2 Screening of Northern Distribution and Conveyance - Northern Water Conservation Area 3A (South of the Redline)

The formulation of northern distribution and conveyance options focused on improving the location, direction, depth, volume, and/or timing of water into and through WCA 3A, WCA 3B, and ENP in order to meet the project objectives. See **Figure 3-6** and foldout Figure in back of this section. The approximately 200,000 ac-ft per year of additional water flow to the Everglades identified with the FEB and Lake Okeechobee operations was the basis for formulating management measures and options for distribution and conveyance south of EAA.

Northern distribution management measures (Hydropattern Restoration Features [HRF]) along the northern boundary of WCA 3A provide a means for distributing treated STA discharges into northern WCA 3A in a manner that will aid in restoration of natural sheetflow from the northern boundary of WCA 3A to the south. Reducing the harmful drainage effects of the Miami Canal make up the conveyance management measures. Options for northern distribution and conveyance in northern WCA 3A were formulated by combining these management measures.

Figure 3-6. Conveyance and Distribution South of the Redline

3.2.2.1 Screening of Northern Distribution and Conveyance Management Measures

Management measures were compiled from previous CERP planning efforts and new measures were identified for CEPP. See **Appendix E.2.1.1** and **Appendix E.2.1.2** for detailed descriptions of management measures. These measures were organized by distribution and conveyance features and were screened with the following criteria that were established specifically for northern WCA 3A (**Appendix E.2.2**):

- **Effectiveness:** ability to meet objectives and avoid constraints
- **Environmental Effects:** avoidance of negative impacts
- **Maintenance:** avoid measures that are difficult and costly to manage and maintain

The measures that were retained for consideration and potential inclusion in components for the final array of alternatives are listed in **Table 3-5**. Cost estimates were not generated for infeasible measures; consequently, no measures were eliminated based on cost. Minor restoration features such as littoral shelves in canals, creation of tree islands, exotic removal along levees, etc., were not evaluated in the initial screening process as those features would generally not influence the modeling outcome or affect comparison of alternatives; however, they will be considered during detailed design of the recommended plan as there may be associated costs and construction requirements with these minor features.

Table 3-5. Management Measures for Northern Distribution and Conveyance

Distribution Measures (HRF):	Conveyance Measures
HRF Infrastructure: <ul style="list-style-type: none"> • Spreader Canal • Levee Removal/Degrade or Gaps Associated Infrastructure: <ul style="list-style-type: none"> • New or Modified Pump Stations • Canal Modifications 	Miami Canal Infrastructure: <ul style="list-style-type: none"> • Plug to Marsh Grade • Backfill to Marsh Grade • Spoil Mound Removal

3.2.2.2 Locations of Northern Distribution Management Measures

Northern WCA 3A contains three existing canals that were identified as an efficient means to locate distribution measures:

- L-4 (levee removal/degrade west of the Miami Canal);
- L-5 (new spreader canal or levee gaps between the North New River and the Miami Canal);
- Remnant L-5 (remnant L-5 as spreader south of STA 3/4)

From these canals, six HRF locations were identified from the physical characteristics of northern WCA 3A to evaluate specific locations to distribute water across northern WCA 3A (**Figure 3-7**).

- Three segments established in northern WCA 3A;
 - East (remnant L-5 from the STA3/4 outlet canal to S-7)
 - West (West of S-8): L-4 levee degrade canal from L-28 intersection to S-8
 - Mid (L-5 Canal from S-8 to the STA 3/4 outlet canal)
- Two segments established in northern WCA 3A;
 - West of G-205 (western half of northern WCA 3A)

- East of G-205 (eastern half of northern WCA 3A)
- One complete segment distributes water across full northern WCA 3A boundary;
 - Full (L-4/L-3 intersection to S-7)

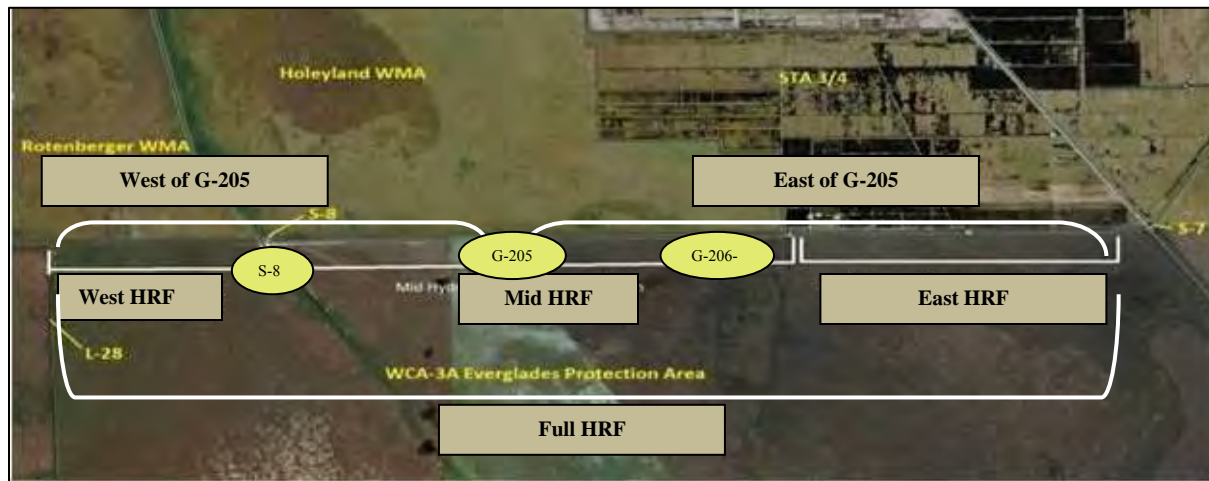


Figure 3-7. Six HRF Locations to Evaluate to Distribute Water Across Northern WCA 3A

All of the HRF measures include the appropriate pump stations and canal improvements required to deliver water from STA 3/4 to northern WCA 3A while maintaining the design capacity of the S-8 pump station. The six management measure locations could be combined to form numerous components. Therefore, to reduce the potential number of HRF measures, screening criteria derived from CEPP and CERP objectives were developed specifically for northern WCA 3A and applied to examine the locations and combinations of locations. Of the six locations, the East of G-205, West HRF, Mid HRF, and East HRF scored the lowest due to poorer abilities to place flows where they are most useful and to promote project objectives such as ecological connectivity. See **Appendix E.2.2.1** for details and results of screening.

The primary screening criteria included:

- Maximizes spatial extent of restoration potential (maximizes acreage)
- Flexibility to move water where most needed
- Promotes longer flow path through WCA 3A (connectivity)
- Maximizes sheetflow objectives (overall distribution – includes minimizing short-circuiting along eastern and western boundaries)
- Minimizes likelihood to increase phosphorus movement from impacted areas (large volume inflow in small area)
- Best addresses dry downs in over-drained areas
- Improves conditions for wading birds (foraging/nesting)
- Maximizes potential to restore and sustain ridge and slough pattern and tree islands where desired

Two HRF locations were retained for further consideration after application of the primary screening criteria: the Full HRF across northern WCA 3A, and the HRF West of G-205.

3.2.2.3 Locations of Northern Conveyance Management Measures

The formulation of conveyance measures relies on determining the best locations for backfill and plugs in the Miami Canal in order to restore more natural hydropatterns in WCA 3A and minimize negative effects caused by the canal. The initial CEPP formulation used findings and data developed during previous plan formulation efforts from the CERP Decomp project. Since the full Miami Canal in WCA 3A is 27.65 miles from S-8 to S-151, to aid in incrementally building Miami Canal conveyance management measures, the Miami Canal was divided into three segments defined by existing water control structures.

- North segment only: 9.45 miles (S-8 to S-339)
- Central segment only: 8.45 miles (S-339 to S-340)
- South segment only: 9.75 miles (S-340 to S-151)

An array of 23 plugging and filling combinations were developed within the three identified reaches. The following criteria related to meeting CEPP and CERP objectives and constraints were used to evaluate the 23 Miami Canal combinations. The screening criteria evaluation led to the components being ranked from 1 to 23 in a multi-agency exercise. Implementation cost estimates were used to distinguish between similarly ranked components. See **Appendix E.2.2.2** for details.

- Reducing dry downs in northern WCA 3A
- Reducing ponding in southeastern/central WCA 3A
- Maintaining water quality constraint
- Providing ecologic and hydrologic connectivity
- Increased sheetflow
- Minimizing risk and uncertainty

The top four ranked management measure locations were identified for further consideration. Generally, the remaining 19 were ranked lower due to lesser abilities to promote project objectives, lesser abilities to work together with other CEPP management measures, and due to important considerations such as coordination with other restoration efforts including State planted and maintained tree islands in the area. Miami Canal backfill to bedrock grade was the conceptual design for all backfill configurations and each of these locations incorporates spoil mound removal. The exact location and extent of the spoil removal and refined Miami Canal backfill design was not identified until the evaluation of the final array.

- Complete backfill of the north segment, plug central and south segments
- Complete backfill of the north, central & south segments
- Complete backfill of the north and central segments
- Plug north, central and south segments from S-340 to C-11 Extension

3.2.2.4 Formulation of Initial Options for Northern Distribution and Conveyance

An initial array of options for distribution and conveyance in northern WCA 3A was developed by combining the retained three HRF (2 locations plus no action) and five Miami Canal backfill (4 locations plus no action) locations. Fifteen possible combinations were then screened (**Appendix E, Table E.1-25**) to identify the 7 options that would undergo further detailed modeling with the Regional Simulation Model-Glades and Lower East Coast Service Area (RSM-GL). The RSM-GL provides detailed (cell-based)

stage and flow information on a regional scale and can account for current or proposed changes in infrastructure and operations. The 7 options were selected because they would, when compared to each other, produce the greatest amount of information on the effectiveness of the individual distribution and conveyance measures. It was generally recognized through the Decomp formulation effort that if plug performance was determined as comparable to the full backfill, plugs could be incorporated into any of the other options that included full backfill of all or portions of the Miami Canal. Due to this recognition, only one plug option was carried forward for the modeling effort.

The following seven options were modeled with the RMS-GL for the Decomp project:

- A. Full HRF and complete backfill of Miami Canal (S-8 to S-151)
- B. Full HRF and north backfill of Miami Canal (S-8 to S-339)
- C. Full HRF and plugging of Miami Canal (S-8 to S-151) with 4,000 ft length plugs and 2,000 ft spacing between plugs
- D. West of G-205 HRF and complete backfill of Miami Canal (S-8 to S-151)
- E. West of G-205 HRF and north backfill of Miami Canal (S-8 to S-339)
- F. Full HRF Only (no Miami Canal modifications)
- G. West of G-205 HRF and I-75 backfill of Miami Canal (S-8 to I-75)

While providing valuable insight and information, this first RSM-GL modeling only considered distribution of the pre-project existing volume of water. Additional RSM-GL screening modeling and evaluation would be necessary to account for the additional water provided by the FEB and Lake Okeechobee operational refinements.

3.2.2.5 Evaluation Criteria and Results of Initial Options Analysis - Northern Water Conservation Area 3A

MCDA and a cost-effectiveness evaluation were used to evaluate the 7 options that resulted from the preliminary screening of distribution and conveyance measures in northern WCA 3A. There were two levels of criteria evaluated (**Table 3-6**). Level 1 corresponded to the primary objectives of CEPP and Level 2 assessment was used to ensure ecologically significant considerations and other stakeholder concerns were included in determination of what options were carried forward. See **Appendix E.2.4** for detailed criteria descriptions, evaluation tools used, scoring methodology and results. Four options (Options D, E, F, and G) from the initial array of seven were identified as cost effective.

Table 3-6. Level 1 and Level 2 Criteria for Northern Distribution and Conveyance Options

Level 1 – Criteria Based on CEPP Objectives
Project Performance Measures <ul style="list-style-type: none"> • Inundation Duration in the Ridge and Slough Landscape: Provides a measure of the percent period of record inundation. • Sheetflow in the Ridge and Slough Landscape: Provides a measure of the timing, distribution, and continuity if sheetflow across the landscape. • Hydrologic Surrogate for Soil Oxidation: Provides a measure of cumulative drought intensity to reduce exposure to peat to oxidation. Slough Vegetation Suitability: Provides a measure to evaluate the hydrologic suitability for slough vegetation (Hydroperiod, Dry down, and Wet and Dry Season Depths).

<p>Hydrologic Mapping Results: Performance of each project configuration, in WCA 2A, 2B, 3A and 3B, for each of the six project objectives was compared using hydroperiod distribution maps, ponding depth maps, and overland flow vector maps from the Decomp modeling.</p>
<p style="text-align: center;">Level 2 – Other Important Considerations</p>
<ul style="list-style-type: none"> • Excessive Ponding: Everglades Viewing Windows used to evaluate ponding depths over a percent period of record from 1965 through 2005 along transects in WCA 3A. • Adaptability: Robustness is the ability to function effectively with future variability and uncertainty. Future compatibility is the efficiency of features complementing future increments. • Ecologic Connectivity: Qualitative criterion that evaluates increases in marsh connectivity directly associated with the removal of man-made barriers to flow. • Recreational Impacts: Substantive changes to the landscape and hydrology will potentially affect recreational opportunities in the Everglades marsh.

3.2.2.6 Refinement of Northern Distribution and Conveyance and Options

As previously described, the options evaluated used the existing water budget entering WCA 3A and needed to be refined and expanded to address the additional water provided by FEB and Lake Okeechobee operations and to address other formulation uncertainties.

The refinements resulted in the potential for 18 options (**Table 3-7**) to be evaluated using regional hydrologic model output. Due to the expedited schedule for CEPP and the resource requirements for executing modeling simulations, only a limited number of options were able to be modeled and the simulations were developed starting from the Decomp RSM-GL final array modeling (CEPP inflows to WCA 3A were increased from existing inflows; however, additional WCA 3A outlet capacity was limited to the 1500 cfs identified for the MWD Project). Rather than model all possible combinations, the options selected for modeling were chosen because these options would allow the project team to evaluate the potential benefits of lengthening the HRF, adding additional features (plugs) in the Miami Canal south of I-75, and including a new distribution management measure that diverts additional water from STA 2 to WCA 3A via the L-6 canal. Four combinations of options were identified to be modeled: Options 4a, 6a, 7a, and 7b. See **Appendix E, Section E.2.6** for details of refinement.

Table 3-7. Combinations of HRF and Miami Canal Options

Option	HRF	Miami Canal	L-6 Diversion (a/b)
1a, 1b	West G-205	North I-75	With/Without
2a, 2b	West G-205	North I-75, Plug at S-340	With/Without
3a, 3b	West G-205	North I-75, Plug at S-340, Plug South of C-11	With/Without
4a, 4b	West G-206	North I-75	With/Without
5a, 5b	West G-206	North I-75, Plug at S-340	With/Without
6a, 6b	West G-206	North I-75, Plug at S-340, Plug South of C-11	With/Without
7a, 7b	Full	North I-75	With/Without
8a, 8b	Full	North I-75, Plug at S-340	With/Without
9a, 9b	Full	North I-75, Plug at S-340, Plug South of C-11	With/Without

Directing water west of the G-206 structure (Options 4a) resulted in more hydrologic improvement in comparison to the full HRF (Option 7a). The full HRF was not determined to be cost effective, since it costs more and provided fewer benefits.

Compared to complete Miami Canal backfill north of I-75 (Option 4a), construction of additional plugs located directly adjacent to S-340 and south of C-11 Extension (Option 6a) provided minimal project benefits as localized hydrologic improvements were only seen during the driest years. The relatively small increase in potential project benefits does not warrant the additional construction cost required. Because the CEPP RSM-GL screening modeling did not include increased WCA 3A outlet capacity beyond the MWD Project (based on the Decomposition modeling assumptions), which would provide further reduction to the existing ponding conditions within southern WCA 3A, consideration of Miami Canal modifications south of I-75 may warrant reevaluation under future CERP/CEPP increments.

The model results demonstrated that the re-direction of flow from STA-2 to the HRF via the L-6 and L-5 canal offered significant project benefits (Option 7a compared to Option 7b). Redirection of flow requires conveyance improvements to the L-5 canal, new structures, and increased operations and maintenance costs. The L-5 conveyance improvements also provides a substantial amount of fill material available to be used in the Miami Canal backfill feature, thereby eliminating the need to import additional fill material from outside the CEPP project for the final 18 options evaluated in the refinement. The results demonstrated that without the diversion of the flow from STA-2 to the west (Option 7b), detrimental impacts due to excessive ponding would occur in WCA 2, and potential Zone A regulation schedule constraint impacts in WCA 3A could occur due to exacerbated ponding south of the S-11s (which affect the 3A-3 gauge stages). Taking into account the negative impacts that would occur without diverting the STA-2 water and the ability to use the L-5 canal modification as a source of fill for the Miami Canal, the L-5 modifications with L-6 water diversion operations from STA-2 to WCA 3A were retained.

The combinations of Miami Canal, HRF, and L-6 diversion features for northern distribution and conveyance that were retained for inclusion in the final alternatives are described in the next section.

3.2.2.7 Northern Distribution and Conveyance Conclusion

Northern distribution and conveyance screening, based on the water budget provided from the North of the Redline “option”, resulted in the identification of two options for incorporation into the final array of alternatives (Figure 3-8).

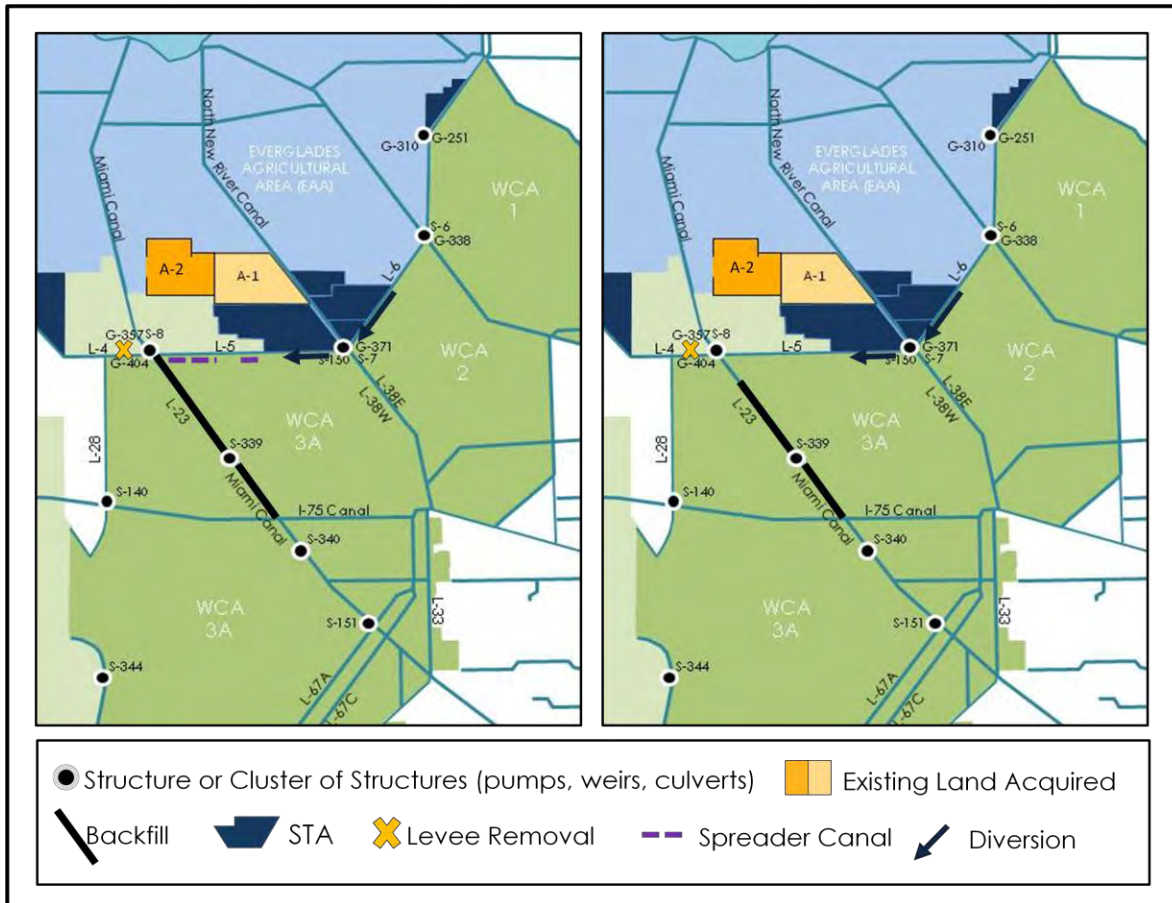


Figure 3-8. Two Options for Northern Distribution and Conveyance (Left Panel-Option 1) (Right Panel - Option 2)

Option 1: The detailed screening conducted for CEPP distribution and conveyance in northern WCA 3A, with additional preliminary conceptual design efforts, resulted in the identification of one highly functioning option for inclusion in the final array alternatives:

- Levee removal ~ 3 miles west of S-8 pump station (along the L-4) (HRF)
- Spreader canal ~ 3 mile east of S-8 pump station (S-8 to G-205) (HRF)
- Spreader canal 1.5 mile at G-206 (HRF)
- Full backfill of the Miami Canal from S-8 to I-75
- STA-2 outflow diverted to WCA 3A via the L-6 and L-5 canals (L-6 diversion)

Option 2: The second option identified for inclusion into a final array configuration resulted from stakeholder concerns. Option 1 includes a new spreader canal east of the S-8 pump station, parallel to L-5 and within WCA 3A. This area provides terrestrial refuge for deer on the L-4 levee during high water

events and provides recreational opportunities. The spreader canal construction, which is necessary to accommodate required pumped inflows from L-5, could also affect the wetlands within this section of northern WCA 3A. Stakeholders pointed out that, even without a spreader canal east of the S-8, water could still flow from the L-4 distribution canal located west of S-8 to the lower areas to the east, allowing for rehydration of areas both east and west of the Miami Canal. Therefore, an option that avoids constructing a new spreader canal and includes only an HRF west of the S-8 pump station was recommended to be considered in the final array. While the preliminary screening analysis (**Appendix E.2.2.1.3**) concluded that northern distribution solely in the west (the existing L-4 Canal is used to distribute water in this area) should not be further considered this option is a lower cost alternative to establishing desired hydroperiods in northern WCA 3A while avoiding impacts associated with a new canal in a terrestrial refuge area.

- Levee removal ~ 3 miles west of S-8 pump station (Along the L-4) (HRF)
- Full backfill of the Miami Canal from 1.5 miles south of S-8 to I-75
- STA-2 outflow diverted to WCA 3A via the L-6 and L-5 canals (L-6 diversion)

3.2.3 Screening of Southern Distribution and Conveyance (Blueline and Greenline)

Distribution and conveyance measures were formulated to meet CEPP project objectives by incrementally restoring hydropatterns and historic seasonal water flow through WCA 3A, WCA 3B, and ENP and to reverse the hydrological and ecological fragmentation caused by the L-67s and L-29 levees. Formulation of management measures began with the projected increase in the amount of treated water flowing into WCA 3A and the distribution across northern WCA 3A, identified by the North of Redline and South of the Redline screening. The distribution and conveyance configurations in southern WCA 3A, WCA 3B and ENP were sized to handle typical wet season flows to achieve marsh restoration targets within these areas.

The methods and steps used during screening of distribution and conveyance measures in southern WCA 3A, WCA 3B, and ENP are discussed further in the text that follows. See **Figure 3-9** and foldout Figure in back of this section.

CONVEYANCE AND DISTRIBUTION MEASURES/COMPONENTS/OPTIONS

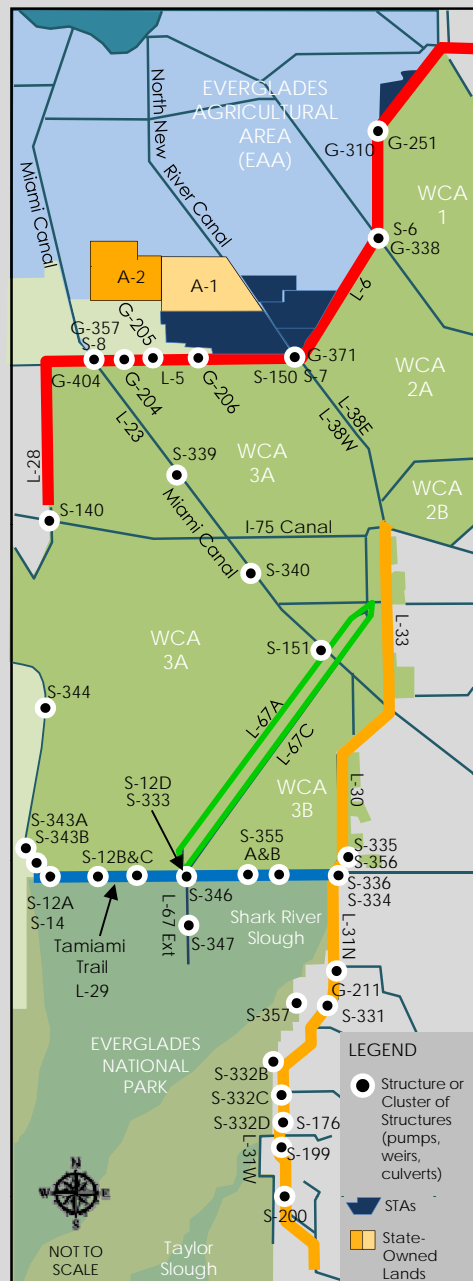
Southern WCA 3A, WCA 3B, & ENP – Greenline/Blueline

PURPOSE

Incrementally restore hydropatterns, hydrologic connections, and historic seasonal water flow through WCA 3A, WCA-3B, and ENP ecosystem, and to reverse the ecosystem fragmentation caused by the L-67s and L-29.

CEPP OBJECTIVES

- 1 Restore seasonal hydroperiods & freshwater distribution to support a natural mosaic of wetland/upland habitat in Everglades system.
- 2 Improve sheetflow patterns and surface water depths and durations in the Everglades system to reduce soil subsidence, frequency of damaging fires, decline of tree islands, and decrease saltwater intrusion.
- 4 Restore more natural water level responses to rainfall to promote plant and animal diversity and habitat function.



1 SCREEN MANAGEMENT MEASURES

3.2.3.1

1. Compile measures from CERP efforts, Modified Water Deliveries to ENP Studies, Tamiami Trail Modifications Next Steps, Everglades Restoration Transition Plan (ERTP), tree island and ridge and slough habitat research, Working Group sponsored workshops, and PDT meetings
2. Determine consistency with CEPP objectives
3. Screen configurations of measures (sizes, combinations, locations) based on:
 - Environmental effectiveness
 - Maintenance needs
 - Cost

RESULT

WCA 3A TO WCA 3B CONVEYANCE AND DISTRIBUTION

- Levee Removal
- Levee Degradation/Gaps
- Levee/Berm Construction
- Weirs
- Gated Water Control Structures
- Culverts within Existing Levees

WCA 3A/3B TO ENP CONVEYANCE AND DISTRIBUTION

- Collection canal
- Elevate roadway
- Gated water control structures
- Weirs
- Pump stations
- Levee berm
- Operational changes
- Bridging
- Flow-through wetlands

2 LOCATE MANAGEMENT MEASURES

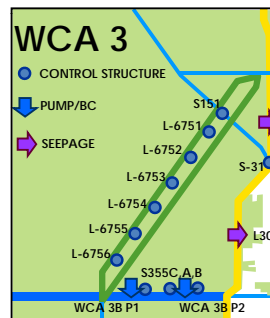
3.2.3.2

1. Configurations of retained management measures established by Working Group, stakeholders, and PDT members – evaluated on feasibility and effectiveness (meeting objectives and avoiding constraints)

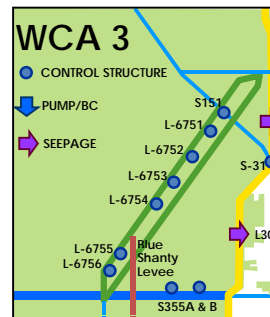
RESULT

2 configurations:

- Concept 1: multiple conveyance structures in L-67 and L-29 levees
- Concept 2: Similar conveyance structures plus a levee within WCA 3B near the Blue Shanty Canal to redirect water within WCA 3A and modify seepage out of WCA 3B



Concept 1



Concept 2

3 FORMULATE OPTIONS

3.2.3.3

1. Two flowways underwent iModel analysis – hydrologic modeling using operational targets (water depths and durations) to arrive at optimized combinations of structures and operations to best fit the targets
2. Highly functional features of the two flowways were assembled into 23 different “options” (locations and varying capacities)
3. Screening removed options that were:
 - very similar to each other
 - incompatible with future plans for Tamiami Trail construction

RESULT

10 options retained for further iModel analysis

4 EVALUATE OPTIONS

3.2.3.4

1. Multi-Criteria Decision Analysis (MCDA) & Cost-Effectiveness Evaluation for 10 options

LEVEL 1

- CEPP OBJECTIVES
- PERFORMANCE MEASURES:
 - Inundation (WCA 3A, 3B, & ENP)
 - Average ponding depth
 - Recession rate for gage 205 (healthy marl prairie habitat)

LEVEL 2

- OTHER ECOLOGICAL CONCERNS
- STAKEHOLDER CONCERNS:
 - Operational flexibility
 - Adaptability (robustness & future compatibility with future CERP increments)
 - Ecologic connectivity)

RESULT

4 options carried forward
3 cost-effective options + revised flowway option

4 OPTIONS

- | |
|---|
| Option 1 <ul style="list-style-type: none"> ▪ Increase S-333 to 3,000 cfs ▪ Unconstrained L-29 stage ▪ 750cfs centrally located structure on L-67A ▪ Gaps on L-67C Levee @ 750cfs structure |
| Option 2 <ul style="list-style-type: none"> ▪ Increase S-333 to 3,000 cfs ▪ Unconstrained L-29 stage ▪ (2) 500 cfs and (1) 750cfs structure on L-67A ▪ Gaps on L-67C Levee @ structures ▪ New S-355C outflow structure (500 cfs) on L-29 |
| Option 3 <ul style="list-style-type: none"> ▪ Increase S-333 to 3,000 cfs ▪ Unconstrained L-29 stage ▪ (4) 500 cfs structures on L-67A ▪ Gaps on L-67C Levee @ structures ▪ (2) 500 cfs pumps on the L-29 |
| Option 4 <ul style="list-style-type: none"> ▪ Increase S-333 to 3,000 cfs ▪ Blue Shanty Levee L-67A to L-29 ▪ Unconstrained L-29 stage ▪ (2) 500 cfs structures on L-67A inside Blue Shanty Flowway ▪ Degrade L-67C and L-29 in Flowway ▪ (1) 500 cfs structure north of Flowway ▪ Gap on L-67C Levee @ structure |

Figure 3-9. Conveyance and Distribution Southern WCA 3A, WCA 3B, and ENP (Blueline and Greenline)

3.2.3.1 Screening of Southern Distribution and Conveyance Management Measures

Sources of information and ideas for the alignment, sizes, and operations of the management measures in the L-67A, L-67C, L-29, and L-30 levees (and their borrow canals), and Tamiami Trail included: CERP report (USACE 1999); Modified Water Deliveries to ENP Project (USACE 1992); Tamiami Trail Modifications Next Steps (National Park Service 2010); Everglades Restoration Transition Plan (USACE 2012c); research on tree islands and ridge and slough habitats; Working Group sponsored workshops; and CEPP PDT meetings. See **Appendix E.3.1** and **Appendix E.3.2** for detailed descriptions and screening rationale.

Management measures were organized by geographic region features and were screened with criteria that were established specifically for CEPP:

- **Effectiveness:** ability to meet objectives within constraints
- **Maintenance:** avoidance of costly and intensive management and maintenance
- **Environmental Effects:** avoidance of negative impacts

Seven management measures were evaluated and consequently one measures to convey water from WCA 3A to WCA 3B (pump stations) was screened from further consideration due to the effectiveness of meeting project objectives. Measures that were retained for consideration are in **Table 3-8**.

Table 3-8. Southern WCA 3A, 3B and ENP Management Measures Retained for Consideration

WCA 3A to WCA 3B: Distribution and Conveyance	WCA 3A/3B to ENP: Distribution and Conveyance
<ul style="list-style-type: none"> • Levee Removal (L-67A, L-67C) • Levee Degradation/Gaps(L-67A, L-67C) • Levee/Berm Construction (within WCA 3B) • Weirs (L-67A and L-67C) • Gated Water Control Structures • Culverts within Existing Levees 	<ul style="list-style-type: none"> • Collection Canal (within WCA 3B) • Elevate Roadway/ Bridging (Tamiami Trail) • Gated Water Control Structures (S-333, L-29) • Weirs • Pump Stations • Levee/Berm Construction(within WCA 3B) • Operational Changes • Flow-through Wetlands

3.2.3.2 Locations of Southern Distribution and Conveyance Management Measures

Working Group workshop stakeholders and PDT members assembled dozens of combinations from the retained management measures. These combinations were methodically evaluated on the feasibility and effectiveness of meeting project objectives, and were subsequently screened to eliminate redundancies and grouped by common theme. Two primary concepts (**Figure 3-10**) were identified as a result of this evaluation. The first concept had multiple conveyance structures in the L-67A and L-29 levees (Concept 1), and the second (Concept 2) had a similar set of conveyance structures but also contained a new levee within WCA 3B (located near the Blue Shanty Canal) that redirects water flow within southwest WCA 3B and would change the patterns (rate and location) of seepage out of WCA 3B.

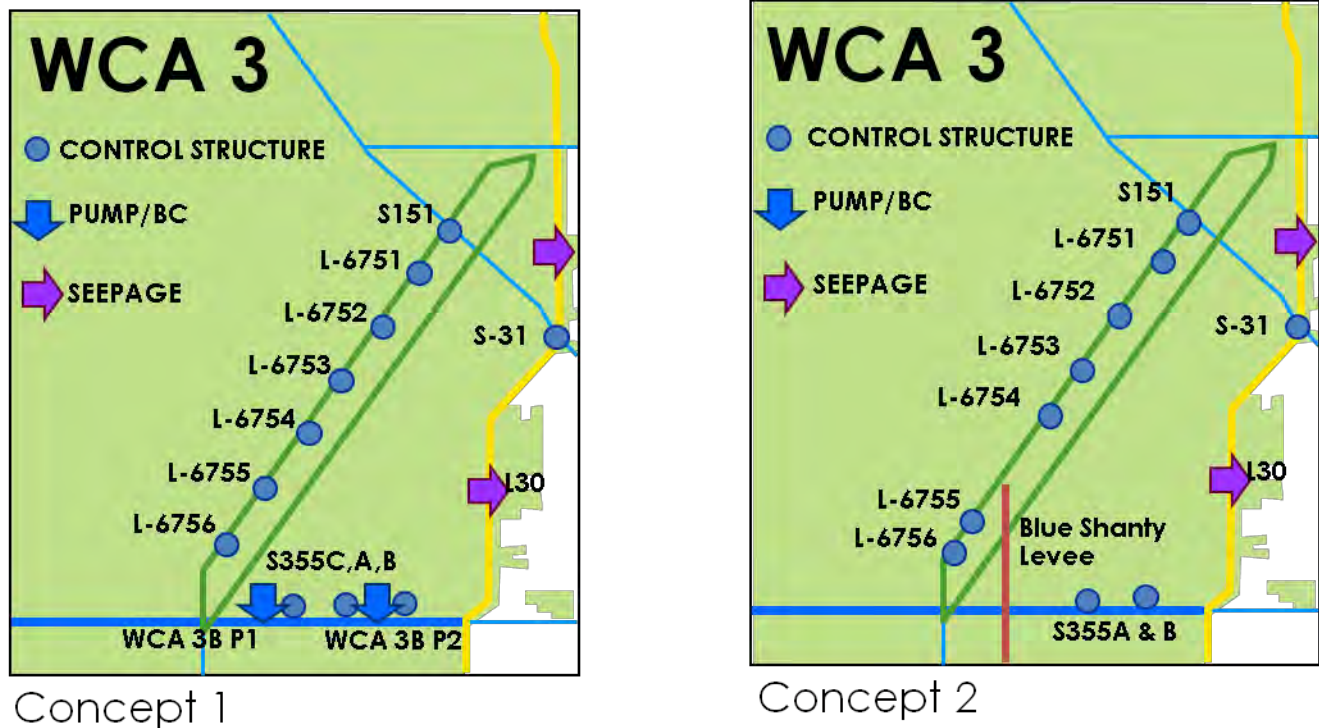


Figure 3-10. Two Primary Flowway Concepts for Distribution and Conveyance in Southern WCA 3A

These two concepts underwent analysis with the iModel screening tool. While the iModel tool emulates the hydrologic response characteristics of the RSM-GL model, unlike traditional hydrologic models, the iModel is “inverse” in that inputs to the iModel are operational targets (water depths and durations) and outputs are the optimized combination of structures and operations of structures that provide the overall “best” fit to the hydrologic targets. The iModel tests the need for individual structures and compares differences in achievement of performance. This tool is helpful to identify features and operations to undergo further investigation and is an efficient starting point for establishing the operations of features to be included in the RSM-GL evaluation of the final array. The iModel domain includes only WCA 3A, WCA 3B, and ENP, as well as WCAs 1 & 2; effects outside of the iModel domain, including the Lower East Coast, were not able to be assessed through iModel preliminary screening efforts.

3.2.3.3 Formulation of Options for Southern Distribution and Conveyance

The measures contained in the conceptual configurations (Concept 1 and Concept 2) were assembled into 23 combinations of differing locations and varying capacities based on the results of the initial iModel simulations and subsequent operational target refinements. Operational target refinements were conducted to ensure that project objectives and constraints were met. See **Appendix E 3.3** for description of the 23 options, operational target refinements, and screening details. Initial screening of the 23 combinations removed options that were not substantially different from each other, that included structures that were rarely used, or could not be implemented because they produced substantially different stages in adjacent areas.

Initial screening resulted in 10 options (**Appendix E, Table E.1.41**) that then underwent additional iModel analysis for performance toward full CERP restoration ecological targets (pre-drainage conditions).

3.2.3.4 Evaluation Criteria and Results of Options Analysis for Southern Distribution and Conveyance

Like previous options analyses, MCDA and a cost-effectiveness evaluation were used to evaluate the 10 options that resulted from the preliminary screening of southern distribution and conveyance measures. There were two levels of criteria evaluated (**Table 3-9**). Level 1 corresponded to the primary objectives of CEPP and Level 2 was used to ensure other important considerations were included in determination of what options were carried forward. See **Appendix E.3.4** and **Appendix E 3.5** for detailed criteria descriptions, evaluation tools used, scoring methodology and results.

Table 3-9. Level 1 and Level 2 Evaluation Criteria

Level 1 – Criteria Based on CEPP Objectives
<ul style="list-style-type: none"> • Inundation: average % time above ground surface elevation. Estimated for multiple locations throughout WCA 3A, WCA 3B, and ENP. • Depth: average ponding depth (ft) above ground surface elevation. Estimated for multiple locations throughout WCA 3A, WCA 3B, and ENP. • Recession Rate: estimated for location NP-205 within ENP. It is a key criterion for healthy marl prairie habitat which is less common and has a different target than ridge and slough habitat.
Level 2 – Other Important Considerations
<ul style="list-style-type: none"> • Operational flexibility: the speed, ease, efficiency of moving water to adjust to changing conditions such as storms or other real-time needs. • Adaptability (Robustness and Future Compatibility): Robustness was defined as the ability to function effectively in the face of variability and uncertainty of future events. Future compatibility is the efficiency of using the project configuration to complement future CEPP increments. • Ecologic Connectivity: qualitative criterion that evaluates increases in marsh connectivity directly associated with the removal of man-made barriers to flow.

3.2.3.4.1 Results of Level 1 and Level 2 Screening of Southern Distribution and Conveyance Options

The MCDA and cost effectiveness evaluation resulted in the elimination of several non-cost effective options. Evaluations were based on model output, records and guidance on requirements that the options would entail (such as levels of maintenance that each would require), and the results and lessons learned from relevant projects and restoration efforts in the region. Options were screened out due to lesser abilities to support project objectives combined with higher expected costs, as explained in **Appendix E.3.4** and **E.3.5**. Screening identified three cost-effective groups of options with similar costs and MCDA rating, which are listed below further described in **Section 3.2.3.5**.

Group 1: The first cost-effective group (Option 1A) was the lowest cost option that also yielded the lowest benefit.

Group 2: The second cost-effective group (Options 3A1 and 3A2) contained two options that demonstrated similar performance with similar costs. Additionally, the controllable gravity structures in these options restore more natural flow of water through the ecosystem while at the same time minimize O&M costs, fossil fuel consumption, and carbon emissions.

Group 3: The final cost-effective group (Options 3B2, 3B3 and 10A) are the highest performing plans and also exhibit the highest cost.

3.2.3.5 Refinement of Southern Distribution and Conveyance Options

The analysis conducted for this screening of options did not have the precision required to determine that one particular option was far superior to another in the same grouping. Further examination of the infrastructure sizing and usage was warranted on the three groupings of cost effective options to identify recommendations for inclusion in the final array.

Group 1: There was substantial stakeholder concern about the completeness of this option (1A) since this option bypassed delivering water to WCA 3B, leaving that area subject to continued degradation. This option also fails to utilize S-355A and S-355B, the previously constructed WCA 3B outlet structures in the L-29 levee. Additionally, it was apparent from the model output that the S-333 structure at 2,000 cubic feet per second (cfs) was frequently reaching capacity and a larger capacity could provide greater benefits at a relatively small increase in cost.

This option was modified to efficiently size the new infrastructure and maximize the use of existing infrastructure, and add one additional structure to deliver water from WCA 3A to WCA 3B (**Table 3-10**).

Table 3-10. Group 1 Refined Option for Southern Distribution and Conveyance

Initial Option 1A	Refined Group 1: Option 1
<ul style="list-style-type: none"> • Increase S-333 to 2,000 cfs • Unconstrained L-29 stage 	<ul style="list-style-type: none"> • Increase S-333 to 3,000 cfs • Unconstrained L-29 stage • 750cfs centrally located structure on the L-67A • Gaps on L-67C Levee @ 750cfs structure • Existing S-355 A&B

Group 2: The second group (**Table 3-11**) contained two options (Options 3A1 and 3A2) that demonstrated similar performance with similar costs. Additionally, the controllable gravity structures in these options restored more natural flow of water through the ecosystem while at the same time minimized O&M costs, fossil fuel consumption and carbon emissions.

Table 3-11. Group 2 Refined Option for Southern Distribution and Conveyance

Initial Option 3A1	Initial Option 3A 2	Refined Group 2: Option 2
<ul style="list-style-type: none"> • Increase S-333 to 2,000 cfs • Unconstrained L-29 stage • (3) 500 cfs structures on the L-67A • Gaps on L-67C Levee @ structures • S-355 existing A&B and new S-355C outflow structure on L-29 	<ul style="list-style-type: none"> • Increase S-333 to 2,000 cfs • Unconstrained L-29 stage • (3)750 cfs structures on the L-67A • Gaps on L-67C Levee @ structures • S-355 existing A&B and new S-355C outflow structure on L-29 	<ul style="list-style-type: none"> • Increase S-333 to 3,000 cfs • Unconstrained L-29 stage • (2) 500 cfs and (1) 750cfs structure on the L-67A • Gaps on L-67C Levee @ structures • S-355 existing A&B and new S-355C outflow structure (500 cfs) on L-29

Model output demonstrated that the S-333 structure was frequently reaching capacity and larger capacity could provide greater benefits at a relatively low increase in cost. The modeling output also demonstrated that while Option 3A2 performed marginally better than Option 3A1, only one of the three proposed L-67A structures was operating at 750 cfs. Therefore, the refined options could maximize benefits and minimize costs with two 500 cfs structures and one 750 cfs structure.

Group 3: The final group (**Table 3-12**) contained the highest performing options (Options 3B2, 3B3, and 10A) and also exhibited the highest cost. An option from this grouping is recommended for inclusion in the final array because of the high degree of benefits achieved, despite stakeholder concern over having pumps operating to move water out of WCA 3B. Consistent with the first two groups, model output demonstrated that the S-333 structure frequently reached capacity and larger capacity could provide substantially greater benefits at a relatively low increase in cost.

Table 3-12. Group 3 Refined Option for Southern Distribution and Conveyance

Initial Option 3B 2	Initial Option 3B 3	Initial Option 10A	Refined Group 3: Option 3
<ul style="list-style-type: none"> • Increase S-333 to 2,000 cfs • Unconstrained L-29 stage • (3)750 cfs L-67A structures • Gaps on L-67C Levee @ structures • S-355 existing A&B and new S-355C • (1) 1,000 cfs pump on L-29 • Unconstrained WCA 3B Seepage 	<ul style="list-style-type: none"> • Increase S-333 to 2,000 cfs • Unconstrained L-29 stage • (3)750 cfs L-67A structures • Gaps on L-67C Levee @ structures • S-355 existing A&B and new S-355C • (1) 1,000 cfs pump on L-29 • Constrained WCA 3B Seepage 	<ul style="list-style-type: none"> • Increase S-333 to 2,000 cfs • Unconstrained L-29 stage • (4)500 cfs L-67A structures • Gaps on L-67C Levee @ structures • S-355 existing A&B and new S-355C • (2) 500 cfs pumps on L-29 • Unconstrained WCA 3B Seepage 	<ul style="list-style-type: none"> • Increase S-333 to 3,000 cfs • Unconstrained L-29 stage • (4) 500 cfs structures on L-67A • Gaps on L-67C Levee @ structures • S-355 existing A&B • (2) 500 cfs pumps on the L-29 • Unconstrained WCA 3B Seepage

Option 10A had four 500 cfs structures conveying water into WCA 3B and two 500 cfs pumps moving water out, while options 3B2 and 3B3 had three 750 cfs structures conveying water into WCA 3B and one 1,000 cfs pump moving water out. The greater number of smaller structures of Option 10A provided increased operational flexibility and potentially greater spatial distribution of flow across the landscape relative to Options 3B2 and 3B3. Thus the pump option will contain the number and sizes of structures from Option 10A. The location of the structures was refined based on evaluation of model results to be more similar to that of the options 3B2 and 3B3 than 10A.

Revisions to Non-Cost Effective Options: The non cost-effective options were eliminated from further consideration through the iModel screening evaluations. However, major conceptual revisions (**Table 3-13**) were identified to Option 4A, B, and C (the Blue Shanty Flowway Options) that could bring the costs down substantially and increase the benefits to a level that is commensurate with the highest performing grouping. These options correspond to the Concept 2 (**Figure 3-10**) and provide a flowway through WCA 3B via the use of a new levee. These options provided the greatest improvement in ENP ridge and slough habitat, which warranted the consideration of a major conceptual revision to achieve the environmentally preferred level of benefits.

Table 3-13. Features in the Refined Group from Non-Cost Effective Options

Initial Option 4A	Initial Option 4B	Initial Option 4C	Refined Group 4 : Option 4
<ul style="list-style-type: none"> • Increase S-333 to 2,000 cfs • Unconstrained L-29 stage • Blue Shanty Levee L- 	<ul style="list-style-type: none"> • Increase S-333 to 2,000 cfs • Unconstrained L-29 stage • Blue Shanty Levee L- 	<ul style="list-style-type: none"> • Increase S-333 to 2,000 cfs • Unconstrained L-29 stage • Blue Shanty Levee L- 	<ul style="list-style-type: none"> • Increase S-333 to 3,000 cfs • Blue Shanty Levee L-67A to L-29 combined with a divide structure in the L-29 canal east of the terminus of the

Initial Option 4A	Initial Option 4B	Initial Option 4C	Refined Group 4 : Option 4
67A to L-29 • (2) 500 cfs structures on L-67A inside Blue Shanty Flowway • Degrade L-67C and L-29 in Blue Shanty Flowway • (4) 500 cfs structure north of Blue Shanty Flowway • Gaps on L-67C Levee @ structures north of Flowway • Blue Shanty Levee in ENP	67A to L-29 • (2) 500 cfs structures on L-67A inside Blue Shanty Flowway • Degrade L-67C and L-29 in Blue Shanty Flowway • (1) 500 cfs structure north of Blue Shanty Flowway • Gaps on L-67C Levee @ structures north of Flowway • Blue Shanty Levee in ENP	67A to L-29 • (2) 500 cfs structures on L-67A inside Blue Shanty Flowway • Degrade L-67C and L-29 in Blue Shanty Flowway • Blue Shanty Levee in ENP	Blue Shanty Levee • Unconstrained L-29 stage • (2) 500 cfs structures on L-67A inside Blue Shanty Flowway • Degrade L-67C in Blue Shanty Flowway • Degrade L-29 in Blue Shanty Flowway • (1) 500 cfs structure north of Blue Shanty Flowway • Gaps on L-67C Levee @ structures north of Flowway

The Blue Shanty Flowway (i.e. new levee in WCA 3B /L-29 degrade) options were initially envisioned to minimize requirements needed to raise eastern Tamiami Trail and was expected to likely train water into central Shark River Slough which could lead to increased benefits in ENP. Upon further investigation, in the absence of raising Tamiami Trail east of the Blue Shanty Flowway, CEPP would be required to construct a levee inside ENP to protect eastern Tamiami Trail from high water impacts. In order to maintain consistency with the other options that were modeled, the Blue Shanty Flowway concept was altered to reflect full Tamiami Trail raising east of the flowway, consistent with the authorized TTNS Project, thereby removing the need for a levee in ENP. It is expected that the modified concept would avoid the adverse effects the Blue Shanty Levee caused to the marl prairie areas in ENP.

The Blue Shanty Flowway negates the need for additional seepage management features north of Tamiami Trail along the L-30 (eastern side of WCA 3B). Without the new WCA 3B levee, additional seepage management features would be required to protect against increased flooding risk to the adjacent Lower East Coast areas that would result from holding WCA 3B stages higher to promote significant wet season gravity outflows to the L-29 Canal. When considering the overall cost of the alternatives, this cost of this option will more closely reflect the other alternatives that are required to include seepage management features north of Tamiami Trail.

3.2.3.6 Southern Distribution and Conveyance Conclusion

Four options for southern distribution and conveyance are retained for incorporation into alternatives. The four options include incremental increases in the number of operable structures to deliver water from WCA 3A to WCA 3B across the L-67A levee and some degree of removal of L-67C levee. The first option has one structure in the L-67A levee and one gap in the L-67C levee. The second option has three structures and three gaps in the L-67A. The third option has four structures and four gaps. Similar to the second option, the fourth option also has three structures in the L-67A levee and complete removal of several miles of the L-67C levee; however, includes the north-south Blue Shanty Levee within WCA 3B combined with a divide structure in the L-29 canal east of the terminus of the Blue Shanty Levee,.

The four options also differ in the means by which water is conveyed out of WCA 3B into ENP across the L-29 Levee : option 1 relies on the existing 2 S-355s (gravity spillways), option 2 uses additional gravity flow structures, option 3 uses additional pumps, and option 4 removes approximately 4 miles of the L-29

Levee. All four options rely on the Tamiami Trail bridges to convey water from the L-29 canal to northeast ENP.

3.2.4 Screening of Seepage Management (Yellowline)

Seepage management features are located along the eastern boundary of the Everglades at the interface of the natural ecosystem and the agricultural and urban centers of Miami. See **Figure 3-11** and foldout Figure in back of this section. The focus of seepage management is on ground water that moves east through the protective levees and porous underground aquifer. Seepage management measures ensure that the seepage that crosses the levees can be effectively managed by the infrastructure east of the East Coast Protective Levee to achieve the objectives of the project. The objective of seepage management measures is to reduce water loss out of the natural system. Seepage management measures must also meet the project constraints to not reduce the level of service for flood protection and to maintain existing water supplies for adjacent agricultural and urban areas immediately east within the Lower East Coast Service Areas (LECSA) and Biscayne Bay, which could potentially be affected by restored water levels in the Everglades.

SEEPAGE MANAGEMENT MEASURES/COMPONENTS/OPTIONS

PURPOSE

Seepage management measures reduce water loss out of the natural system and reduce the flood risk to agricultural and urban areas

CEPP OBJECTIVES

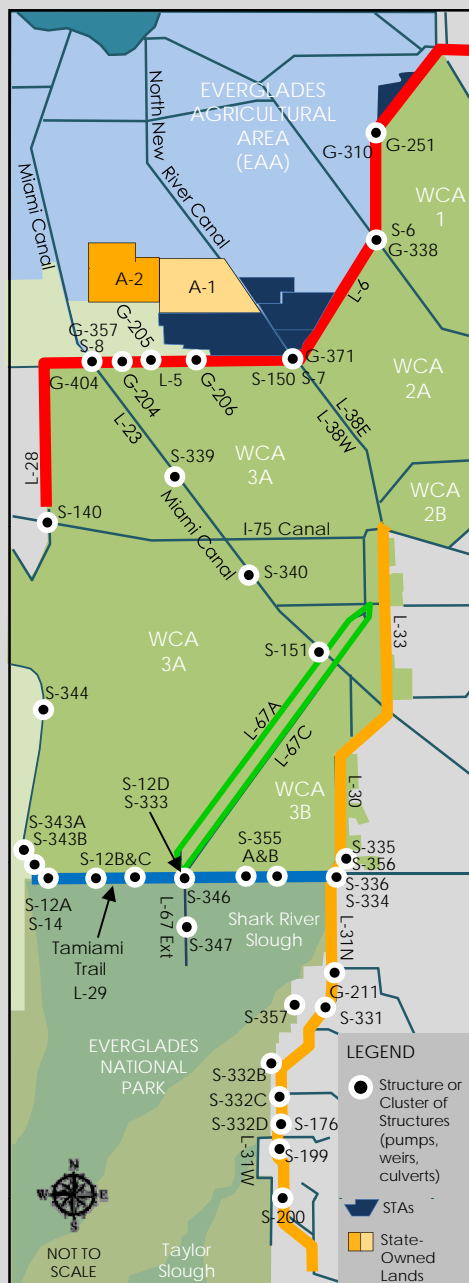
3 Reduce water loss out of natural system to promote appropriate dry season recession rates for wildlife utilization.

6 Increase availability of water supply

CEPP CONSTRAINTS

Avoid any reduction in level of service for flood protection.

Provide replacement sources of water of comparable quantity and quality for existing legal users for reductions caused by the project



1 SCREEN MANAGEMENT MEASURES 3.2.4.1

1. Canvass CERP efforts for measures and identify new measures

2. Determine consistency with CEPP objectives and constraints

3. Screen & optimize configurations of measures (sizes, locations, combinations) based on:

- Flooding impacts
- Effectiveness
- Land available
- Cost

RESULT

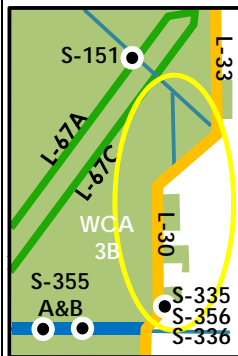
- New Pump Stations
- Raised Canal Stages
- New Canals
- Divide Structure
- Operational Changes
- Relocate /Operate Existing Pumps
- In-Ground Seepage Barrier
- Step-Down Levee

2 LOCATE MANAGEMENT MEASURES 3.2.4.2

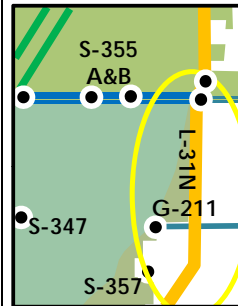
1. Seepage management location is directly related to the spatial distribution and quantity of water delivered across the L-67 levees and Tamiami Trail

RESULT

- North of Tamiami Trail



- South of Tamiami Trail



3 FORMULATE OPTIONS 3.2.4.3

1. **Sensitivity modeling** using several quantities of new water and existing facilities to predict locations and volumes of seepage

2. **Sensitivity modeling** of five sets of management measures to assess performance trends and effectiveness

- Seepage Barrier | S-335 to S-334
- Seepage Barrier Pennsuco to G-211
- Convey Discharges to Coastal Canals + Utilize North and South Detention areas
- Distributed pump scenario
- Hydraulic Ridge + Pennsuco Pump

Criteria

Quantity of water seepage into the LEC Canal Stage Groundwater Stage Structure Flow through Coastal Structures

RESULT

Each set of measures had some level of success in reducing seepage and retaining water within the natural areas

4 EVALUATE OPTIONS 3.2.4.4

1. Further evaluation of modeling results

Criteria:

- Adaptability
- Fuel consumption
- Land requirements and costs
- O&M costs

RESULT

Four seepage Management measures to be included in final alternatives:

- Increase S-356 to 1,000cfs
- Full depth seepage barrier between S-335 and S-334
- Partial depth seepage barrier
- 250 cfs seepage return pumps on L-31N



Figure 3-11. Seepage Management Along the Lower East Coast Protective Levee

3.2.4.1 Screening of Management Measures for Seepage Management

Several seepage management options were modeled and the results were used to inform development of the final array. The process followed similar steps used throughout CEPP screening and formulation, including: identifying and screening viable management measures, identifying combinations of those management measures that would provide the most informative model output, and using the output and information gathered in PDT discussions to determine feasible options for seepage management. A structured MCDA approach was not used for evaluating the results of the seepage management options.

A large compilation of measures previously suggested for other Everglades projects during PDT and stakeholder interactions and other measures suggested for CEPP based on professional judgment and experience were considered.

Initial screening criteria included:

- **Flooding impacts:** potential to cause adverse inundation in surrounding area
- **Effectiveness:** ability of the measure to achieve the seepage control desired
- **Costs:** efficiency and acceptability of high capital cost
- **Land availability:** sufficient or suitable property for construction and operation

The initial screening eliminated flood attenuation reservoirs, groundwater wells, lined canals and recharge basins. See **Appendix E.4.1** and **Appendix E.4.2** for detailed descriptions of management measures. **Table 3-14** lists the retained management measures.

Table 3-14. Results of Initial Screening of Management Measures

Seepage Management Measures	
<ul style="list-style-type: none"> • New Pump Stations • Raised Canal Stages • New Canals • Step-Down Levee (Blue Shanty Levee Divide Structure (L-29 Canal)) 	<ul style="list-style-type: none"> • Operational Changes • Relocate /Operate Existing Pumps • In-Ground Seepage Barrier • Detention Areas

3.2.4.2 Locations of Seepage Management Measures

The siting of the seepage management measures is directly related to the spatial distribution, directionality, and quantity of water being conveyed across the L-67s and Tamiami Trail. The conveyance options that increase the water depth in WCA 3B require increased seepage control over what currently exists to manage seepage north of Tamiami Trail. All conveyance and seepage options increase the water depth in ENP and will require some degree of seepage control south of Tamiami Trail. The Blue Shanty Levee combined with a divide structure in the L-29 was carried forward as an effective WCA 3B measure.

3.2.4.3 Formulation of Seepage Management Options

Two iterations of RSM-GL screening modeling were conducted to test the effectiveness of seepage management measure configurations. The highest flow and stage scenarios (upper bookend identified during the Greenline evaluations) were used as modeling baseline for the Yellowline seepage management configuration modeling. Information gained from testing against this upper bookend provided support in identifying configurations that minimize potential impacts on water supply and flood control.

Round 1: The first round of RSM-GL seepage screening modeling developed several quantities of additional water to northeast ENP to quantify changes to the total and event-based quantities of seepage and to characterize the performance of the S-356 pump station and other existing facilities in response to the increased water in ENP. The S-356 is an existing temporary 500 cfs pump station that was constructed under the MWD project, although the pump has not been operated pending completion of the MWD project. During formulation, there was a desire to modify or improve upon this pump station to identify if efficiency and cost savings could be realized by using an existing structure.

Round 2: The second round of screening modeling gathered information about the effectiveness of the proposed management measures from the refined list of measures described above. The goal was to assess the effectiveness of the management measures. The Yellowline sensitivity runs were performed on the five options in **Table 3-15** to examine performance trends for the various infrastructure and operational changes. These trends were used to help identify seepage management measures to include in the final alternatives. The configurations were evaluated to determine trend differences in hydrologic performance between the configuration and that of the existing condition for the following criteria:

- Quantity of water seepage into the LEC
- Canal Stage
- Groundwater stage
- Structure flow through coastal structures

Table 3-15. Seepage Management Options

Option	Description
YL1 - Seepage Barrier S-335 to S-334	<ul style="list-style-type: none"> • Full depth* seepage barrier S-335 to S-334 • Extend barrier a short distance south of Tamiami Trail (1 RSM cell) • S-356@1000 cfs
YL2 - Seepage Barrier Pennsuco to G-211	<ul style="list-style-type: none"> • Partial depth** seepage barrier ~35 ft deep • L-30 and L-31N to 8 ½ sq mile • S-356@1000 cfs
YL3 - Convey Discharges to Coastal Canals + Utilize North and South Detention areas	<ul style="list-style-type: none"> • Utilize coastal canals + existing detention areas • Utilize G-211 and S-331 to convey water supply and flood releases south • Convey water through C-1W @ S-338, C-102 @ S-194, C-103 @ S-196 during dry season • Convey water toward 332s during wet season
YL4 - Distributed pump scenario	<ul style="list-style-type: none"> • Distributed pumping: series of 100 cfs pumps along L-30, L-31N • S-356@500 cfs
YL5 - Hydraulic Ridge + Pennsuco Pump	<ul style="list-style-type: none"> • Hydraulic Ridge + Pennsuco Pump • ~ 1/2 mile wide impoundment area in ENP fed by S-356 @500 cfs and new pump @500 cfs • Pennsuco stage higher, and maintain an improved DBLEV canal • Pump near south end of Pennsuco
<p>* "Full depth" seepage barrier – a barrier that terminates in the uppermost Tamiami Formation, restricting groundwater flow through the entire Biscayne Aquifer</p> <p>** "Partial depth" seepage barrier – a barrier that terminates above Tamiami Formation, restricting groundwater flow through the upper Biscayne Aquifer.</p>	

3.2.4.4 Seepage Management Conclusion

Overall, most of the measures had some level of success, highlighting that there are multiple ways to approach seepage management. One notable exception was identified that a seepage wall that is too long or penetrates too deeply may permanently adversely impact water supply performance and does not achieve the necessary balance between seepage management and replenishing well fields. Cost-effectiveness and screening against other criteria (O&M costs, adaptability to changing and uncertain future conditions, fossil fuel consumption, and other important stakeholder preferences) became key drivers of decision-making.

The seepage management measures retained from the above options include:

- Increase S-356 to 1,000 cfs
- Full depth seepage barrier between S-335 and S-334
- Partial depth seepage barrier
- 250 cfs seepage return pumps on L-31N
- Utilize G-211 and S-331 to convey water supply and flood releases south
- Convey water through C-1W @ S-338, C-102 @ S-194, C-103 @ S-196 during dry season
- Blue Shanty Levee and L-29 Divide Structure

These retained seepage management measures were then incrementally built upon and combined with the options identified through the other screening phases to identify the final array of alternatives. Uncertainties remained about which configuration of these management measures would perform optimally and meet requirements of the Savings Clause when combined with the other options. In order to mitigate this uncertainty, further information will be gathered during subsequent analysis that will allow for the refinement of the sizes, lengths, and capacities of the proposed seepage management measures.

3.3 FORMULATION OF THE FINAL ARRAY OF ALTERNATIVES

A key tenet of CEPP formulation is the interdependency of project components; therefore, the storage and treatment (i.e. water budget), distribution and conveyance, and seepage management components are not standalone features and, while formulated from a spatial perspective, do not function separately from the remaining portions of CEPP. Benefits are realized south of the storage and treatment facilities through redistribution and conveyance of the existing and “new” water made available. Likewise, the design of the seepage management features is highly dependent on the spatial distribution, directionality, and quantity of water that is moving into and through WCA 3A, WCA 3B, and ENP for restoration of natural habitat within these specific areas.

Combining the options identified through the plan formulation screening resulted in four alternatives to be considered in the final array. These alternatives are formulated to incrementally build off each other in terms of infrastructure required. Alt 1 required the least infrastructure and the other alternatives include more. Please see **the foldout Figure at the end of Section 4** for the proposed final array of alternatives. This section provides a synopsis of how the screening results were compiled into the final array.

3.3.1 Storage and Treatment - North of the Redline Options

The screening conducted for CEPP storage and treatment options, to deliver “new” water to the Everglades, resulted in the identification of one highly functioning option for inclusion in the final array

of alternatives (**Alts 1, 2, 3, and 4**). This configuration includes a 14,000 acre FEB on the A-2 footprint that operates in a mutually beneficial, integrated fashion with the State Restoration Strategies (water quality compliance remedy) on the A-1 footprint.

3.3.2 Northern Distribution and Conveyance – South of the Redline Options

The screening analysis identified two distribution and conveyance options in Northern WCA 3A to be combined with the other interdependent options. As previously described, the area east of the S-8 provides terrestrial refuge for deer on the L-5 levee during high water events and provides recreational access to northern WCA 3A. The option that avoids spreader canal construction in this area and minimizes costs, while still providing benefits to the greater ecosystem was recommended to be included as the minimal sized alternative in the final array (**Alt 1**).

Alt 1:

- Levee removal ~ 3 miles west of S-8 pump station (HRF)
- Full backfill of the Miami Canal from 1.5 miles south of S-8 to I-75
- Diversion of STA 2 flows to WCA 3A

One option was identified that reasonably maximizes project benefits in Northern WCA 3A. This option was included in the other alternatives in the final array (**Alts 2, 3, and 4**).

Alts 2, 3, and 4:

- Levee removal ~ 3 miles west of S-8 pump station (HRF)
- Spreader canal ~ 3 mile east of S-8 pump station (HRF)
- Spreader canal 1.5 mile at G-206 (HRF)
- Full backfill of the Miami Canal from S-8 to I-75
- Diversion of STA 2 flows to WCA 3A

3.3.3 Southern Distribution and Conveyance – Greenline and Blueline Options

The screening conducted for CEPP distribution and conveyance in Southern WCA 3A, WCA 3B, and ENP resulted in 4 groupings of alternatives to be incorporated into the final array.

First Grouping: The recommendation was to incorporate this option which maximized the use of existing infrastructure while providing moderate ecosystem benefits in the minimally sized alternative in the final array (**Alt 1**).

Alt 1

- Increase S-333 to 3,000 cfs
- One centrally located 750 cfs controlled structure on the L-67A
- Gaps on L-67C Levee @ structures
- Existing S-355 A&B
- Unconstrained L-29 stage

Second Grouping: The recommendation was to incorporate this option in the second alternative of the final array to rely on passive structure flows (**Alt 2**). This alternative would increase the passive inflow and outflow structures of WCA 3B over **Alt 1**.

Alt 2

- Increase S-333 to 3,000cfs
- Two 500cfs and one 750cfs controlled structures on the L-67A
- Gaps on L-67C Levee @ structures
- S-355 existing A&B and new S-355C outflow structure on L-29
- Unconstrained L-29 stage

Third Grouping: - The recommendation was to incorporate this option in the third alternative of the final array (**Alt 3**). These alternatives would increase the passive inflow structure capacity over Alt 2 and incorporate pump stations to move water out of WCA 3B.

Alt 3

- Increase S-333 to 3,000cfs
- (4) 500cfs controlled structures on L-67A
- Gaps on L-67C Levee @ structures
- S-355 existing A&B on L-29
- Two 500cfs pumps on the L-29
- Unconstrained L-29 stage

Fourth Grouping: The recommendation was to include the fourth grouping in the final array (**Alt 4**). This alternative builds off Alt 2 infrastructure with the addition of the Blue-Shanty Flow levee and degrading of the L-29 levee within the flowway in lieu of the additional outflow structure on the L-29.

Alt 4

- Increase S-333 to 3,000cfs
- Blue Shanty Levee L-67A to L-29 and divide structure in L-29 east of the Blue Shanty Levee terminus
- Unconstrained L-29 stage
- (2) 500cfs controlled structures on L-67A inside Blue Shanty Flowway
- Degrade L-67C in Blue Shanty Flowway
- Degrade L-29 in Blue Shanty Flowway
- 500cfs structure north of Blue Shanty Flowway

3.3.4 Seepage Management – Yellowline (Lower East Coast)

The different Greenline options carried forward into the final array have varying degrees and means of water being delivered into WCA 3B but all alternatives increase the stages in ENP. Uncertainties remained about which configuration of these management measures would perform optimally and meet requirements of the Savings Clause when combined with the other options. In order to mitigate this uncertainty, further analysis of the final array will allow for the refinement of the sizes, lengths, and capacities of the proposed management measures.

A commonality among all alternatives in the final array (**Alts 1, 2, 3, and 4**) is to increase the existing S-356 pump station to 1,000 cfs to capture seepage out of the natural system. The central location of the S-356 provides opportunities to manage seepage from both WCA 3B and ENP.

The distribution and conveyance options identified in **Alt 1** (minimal alternative) limit the amount of water entering WCA 3B so minimal seepage management infrastructure is required to handle WCA 3B seepage for this alternative. This alternative assumes only using pumps along L-31N to handle seepage out of WCA 3B and ENP. The configuration determined through screening to be further analyzed contains two distributed (northern and southern) 250 cfs pumps on the L-31N.

Alts 2 and 3 both increase the flow into WCA 3B and require seepage management infrastructure. These alternatives include full depth penetrating seepage barrier between S-335 and S-334, which is the most transmissive area due to the porous nature of the limestone. These alternatives also rely on the S-356 pump station to return excessive seepage. Continuing with the incremental approach to seepage management; **Alt 2** also includes a distributed pump configuration, but the northern pump location is substituted for a partial depth seepage barrier extending 2 miles south of Tamiami Trail, which is supplemented with the southern 250 cfs pump. **Alt 3** substitutes the southern pump for an additional 3 miles of partial depth seepage barrier (5 total miles).

The Blue Shanty Flowway levee in WCA 3B and the 1,000 cfs S-356 pump station negates the need for additional seepage management infrastructure in WCA 3B. **Alt 4** therefore contains no additional seepage infrastructure north of Tamiami Trail. South of Tamiami Trail this alternative incorporates the same infrastructure as **Alt 3**.

3.4 ELIMINATION OF A NON-INCREMENTAL APPROACH TO RESTORATION

The CERP provides a framework of components needed to achieve a practicable level of restoration of the Everglades. Each of the identified alternatives for CEPP has adopted the National Academy of Sciences' recommendation to use incremental adaptive restoration in fulfilling the comprehensive solution, and is therefore recommending an increment of several CERP components. Additionally as part of the CEPP formulation effort, CERP recommended plan components as described in the Restudy, related to the central Everglades, were also examined on the feasibility and efficiency of constructing complete elements of the following two CERP components for this increment of CEPP.

- **Everglades Agricultural Storage Reservoirs (Component G):** 360,000 ac-ft of storage in the EAA
- **Decomartmentalization and Sheetflow Enhancement (Components AA and QQ):** complete Miami Canal backfill within WCA 3A and WCA 3B, distribution of conveyance features along the entire length of the L-67A levee, removal of the L-67C and L-29 levees, and seepage management

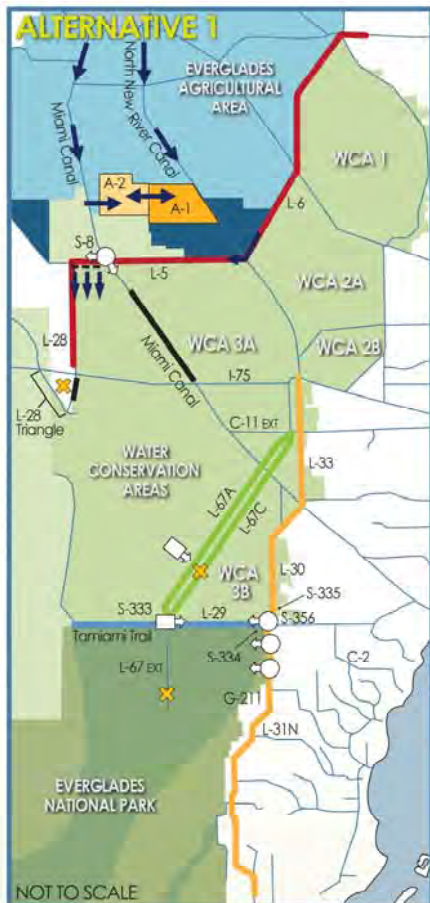
CEPP screening resulted in a 14,000 acre FEB identified as the sole option to include in the final array of alternatives. Larger storage capacity was examined, including up to 360,000 acre feet (12 ft reservoir); however, the deep reservoir storage was not brought forward due to unacceptable cost levels associated with the large increase in both storage and treatment capacity required to provide greater delivery of water to the Everglades. The four alternatives identified include incremental increases in the number of operable structures to deliver water from WCA 3A to WCA 3B across the L-67A levee and some degree of removal of L-67C levee. The alternatives differed in the means of moving water out of WCA 3B into ENP across the levee – gravity flow structures, pumps, or an increment of L-29 levee removal.

A CERP-like plan for CEPP would be based on the FEB in the EAA because of the reasons described above and would also include many CERP decompartmentalization components including: full backfill of the Miami Canal within WCA 3A, maximum distribution of the inflow structures along the L-67A (6 structures), removal of the L-67C levee, and full degradation of the eastern L-29 levee along WCA 3B. This plan could provide the opportunity to move more water through the system than was modeled during the screening effort given the increase in WCA 3B outlet capacity provided by full L-29 levee removal. This plan represents the most complete decompartmentalization consistent with the plan envisioned for CERP.

However, this plan would have to include extensive seepage management along the L-30 and L-31N levees; it would include a seepage barrier along the length of these levees. There is a great deal of uncertainty regarding the full seepage wall functionality and the associated risk to public water supply. Uncertainty about the sufficiency of the water budget available in this increment of CEPP and the potential adverse effects to the natural resources within WCA 3B during the dry season with complete removal of L-29 also pose significant concerns regarding this plan. Additionally, Miami Canal backfilling south of I-75 was demonstrated to provide negligible benefits with the identified water budget and modeling assumptions. The risk and uncertainty associated with the CERP-like plan was determined by the PDT and stakeholders to be unacceptable for this increment of CEPP, but was recommended to be further examined during potential subsequent planning efforts. This analysis supported the conclusion of using an incremental approach to restoration.

3.5 IDENTIFICATION OF THE FINAL ARRAY

Section 3.3 presented and assigned options for storage and treatment, northern conveyance and distribution, southern conveyance and distribution, and seepage management that were combined into four alternatives. Representatives of the Miccosukee Tribe of Indians of Florida have also requested that CEPP consider levee gapping and backfilling of the L-28 levee and canal to re-connect WCA 3A to the Tribal lands located west of the L-28 Levee and south of I-75. This was analyzed as part of Alt 1. Alts 1, 2, 3, and 4 were identified to be further investigated as viable alternatives of the final array. The features of Alts 1 through 4 are listed and illustrated in **Figure 3-12**.



STORAGE AND TREATMENT

- Construct A-2 FEB and integrate with A-1 FEB operations
- Lake Okeechobee operation refinements within LORS

DISTRIBUTION/CONVEYANCE

- Diversion of L-6 flows and L-5 canal improvements
- Spreader canal ~3 miles west of S-8 (3,000 cfs)
- Backfill Miami Canal from ~1.5 mile south of S-8 to L-75
- L-28 Triangle - gap levee

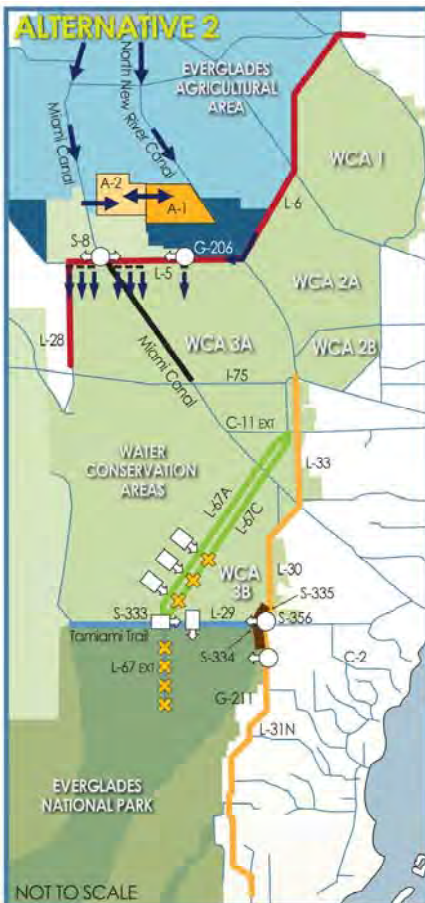
DISTRIBUTION/CONVEYANCE

- Increase S-333 capacity to 3,000 cfs
- One 750 cfs gated structure in L-67A, 0.5 mile spoil removal west of L-67A north and south of structures
- One 6,000-ft gap in L-67C levee
- Tamiami Trail western 2.6 mile bridge and L-29 canal max stage at 9.7 ft (FUTURE WORK BY OTHERS)
- Degrade southern 1.5 miles of L-67 extension

SEEPAGE MANAGEMENT

- Increase S-356 to 1,000 cfs
- Two 250 cfs pumps on L-31N
- G-211 operational refinements; use coastal canals to convey seepage

* cfs = cubic feet per second



STORAGE AND TREATMENT

- Construct A-2 FEB and integrate with A-1 FEB operations
- Lake Okeechobee operation refinements within LORS

DISTRIBUTION/CONVEYANCE

- Diversion of L-6 flows and L-5 canal improvements
- Spreader canal: ~3 miles west of S-8 (3,000 cfs), ~3 miles east of S-8 (800 cfs) and ~1.5 miles east of G-206 (400 cfs)
- Backfill Miami Canal from S-8 to L-75

DISTRIBUTION/CONVEYANCE

- Increase S-333 capacity to 3,000 cfs
- One 750 cfs and two 500 cfs gated structures in L-67A, 0.5 mile spoil removal west of L-67A north and south of structures
- 6,000-ft gaps in L-67C levee at each structure
- One additional 500 cfs gravity structure out of WCA-3B
- Tamiami Trail western 2.6 mile bridge and L-29 canal max stage at 9.7 ft (FUTURE WORK BY OTHERS)
- Degrade entire L-67 extension levee

SEEPAGE MANAGEMENT

- Increase S-356 to 1,000 cfs
- Full depth penetrating seepage barrier from S-335 to S-334
- Partial depth seepage barrier south of Tamiami Trail 2 miles along L-31N
- One 250 cfs pump on L-31N into ENP
- G-211 operational refinements; use coastal canals to convey seepage



STORAGE AND TREATMENT

- Construct A-2 FEB and integrate with A-1 FEB operations
- Lake Okeechobee operation refinements within LORS

DISTRIBUTION/CONVEYANCE

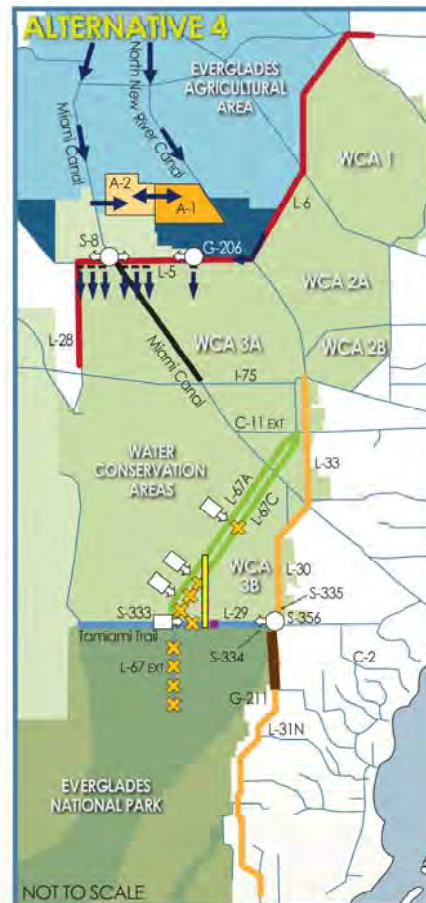
- Diversion of L-6 flows and L-5 canal improvements
- Spreader canal: ~3 miles west of S-8 (3,000 cfs), ~3 miles east of S-8 (800 cfs) and ~1.5 miles east of G-206 (400 cfs)
- Backfill Miami Canal from S-8 to L-75

DISTRIBUTION/CONVEYANCE

- Increase S-333 capacity to 3,000 cfs
- Four 500 cfs gated structures in L-67A, 0.5 mile spoil removal west of L-67A north and south of structures
- 6,000-ft gaps in L-67C levee at each structure
- Two 500 cfs pumps out of WCA-3B at existing agricultural canals with improvements to Ag canals in WCA-3B
- Tamiami Trail western 2.6 mile bridge and L-29 canal max stage at 9.7 ft (FUTURE WORK BY OTHERS)
- Degrade entire L-67 extension levee

SEEPAGE MANAGEMENT

- Increase S-356 to 1,000 cfs
- Partial depth seepage barrier south of Tamiami Trail 5 miles along L-31N
- Full depth penetrating seepage barrier from S-335 to S-334
- G-211 operational refinements; use coastal canals to convey seepage



STORAGE AND TREATMENT

- Construct A-2 FEB and integrate with A-1 FEB operations
- Lake Okeechobee operation refinements within LORS

DISTRIBUTION/CONVEYANCE

- Diversion of L-6 flows and L-5 canal improvements
- Spreader canal: ~3 miles west of S-8 (3,000 cfs), ~3 miles east of S-8 (800 cfs) and ~1.5 miles east of G-206 (400 cfs)
- Backfill Miami Canal from S-8 to L-75

DISTRIBUTION/CONVEYANCE

- Increase S-333 capacity to 3,000 cfs
- Two 500 cfs gated structures in L-67A, 0.5 mile spoil removal west of L-67A north and south of structures
- Include levee in WCA 3B
- Degrade L-67C levee in Blue Shanty flowway
- One 500 cfs gated structure north of Blue Shanty levee and 6,000-ft gap in L-67C levee
- Degrade L-29 levee in Blue Shanty flowway; add divide east of Blue Shanty levee at terminus of western bridge
- Tamiami Trail western 2.6 mile bridge and L-29 canal max stage at 9.7 ft NGVD 29 (FUTURE WORK BY OTHERS)
- Degrade entire L-67 extension levee

SEEPAGE MANAGEMENT

- Increase S-356 to 1,000 cfs
- Partial seepage barrier south of Tamiami Trail 5 miles along L-31N
- G-211 operational refinements; use coastal canals to convey seepage

Figure 3-12. Final Array of Alternatives

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CENTRAL EVERGLADES PLANNING
PROJECT (CEPP) SPATIAL PERSPECTIVE

- North of the Redline**
- Combination of features to increase water deliveries downstream and improve estuarine benefits
- South of the Redline**
- Features and their locations to best restore sheetflow in northern Water Conservation Area 3A
- Greenline/Blue line**
- Features to best restore sheetflow through southern WCA-3A and 3B
 - Configuration of conveyance features to best restore flows to Everglades National Park
- Yellowline**
- Features to best compliment rest of project and manage seepage to the eastern urban area without impacting the water supply

- LEGEND
- Structure or Cluster of Structures (pumps, weirs, culverts)
 - STAs
 - State-owned Land

- Future Without Project Conditions – Other Related Projects and Operations:
- Projects (Non-CERP&CERP)
1. Modified Water Deliveries to ENP Components: Tamiami Trail Modifications (1-mile eastern bridge); 8.5 SMA;
 2. C-111 South Dade (contracts 8 & 9)
 3. Kissimmee River Restoration
 4. SFWMD Restoration Strategies (Central Flow Path)
 5. DOI Tamiami Trail Modifications (5.5 miles of bridges)
 6. CERP Indian River Lagoon
 7. CERP Picayune Strand Restoration
 8. CERP Site 1 Impoundment
 9. CERP Broward County Water Preserve Areas
 10. CERP C-43 West Basin Storage Reservoir
 11. CERP C-111 Spreader Canal Western Project
- Operations
- Everglades Restoration Transition Plan (ERTP) 2012
 - L-29 Canal Maximum Operational Limit
 - G-3273 Constraint

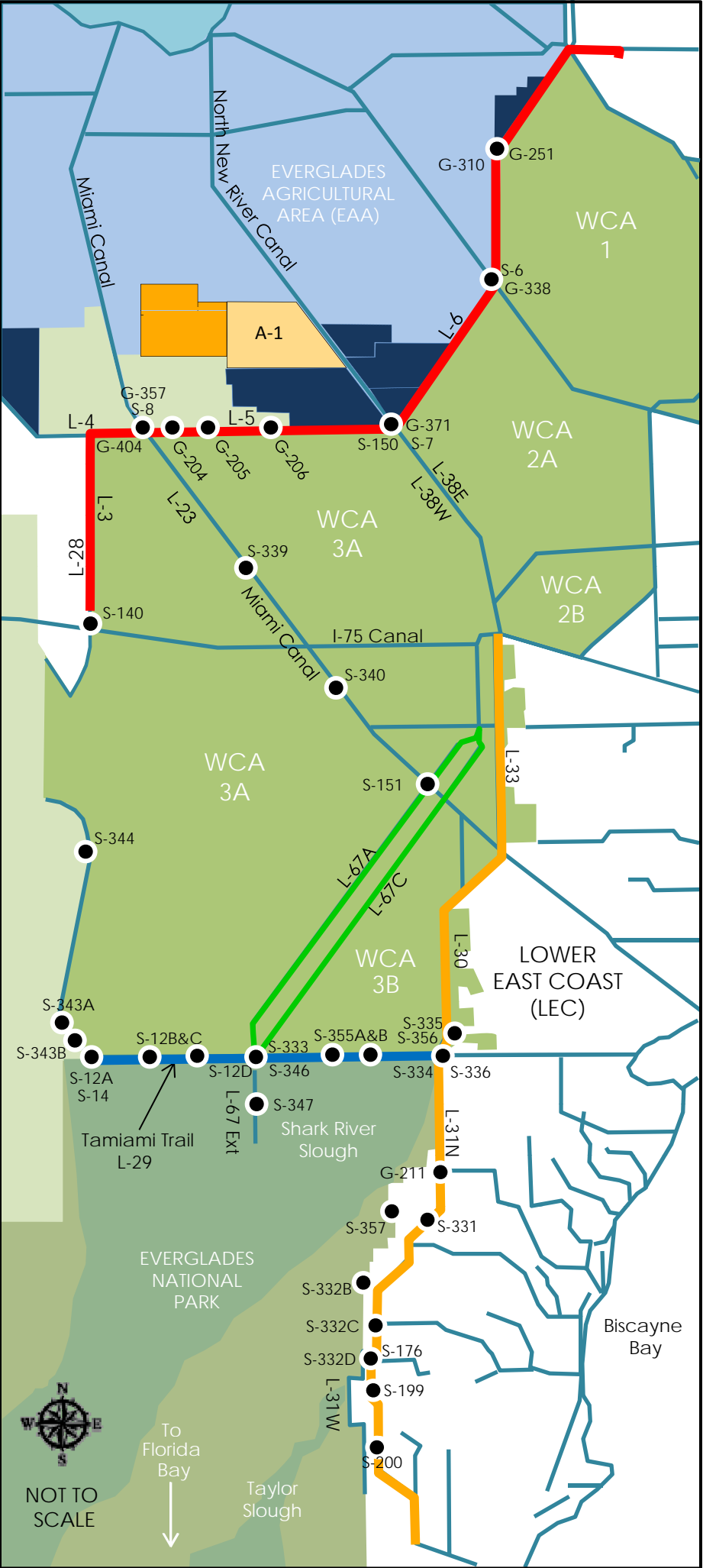
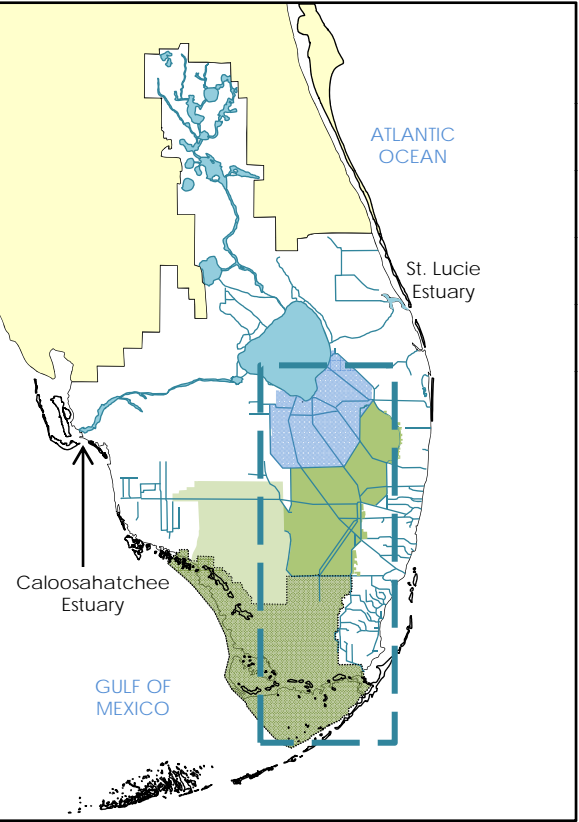


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4.0 EVALUTION AND COMPARISON OF ALTERNATIVE PLANS

Please open the foldout figure at the end of this section to reference while reading.

Upon identification of the final array of alternatives, each alternative was evaluated for its effects on the environment (ecological and social benefits). See **Section 5** for details. The alternatives were compared using the Principles and Guidelines criteria (Completeness, Acceptability, Efficiency and Effectiveness). Project benefits were quantified using project specific performance measures, planning level costs were calculated for each alternative plan, and an analysis was conducted using Cost Effectiveness and Incremental Cost Analysis (CE/ICA) to identify alternatives that maximize environmental benefits compared to costs. The alternatives were also compared using the system of accounts (National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED) and Other Social Effects (OSE)). The evaluation and comparison resulted in the identification of the National Ecosystem Restoration (NER) plan and the recommended plan.

4.1 PRINCIPLES AND GUIDELINES EVALUATION CRITERIA

Principles and Guidelines criteria:

- **Effectiveness:** Extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities (Evaluated in **Section 4.1.1**)
- **Acceptability:** Workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations, and public policies (Evaluated in **Section 4.1.2**)
- **Completeness:** Extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects (Evaluated in **Section 4.1.3**)
- **Efficiency:** CE/ICA identified plans that maximize environmental benefits compared to costs (Evaluated in **Section 4.2**)

4.1.1 Effectiveness

An effective alternative alleviates the specified problems and achieves the specified opportunities for the Central Everglades Planning Project (CEPP). Because CEPP problems and opportunities drove the development of planning objectives (see **Section 1** of the report), effectiveness was evaluated by how well the alternatives achieved the planning objectives. **Table 4-1** presents how each alternative performed with respect to each objective. Additional details on hydrologic and ecological performance can be found in **Section 5.1**, **Appendix C.2.1**, and **Appendix G**. Additional details on hydrologic performance can be found in **Appendix A**.

Table 4-1. Summary Comparison of Alternatives in Effectiveness of Meeting the Planning Objectives of CEPP

Future Without (FWO) Project Condition	Alt 1 (S-333)	Alt 2 (Gravity)	Alt 3 (Pumps)	Alt 4 (Flowway)
Objective: Restore seasonal hydroperiods and freshwater distribution to support a natural mosaic of wetland and upland habitat in the Everglades System.				
Ridge and slough is the most common habitat in the Greater Everglades. The slough vegetation performance measure provides a measure of the suitability of hydrologic conditions for two key species of slough vegetation.				
All alternatives improve hydrologic conditions that support a more natural habitat mosaic. They increase continuous hydroperiods, reduce dry downs and improve average wet season and dry season depths. Performance for slough vegetation between alternatives varies by 1-4 percent, depending on location. All alternatives are closest to the targets in southern Water Conservation Area (WCA) 3A and Everglades National Park (ENP). The degree of freshwater distribution varies depending on the spatial extent and location of distribution features, with Alternative 1 containing the least distribution infrastructure and Alternative 4 the greatest.				
<i>(Performance Measure for Slough Vegetation, 0-100 scale, target is 100)</i>				
33 to 37 in zones north of I-75; 39 to 79 in zones south of I-75 and northern ENP	64 to 68 north 60 to 81 south	61 to 66 north; 60 to 81 south	61 to 66 north; 62 to 83 south	61 to 67 north 58 to 83 south
Objective: Improve sheetflow patterns and surface water depths/durations in the Everglades in order to reduce soil subsidence, frequency of damaging peat fires , decline of tree islands, and salt water intrusion.				
Before drainage, the Everglades probably remained wet nearly all years, with minimum slough water levels remaining at 0.5 to 1.0 feet (ft) above ground. Peat cores reveal little evidence of major fires. The Central and Southern Florida (C&SF) Project substantially altered hydrology. Construction of the Miami, North New River and Hillsboro Canals substantially lowered water levels, drying out the peat, reducing soil accretion, and increasing soil loss through oxidation and severe peat fires.				
Each alternative includes infrastructure that increases sheetflow and water depths across the WCA 3A via hydropattern restoration features and Miami Canal backfilling. Alternatives additionally improve surface water depths and durations through the introduction of additional water made available by the flowage equalization basin (FEB) and the redistribution of stormwater treatment area (STA) 2 discharges with the L-6 diversion operations. All alternatives reduce the risk of soil oxidation and peat fires relative to the FWO. All alternatives perform similarly to each other. Alternatives increase the amount of time that water levels are above the ground surface and do this for a larger portion of the project area relative to the FWO. Alternatives reduce risk of soil oxidation and fire more in the northern zones than in the southern zones.				
<i>(Performance measure for Soil Oxidation, 0-100 scale, target is 100)</i>				
26 to 63 in zones north of I-75; 50 to 100 in zones south of I-75 and northern ENP	85 to 100 north; 77 to 100 south	82 to 100 north; 77 to 100 south	81 to 100 north; 84 to 100 south	83 to 100 north; 86 to 100 south
Objective: Improve the quality of oyster and submerged aquatic vegetation (SAV) habitat in the Northern Estuaries (St Lucie Estuary (SLE) and Caloosahatchee (Cal) Estuary).				
High volume discharges from Lake Okeechobee can result in rapid decreases in salinity. Sustained exposure to reduced salinity produces adverse effects on oyster reefs, juvenile marine fish, sea grass beds, and other submerged aquatic vegetation in the Northern Estuaries. Reducing the frequency and magnitude of the high volume discharges improves salinity conditions in these estuaries thereby improving the quality of oyster and SAV habitat.				
All alternatives reduce high volume discharges to the Northern Estuaries. All alternatives perform equally, because they are dependent on the operations of the FEB, STA 2, STA 3/4, and Lake Okeechobee and contain the same features and operations. The CEPP alternatives reduce the moderately high lake inflow and estuary discharge events by diverting flow to the south, to the storage and treatment facilities, and reducing flows that would have otherwise gone to the estuaries. The largest lake inflow and estuary discharge events far exceed the combined available storage and treatment capacity in the A-1 and A-2 FEBs, STA 3/4, and STA 2, and as a result, the CEPP				

Future Without (FWO) Project Condition	Alt 1 (S-333)	Alt 2 (Gravity)	Alt 3 (Pumps)	Alt 4 (Flowway)
alternatives do not substantially reduce the frequency of extreme high flows to the Northern Estuaries.				
(Number of months of high flow and of extreme high flows, fewer is better)				
High flows: SLE - 54 months; Cal- 81 months	High flows: SLE - 35 months; Cal- 68 months;			
Extreme high flows: SLE - 31 months; Cal – 33 months	Extreme high flows: SLE – 28 months; Cal – 31 months			
Objective: Reduce water loss (seepage) out of the natural system to promote appropriate dry season recession rates for wildlife utilization.				
Without management of seepage, a large portion of the new water delivered to the system would seep across and under the eastern perimeter levees, reducing the desired hydroperiod and water depth changes that produce the ecosystem benefits of the project alternatives. All alternatives include seepage management features that reduce water loss out of the natural system compared to water loss if no seepage management feature were included.				
While all the alternatives are effective in reducing seepage out of the natural system and consequently promoting more appropriate dry season recession rates for wildlife, they differ in the amount and spatial distribution of seepage to the east, where increased seepage may increase the risk of flooding in urban and agricultural areas, and decreased seepage may reduce water supply for municipal and agricultural uses and Biscayne Bay. None of the alternatives fully balance ecosystem benefits with potential adverse effects to water supply and/or flood control performance. The recommended plan will be modified to reduce seepage management infrastructure and/or improve operations in order to avoid impacts to water supply within the Lower East Coast Service Area (LECSA) and Biscayne Bay, while simultaneously reducing overall project costs.				
No change in seepage	All alternatives retain more water in the natural system than the FWO			
Objective: Restore more natural water level responses to rainfall to promote plant and animal diversity and habitat function.				
The target dry season recession rate in WCA 3A is approximately 0.05 ft per week from January 1 to June 1 (or onset of the wet season). This equates to a net stage difference of approximately 1.0 ft. Recession rates that are too slow prevent the gradual concentration of small fish and amphibian prey species into smaller, higher concentration areas where wading birds and other predators can catch them – the fish and other prey stay widely dispersed. Recession rates that are too fast lead to dry downs before the end of the dry season and eliminate the small fish and amphibians prey base. Rapid recession rates also may harm vegetation communities which are critical to nesting success of several bird species.				
All alternatives performed better than the FWO, with more weeks in the target and moderate recession rate zones, and fewer weeks in the lowest zone (recession rate too fast or too slow). All alternatives performed similar to each other. All alternatives improve hydrologic connectivity through backfilling of the Miami Canal. Alt 4 additionally improves hydrologic connectivity between WCA 3B and Northeast Shark River Slough (NESRS), but also reduces connectivity within WCA 3B. All alternatives incorporate rain-driven operations for WCA 3 and ENP to incorporate more natural water level responses to rainfall thereby improving more natural predator – prey relationships.				
(Dry season recession rate in WCA 3A (strive for 0.05 ft/week from Jan 1 to Jun 1)).				
115 of 880 weeks within 0.05 of target rate	143 of 880 weeks within 0.05 of target rate	142 of 880 weeks within 0.05 of target rate	144 of 880 weeks within 0.05 of target rate	148 of 880 weeks within 0.05 of target rate
Objective: Increase availability of water supply.				
Constraint: Ensure plan does not impact existing legal users water supply availability				
Increasing agricultural water availability for the Lake Okeechobee Service Area (LOSA), and increasing municipal/industrial water supply in the LECSA 2 (Broward County) and 3 (Miami-Dade County) is a desired				

Future Without (FWO) Project Condition	Alt 1 (S-333)	Alt 2 (Gravity)	Alt 3 (Pumps)	Alt 4 (Flowway)
<p>outcome of CEPP. As the purpose of the Comprehensive Everglades Restoration Program (CERP) and CEPP is to restore, preserve, and protect the south Florida ecosystem while providing for other water-related needs of the region, the target was established to make additional water available without reducing the natural system benefits justifying the project. There is also a legal requirement to evaluate impacts on legal water users, and provide replacement sources of water of comparable quantity and quality if any adverse impacts are identified.</p> <p>All alternatives performed the same for the LOSA, since they depend on the operations of the FEB, STA 3/4, and Lake Okeechobee, and all alternatives contain the same operations for these features. The alternatives had less water supply cutback volumes than the FWO during 7 of the 8 years with the highest water supply cutback volumes (excluding 1981). Seepage management features and operations included in all alternatives may reduce water supply for municipal and agricultural users within the LECSAs and Biscayne Bay, and consequently all alternatives in the final array were not effective at increasing the availability of water supply. However, the identified NER plan will be modified to, at a minimum, meet project constraints by reducing the L-31N seepage management infrastructure and optimize regional operations in order to avoid impacts to water supply. Potential for adverse impacts on water supply in LECSA and Biscayne Bay is greater for Alts 3 and 4 than for Alts 1 and 2.</p>				

4.1.2 Acceptability

An acceptable alternative plan is workable and viable with respect to acceptance by State and local entities and the public and compatible with existing laws, regulations, and public policies. Positive and negative attributes of project features and effects were characterized and documented in the following table. **Table 4-2** presents a description of specific concerns that have been raised regarding acceptability of alternative components by project component.

Table 4-2. Stakeholder Acceptability of Alternative Components by Region (Red, Green, and Yellow Line)

FEB, STA and Lake Okeechobee Operations
<p>All Alternatives Concerns: FEB access and recreational opportunities should be provided Provide deep water refugia to support fish and wildlife during dry periods Limited additional water supply afforded by the project Limited additional benefits to the Northern Estuaries</p>
Hydropattern Restoration Feature (HRF) and Miami Canal
<p>All Alternatives Concerns: Potential effects on upland wildlife from changes in water depths in northern WCA 3A sawgrass areas Increased closure of WCA 3A to public access for hunting Cattail expansion along spreader canal inflow locations Sufficient deep water refugia to support fish and wildlife during dry periods Conflicting concerns about impacts to Miami Canal spoil mounds</p> <ul style="list-style-type: none"> • Pro: Removing spoil mounds removes an impediment to flow • Con: Removing spoil mounds also removes refuge for terrestrial mammals <p>Conflicting concerns about leaving the Miami Canal open south of I-75</p> <ul style="list-style-type: none"> • Pro: Filling in the Miami Canal removes an unnatural disturbance in WCA 3A • Con: Filling in the Miami Canal impacts prime fishing opportunities in south Florida
<p>Alternatives 2, 3 and 4:</p> <ul style="list-style-type: none"> • Pro: Capability for operational flexibility to reduce fire risk • Pro: Fishing in HRF to offset impacts due to Miami Canal backfilling (boat ramps) • Con: Fewer WCA 3A benefits than Alt 1, yet more costly • Con: Greater impact on recreational hunting access than Alt 1
WCA 3B Flow
<p>Alt 1:</p> <ul style="list-style-type: none"> • Pro: Least expensive • Con: Provides minimal sheetflow in WCA 3B, does not remove barriers to flow
<p>Alt 2:</p> <ul style="list-style-type: none"> • Pro: Low operations and maintenance costs for spillways compared to pumps • Con: Surface water flow does not go south, and lack of flow through WCA 3B, does not remove barriers to flow • Con: Concerns regarding modifications to agricultural ditches as collectors to aid flow of water out of WCA 3B
<p>Alt 3:</p> <ul style="list-style-type: none"> • Pro: Allows greater flow through WCA 3B than Alts 1, 2 and 4 • Con: Increased costs (construction, operations and maintenance) associated with extensive pumping • Con: Does not increase ecological connectivity
<p>Alt 4:</p> <ul style="list-style-type: none"> • Pro: Provides southerly flow direction consistent with landscape patterns in a portion of WCA 3B • Pro: Removal of part of L-29 Levee creates greatest ecological connectivity between WCA 3B and NESRS • Con: Building a new levee is not removing barriers to flow and levee would be a long term landscape feature • Con: Does not provide flow to the majority of WCA 3B • Con: The lack of control of releases from western WCA 3B could exacerbate dry downs or reverse flow situations
Seepage Management
<p>Alt 1:</p> <ul style="list-style-type: none"> • Pro: Utilized coastal canals to deliver water to Biscayne Bay • Con: Point source discharge rather than distributed flow due to pumping directly to eastern ENP along L-31N
<p>Alt 2:</p> <ul style="list-style-type: none"> • Pro: Utilized coastal canals to deliver water to Biscayne Bay • Con: Point source discharge rather than distributed flow due to pumping directly to eastern ENP along L-31N • Con: Increased capital and operations and maintenance costs associated with pumping • Con: Potential adverse impacts on water supply in LECSA with seepage management barrier options
<p>Alt 3:</p> <ul style="list-style-type: none"> • Pro: Utilized coastal canals to deliver water to Biscayne Bay • Con: Water quality concerns for infrastructure returning seepage directly to ENP • Con: Potential adverse impacts on water supply in LECSA and Biscayne Bay from longer and deeper barriers
Alt 4:

- Pro: Utilized coastal canals to deliver water to Biscayne Bay
- Con: Potential adverse impacts on water supply in LECSA and Biscayne Bay from longer barrier

Some of the stakeholder concerns listed in **Table 4-2** are also legal and policy concerns, particularly potential adverse effects to water supply and Biscayne Bay deliveries. For any of the alternatives, these legal and policy concerns could be reduced by refining the operations of the seepage management features.

Alts 1, 2, and 4 have similar levels of acceptability. All have a combination of concerns. Alt 3 is less acceptable since it has a higher reliance on pump stations and the associated operational and maintenance, repair, replacement and rehabilitation (OMRR&R) costs compared to the other alternatives.

4.1.3 Completeness

A complete alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the plan's effects.

Components in CEPP are interdependent features that necessitated formulation from a systems approach. The components in the central part of the Everglades are hydrologically connected from Lake Okeechobee to Florida Bay, and rely on one another for both inflows and outflows. These interdependencies required system-wide plan formulation from a spatial perspective to optimize structural and operational components, rather than formulating separable components that may not be compatible or complete for the cumulative watershed. Consequently, no alternative is complete unless all of the identified operations and infrastructure are included. In order to maintain completeness and meet constraints during construction, a strategic implementation sequencing and adaptive management plan will be required for any alternative suggested as the recommended plan.

In addition to the interdependent completeness of the components in the alternatives, there are both CERP and non-CERP activities that will be required to realize benefits are achieved and constraints are met.

- All alternatives in the final array depend on non-CERP activities:
 - Modified Water Deliveries
 - Tamiami Trail Next Steps – 2.6 mile Western Bridge and Road Raising
 - State of Florida – Restoration Strategies Water Quality Infrastructure
 - C-111 South Dade – North Detention Area Completion
- All alternatives in the final array depend on CERP activities:
 - Broward County Water Preserve Area
 - Indian River Lagoon-South Project
 - C-43 Western Basin Storage Reservoir Project
- All alternatives in the final array depend upon updates to C&SF Water Control Manuals, including revisions to the Lake Okeechobee Regulation Schedule (LORS) as needed

4.2 EFFICIENCY ANALYSIS: ENVIRONMENTAL BENEFITS AND COSTS OF ALTERNATIVE PLANS

The CEPP recommended plan is justified by the environmental benefits derived by the south Florida ecosystem; however, a comparison of the benefits and costs of alternative plans is also conducted to ensure that a selected alternative is efficiently producing the environmental benefits. The measurement of efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating the

specified problems and realizing the specified opportunities, consistent with protecting the nation's environment.

The CE/ICA is used to evaluate and compare the production efficiency of alternatives. This identifies the plans that reasonably maximize ecosystem restoration, a key criterion to select the NER plan. Cost effectiveness analysis begins with a comparison of the costs and outputs of alternative plans to identify the least cost plan for every level of output considered. Alternative plans are compared to identify those that would produce greater levels of output at the same cost or lesser cost than other alternative plans. Alternative plans identified through this comparison are the cost effective alternative plans. Cost effective plans are then compared by examining the additional (incremental) costs for the additional (incremental) amounts of output produced by successively larger cost effective plans. The plans with the lowest incremental costs per unit of output for successively larger levels of output are the best buy plans. The results of these calculations and comparisons of costs and outputs between alternative plans provide a basis for addressing the decision question "Is it worth it?" i.e., are the additional outputs worth the costs incurred to achieve them?

The CE/ICA analysis follows guidance from the U.S. Army Corps of Engineers (USACE) , Engineering Regulation (ER) 1105-2-100, Appendix E, para. E-36. Costs are based initially on a planning level estimate and benefits are based on the habitat unit (HU) evaluation. As per this guidance, CE/ICA analysis compares the alternative plans' average annual costs against the appropriate average annual HU estimates. The average annual outputs are calculated as the difference between with-plan and without-plan conditions over the period of analysis (through year 2072).

4.2.1 Costs of Final Array of Alternative Plans

Costs represent the difference between conditions without any plan (the "base condition" or "without project condition") and with a plan or alternative. For purposes of this report and analysis, NED costs (as defined by Federal and USACE policy) are expressed in 2014 price levels. Costs of a plan represent the value of goods and services required to implement and operate/maintain the plan. The cost estimate for the alternatives includes construction, lands, easements, right-of-ways, relocation (LERR), preconstruction engineering and design (PED), construction management, and OMRR&R, and was developed through engineering design and cost estimation, and real estate appraisal efforts.

4.2.1.1 Overview of the Planning Level Cost Estimating Tool

A Planning Level Cost Estimating Tool has been developed and designed by the South Florida Water Management District (SFWMD) to enable a "Planning Level" Construction Cost Estimate for reservoirs, STA's and canals. The construction costs included in the planning level estimate include PED, engineering during construction (EDC) and construction management supervisions and administration (SA).

The costs generated by this tool are screening level relative costs, not absolute costs. These costs should only be used to compare the costs of alternatives relative to one another and are not to be used as the detailed costs for construction. These costs were developed using historical costs from SFWMD constructed projects. This cost estimating tool can be used to generate simple cost estimate comparisons between specific features, components and configurations. The tool takes into account soil conditions such as muck, sand, and clay, as well as local impacts such as the construction or removal of roads, bridges, transmission lines, railroads, rail yards, railroad bridges, housing, farms, telemetry, etc. This tool does not take into account potential cost savings when some features can serve more than one purpose or function.

4.2.1.2 Overview of Real Estate Costs

A detailed analysis of the real estate requirements of the final array was completed. Each parcel required for construction or restoration activities was identified, characterized, and a value estimate was calculated. The real estate was valued in fee, however, lesser estates and interests in land could be considered.

All of the alternatives had the same land requirements for the storage and treatment features. 14,521 acres in the A-2 Compartment were valued at SFWMD actual acquisition costs since these lands were purchased with both Federal Farm Bill funds and SFWMD funds. 145.5 acres (90.93 acres owned by the State of Florida and 54.57 acres owned by SFWMD) were required for the new feeder canal leading from the Miami Canal on the west running east to the A-2 Compartment. These lands were valued at an estimated fair market value.

Alt 1 included a feature at the L-28 triangle which required additional lands, and accounts for the real estate difference between Alt 1 and the other alternatives. Lands were required for construction of pump stations, and other structures within WCA 3A and 3B. These lands were not assigned a value as they were provided for the prior C&SF Project.

4.2.1.3 Average Annual Costs

The timing of a plan's costs is important. Construction and other initial implementation costs cannot simply be added to periodically recurring costs for project operation, maintenance and monitoring if meaningful and direct comparisons of the costs of the different alternatives are to be made. A common practice of equating sums of money across time with their equivalent at an earlier point in time is the process known as discounting. Through this mathematical process, which involves the use of an interest rate (or discount rate) officially prescribed by Federal policy for use in water resource planning analysis (set at 3.5% at the time of the evaluation), the cost time streams for the alternative plans were mathematically translated into an equivalent time basis value. There is some uncertainty as to how any of the alternatives would be implemented. It is recognized that any of the plans would likely be implemented over a considerable length of time. For purposes of this evaluation, construction costs are assumed to incur on an equal monthly basis during the implementation of the alternative plans and would be implemented with no fiscal appropriation constraints.

ER 1105-2-100 requires that interest during construction (IDC) be computed, which represents the opportunity cost of capital incurred during the construction period. IDC was computed for PED costs from the middle of the month in which the expenditures were incurred until the first of the month following the estimated construction completion date, and assumed a 5 year unconstrained construction timeline. IDC was computed for both real estate and construction costs. IDC was computed for the total real estate cost starting from the month prior to construction commencing. The total first cost is the sum of construction and other capital cost, such as real estate and pre-construction. The total project investment is the first cost plus IDC. **Table 4-3** summarizes the total investment cost and average annual costs of each alternative plan.

Table 4-3. Planning Level Construction and Investment Cost of Alternative Plans

	Summary of Costs for CEPP Alternative Plans*			
	Alt 1	Alt 2	Alt 3	Alt 4
<u>Cost Component</u>				
Construction Features	\$1,855,000,000	\$2,174,000,000	\$2,282,000,000	\$2,147,000,000
Lands	\$41,000,000	\$39,000,000	\$39,000,000	\$39,000,000
Total First Cost	\$1,896,000,000	\$2,213,000,000	\$2,321,000,000	\$2,186,000,000
<u>Interest During Construction</u>				
Construction	\$141,000,000	\$165,000,000	\$174,000,000	\$163,000,000
Lands	\$4,000,000	\$4,000,000	\$4,000,000	\$4,000,000
Total Interest During Construction	\$145,000,000	\$169,000,000	\$178,000,000	\$167,000,000
Total Project Investment	\$2,041,000,000	\$2,382,000,000	\$2,499,000,000	\$2,353,000,000
<u>Average Annual Cost</u>				
Interest & Amortization	\$87,000,000	\$101,600,000	\$106,500,000	\$100,300,000
OMRR&R	\$5,500,000	\$6,400,000	\$6,900,000	\$6,500,000
Average Annual Cost	\$92,500,000	\$108,000,000	\$113,400,000	\$106,800,000
*NER annual costs are based on a 50-year period of analysis. Costs do not include costs of recreation features. *Costs are planning level costs and do not coincide exactly with the detailed costs of the recommended plan presented in other sections of the report. * Computation of the detailed estimate for the recommended plan is based on additional engineering and design. * Contingency used in planning level costs was 82% due to the high level of uncertainty in the design of alternatives				

4.2.2 Ecological Evaluation (Habitat Units)

The CEPP devised a project specific tool, referred to as the CEPP planning model to evaluate alternatives within the CEPP project area. The primary areas evaluated included the St. Lucie River and Indian River Lagoon and the Caloosahatchee River and Estuary, WCAs 3A and 3B, ENP, and Florida Bay. HUs were not calculated for Lake Okeechobee or Biscayne Bay, since the performance of these areas were considered a constraint during formulation. The CEPP planning model is a Microsoft (MS) Excel spreadsheet that utilizes project performance measures to derive a HU score that represents the ecological performance achieved by each alternative. The complete description of the model, equations and calculations, and further information pertaining to the alternative evaluation is described in **Appendix G**.

The CEPP planning model was used to aggregate the results of project performance measures. Each of the performance measures for the CEPP planning effort was derived from those approved for use in CERP by Restoration, Coordination and Verification (RECOVER). Eight performance measures were identified (**Table 4-4**). Performance measures were developed from the Northern Estuaries, Greater Everglades Ridge and Slough, and Florida Bay Conceptual Ecological Models (CEMs) (Barnes 2005, Ogden 2005a, Rudnick et al. 2005, Sime 2005). CEMs, as used in the Everglades restoration program, are non-quantitative planning tools that identify the major anthropogenic drivers and stressors on natural systems, the ecological effects of these stressors, and the best biological attributes or indicators of these ecological responses (Ogden et al. 2005b). These CEMs have been extensively peer reviewed and

provide the framework for the planning and assessment of the CERP. Each performance measure has a predictive metric and targets based on hydrologic requirements necessary to meet empirical or theoretical ecological thresholds. Detailed estimates of hydrology across the 41-year period of record (January 1965 – December 2005) generated by the RSM-BN (for the Northern Estuaries) and the RSM-GL (for the Greater Everglades (WCA 3 and ENP) and Florida Bay) were used to calculate performance measure scores.

Table 4-4. Performance Measures Used to Quantify Plan Benefits

Region	Performance Measure (PM)	Description
Northern Estuaries	Caloosahatchee Estuary <ul style="list-style-type: none"> PM 6.1 Low Flow Targets PM 6.2 High Flow Targets 	Measure of the frequency of flows correlated to downstream estuarine salinities favorable to marine fish, shellfish, oyster and SAV.
	St. Lucie Estuary <ul style="list-style-type: none"> PM 7.1 Low Flow Targets PM 7.2 High flow Targets 	
Greater Everglades (WCA 3 and ENP)	Hydrologic Surrogate for Soil Oxidation <ul style="list-style-type: none"> PM 3.1 Drought Intensity Index 	Measure of cumulative drought intensity as an indicator of peat oxidation and risk of fire.
	Inundation Duration: Ridge and Slough Landscape <ul style="list-style-type: none"> PM 1.1 Percent Period of Record of Inundation 	Measure of the frequency and duration of marsh inundation.
	Number and Duration of Dry Events: Shark River Slough <ul style="list-style-type: none"> PM 4.1 Number of Dry Events PM 4.2 Duration of Dry Events PM 4.3 Percent Period of Record of Dry Events 	Measure of the number of times and mean duration of periods when water levels drop below ground.
	Sheet flow in the Ridge and Slough Landscape <ul style="list-style-type: none"> PM 2.1 Timing of Sheetflow PM 2.2 Continuity of Sheetflow PM 2.3 Distribution of Sheetflow 	Measure of the agreement of seasonal timing of flows with pre-drainage timing and of the spatial uniformity of sheet flow across the landscape.
	Slough Vegetation Suitability <ul style="list-style-type: none"> PM 5.1 Hydroperiod PM 5.2 Dry down PM 5.3 Dry Season Depth PM 5.4 Wet Season Depth 	Measure of hydrologic conditions favorable to two species (white water lily and spikerush) indicative of Everglades sloughs.
Florida Bay	Salinity in Florida Bay <ul style="list-style-type: none"> PM 8.1 Dry Season Regime Overlap PM 8.2 Wet Season Regime Overlap PM 8.3 Dry Season High Salinity PM 8.4 Wet Season High Salinity 	Measure of temporal-seasonal agreement between predicted salinity regimes in Florida Bay and pre-drainage salinity targets.

Performance measure scores are displayed as a function of restoration potential or achievement of the target with the minimum value of zero representing a fully degraded ecosystem and a maximum value of 100 representing the restoration target. Habitat suitability indices associated with each performance measure are then summed and applied to the total spatial extent (acres) for each of the 17 zones (**Figure 4-1** through **Figure 4-4**) to produce HUs. HU results for the existing conditions baseline (ECB), the FWO project condition, and the alternatives are displayed in **Table 4-5**.

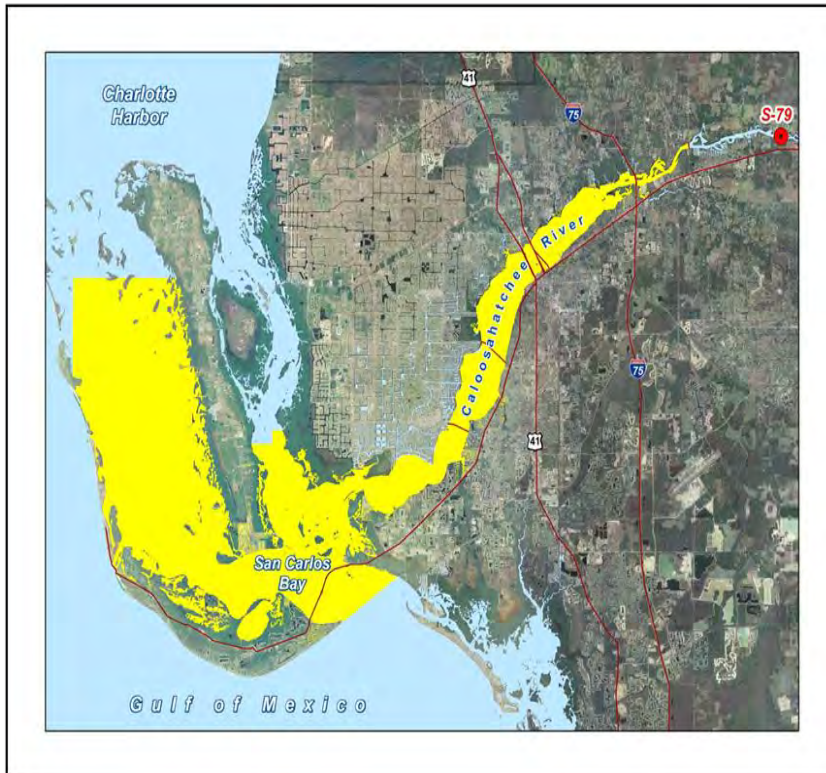


Figure 4-1. Zones for Habitat Suitability within the Caloosahatchee Estuary



Figure 4-2. Zones for Habitat Suitability within the St. Lucie Estuary

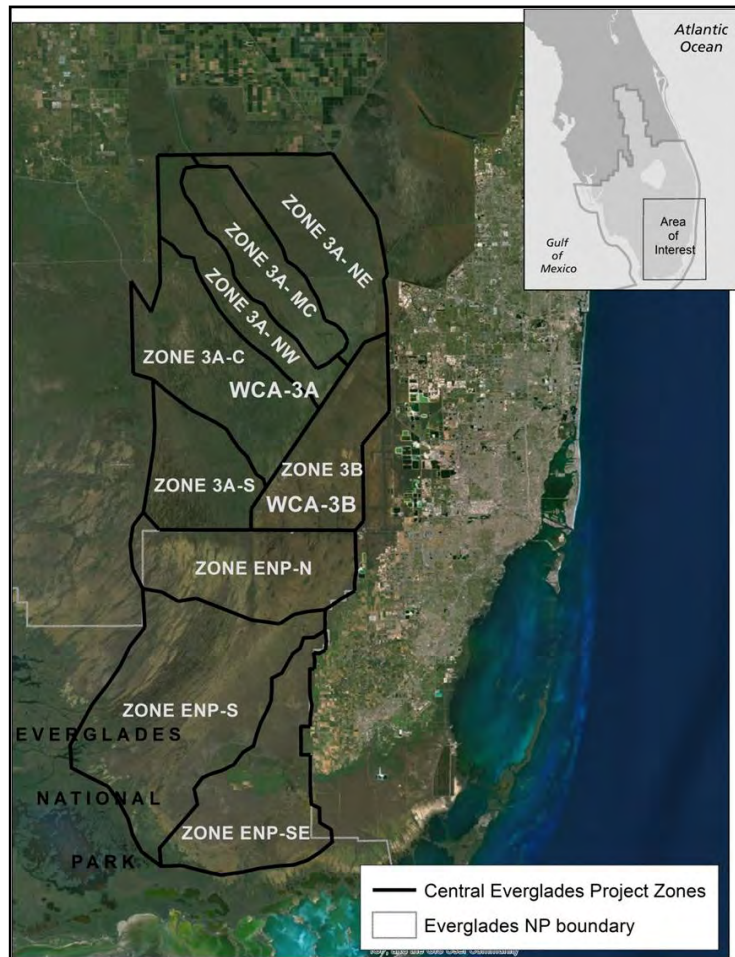


Figure 4-3. Zones for Habitat Suitability within WCA 3 and ENP

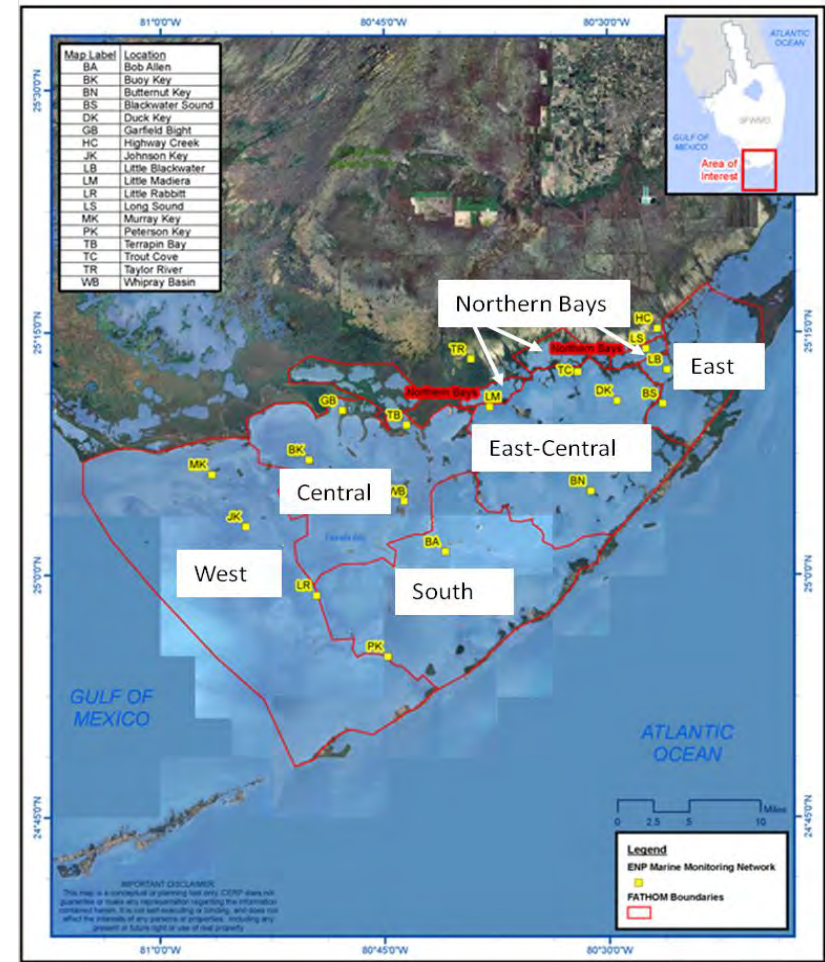


Figure 4-4. Zones for Habitat Suitability within Florida Bay

Table 4-5. Total Habitat Units for each Alternative Condition

Project Region (Zone)	ECB*	FWO**	Alt 1**	Alt 2**	Alt 3**	Alt 4**
Caloosahatchee Estuary (CE-1)	2,839	34,070	39,038	39,038	39,038	39,038
St Lucie Estuary (SE-1)	2,099	2,399	4,798	4,798	4,798	4,798
Total Northern Estuaries	4,938	36,469	43,836	43,836	43,836	43,836
Northeast WCA 3A (3A-NE)	44,451	29,634	96,311	96,311	96,311	96,311
WCA 3A Miami Canal (3A-MC)	32,847	27,373	57,874	57,092	56,310	57,092
Northwest WCA 3A (3A-NW)	30,970	30,266	54,902	53,494	53,494	53,494
Central WCA 3A (3A-C)	108,414	105,669	109,786	109,786	109,786	109,786
Southern WCA 3A (3A-S)	69,247	68,423	68,423	67,598	67,598	68,423
WCA 3B (3B)	55,697	48,842	58,268	59,125	57,411	54,840
Northern ENP (ENP-N)	57,557	55,054	102,601	101,350	103,852	102,601
Southern ENP (ENP-S)	124,068	126,454	169,400	169,400	176,558	188,488
Southeast ENP (ENP-SE)	79,711	81,062	82,413	82,413	82,413	83,764
Total Greater Everglades (WCA 3 and ENP)	602,962	572,777	799,978	796,569	803,733	814,799
Florida Bay West (FB-W)	23,693	20,534	42,647	42,647	47,386	52,124
Florida Bay Central (FB-C)	9,025	8,205	15,589	14,769	17,230	17,230
Florida Bay South (FB-S)	16,614	14,659	30,296	29,318	33,228	35,182
Florida Bay East Central (FB-EC)	21,984	20,225	36,933	36,933	42,209	46,606
Florida Bay North Bay (FB-NB)	2,154	2,028	2,661	2,661	2,788	2,915
Florida Bay East (FB-E)	9,440	8,685	10,573	10,573	10,950	10,950
Total Florida Bay	82,910	74,336	138,699	136,901	153,791	165,007
Total All Regions	690,810	683,582	982,513	977,306	1,001,360	1,023,642

* HU values for the ECB represent those calculated in the year 2010.

** HU values for the FWO and Alts 1 through 4 are calculated for the full ecological response time.

There are substantial benefits within the Blue Shanty flowway in WCA 3B that are not captured in the HU calculations. The CEPP planning model uses an indicator region that falls outside the Blue Shanty flowway; however, the hydrology within the flowway would more closely resemble southern WCA 3A, potentially leading to an underrepresentation of benefits for Alt 4.

4.2.2.1 Average Annual Habitat Units

The average annual outputs were calculated as the difference between the with-plan and without plan conditions over the period of analysis (through year 2072). The base year for the period of economic analysis for CEPP is the year 2022. The average annual HU lift is calculated as subtracting the FWO project HUs from the future with project HUs for each year and averaging over the 50 period of analysis. The anticipated time it will take to realize the benefits is necessary to calculate the average annual lift associated with each alternative.

Natural ecosystems are complex, dynamic systems and the exact functional form of the relationship among variables is rarely if ever known. South Florida ecosystems have been subject to extensive

research and monitoring, and credible estimates of response times can be predicted based on how key ecosystem components have responded to varying hydrologic conditions. The rate at which CEPP benefits accrue over various time intervals, depending on the region, were estimated using these inferences. Linear interpolation was used as a simple method for inferring the rate at which benefits would accrue between those time intervals for each of the three regions of the project area for both the FWO and future with project conditions.

Greater Everglades (WCA 3 and ENP)

An ecological response time for the Greater Everglades was estimated based on the ability of CEPP to improve conditions for aquatic and herbaceous vegetation communities, periphyton, piscivorous fish, aquatic prey base organisms, and hydroecological reshaping of ridges and tree islands. The ecological response time was estimated to be approximately 75-100 years until full impact would be realized, with a large percentage of benefits accruing earlier as identified in **Table 4-6**.

Table 4-6. Ecological Response Time for Greater Everglades (WCA 3 and ENP)

Percentage of Benefit Achieved Over Time for the Greater Everglades				
0-2 Years*	2-5 Years	5-10 Years	25-50 Years	75-100 Years
50%	70%	80%	90%	100%

*Base year is 2022

Figure 4-5 graphically displays the ecological response time in the Greater Everglades for each alternative condition. As previously discussed, the period of analysis for CEPP extends 50 years out from the base year (2022) and consequently a greater degree of the full impact of the CEPP alternatives is captured by extending the period of analysis past the traditional CERP 2050 end year.

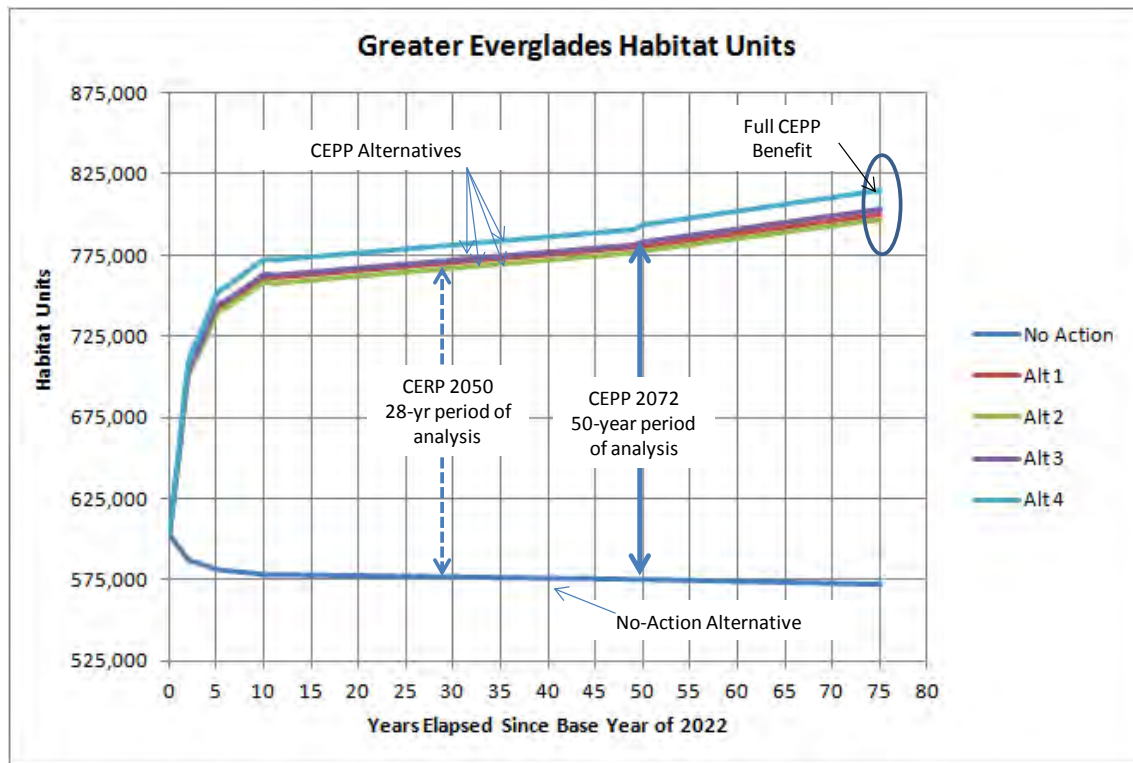


Figure 4-5. Habitat Units through Time for Alternative Conditions in Reaction to Ecological Response Times

Florida Bay

An ecological response time for Florida Bay was estimated based on the ability of CEPP to improve conditions for phytoplankton, zooplankton, seagrass, and large and small invertebrates. The ecological response time was estimated to be approximately 15-25 years until full impact would be realized, with a large percentage of benefits accruing earlier as identified in **Table 4-7**.

Table 4-7. Ecological Response Time for Florida Bay

Percentage of Benefits Achieved Over Time for Florida Bay				
0-2 years	2-5 years	5-10 years	10-15 years	15-25 years
40%	80%	90%	95%	100%

*Base year is 2022.

Northern Estuaries

An ecological response time for the Northern Estuaries was estimated based on the expected response time of oysters and submerged aquatic vegetation to improved salinities. The ecological response time was estimated to be approximately 6 years until full impact would be realized.

Table 4-8 includes the average annual lift when taking into account the ecological response times of each of the three regions described above.

Table 4-8. Average Annual Habitat Unit Lift

	No Action	Alt 1	Alt 2	Alt 3	Alt 4
St Lucie Estuary					
Average Annual Habitat Units	2,378	4,612	4,612	4,612	4,612
Average Annual Habitat Unit Lift		2,234	2,234	2,234	2,234
Caloosahatchee Estuary					
Average Annual Habitat Units	31,918	36,543	36,543	36,543	36,543
Average Annual Habitat Unit Lift		4,625	4,625	4,625	4,625
Greater Everglades (WCA 3 and ENP)					
Average Annual Habitat Units	578,991	759,417	756,087	761,503	769,866
Average Annual Habitat Unit Lift		180,426	177,096	182,512	190,875
Florida Bay					
Average Annual Habitat Units	75,047	133,510	131,877	147,218	157,406
Average Annual Habitat Unit Lift		58,463	56,830	72,171	82,359
Total Average Annual Habitat Unit Lift		245,748	240,785	261,542	280,093

4.2.3 Cost Effectiveness Incremental Cost Analysis

Sometimes it is difficult to summarize the results of CE/ICA when the analyses are performed separately on HUs for distinct species, communities or geographic areas. This phenomenon often occurs simply because different management measures or alternative plans have different functions, provide different types of output, and provide benefits to different biological communities. This is the case for the CEPP plans, in which certain features or alternatives provide greater benefits to Florida Bay and ENP, while other alternatives provide greater benefits for northern WCA 3A and WCA 3B.

Costs and benefits for each geographic area (Northern Estuaries, Greater Everglades (WCA 3A and ENP) and Florida Bay) were examined both independently and combined. However, a combined HU score summing all geographic areas of the study area, while not appropriately representing the significance of each geographic area, provides a valuable cumulative analysis for determining the plan that best meets the needs of the entire watershed; for this reason, the combined HU were used to ensure a cost effective solution is identified.

For the incremental cost analysis, only the cost effective plans are arrayed by increasing output to show changes in cost (marginal cost) and changes in output (marginal output) of each cost effective alternative plan compared to the without plan condition. The plan with the lowest incremental costs per unit of output of all plans is the first best buy plan. All larger cost effective plans are compared to the first best buy plan in terms of increases in cost and increases in output. The alternative plan with the lowest incremental cost per unit of output for all cost effective plans larger than the first best buy plan is the second best buy plan. In summary, CE/ICA was performed using the following four spatial metrics to represent various ecosystem outputs of the CEPP alternatives:

1. System-Wide HU Score
2. Northern Estuaries alone
3. Greater Everglades (WCA 3A and ENP) alone
4. Florida Bay alone

4.2.3.1 Cost Effectiveness Incremental Cost Analysis – Total System-Wide Outputs

As can be seen in the following table (**Table 4-9**), both Alts 1 and 4 are identified as being cost effective for the aggregated system-wide HUs. Alts 2 and 3 are both more costly than Alt 4 and provide fewer overall HUs, and these alternatives are not cost effective for the production of system-wide HUs.

Table 4-9. Results of Cost Effectiveness Analysis for Total System-Wide Performance

	Alt 1	Alt 2	Alt 3	Alt 4
Average Annual Cost	\$92,500,000	\$108,000,000	\$113,400,000	\$106,800,000
Northern Estuaries	6,859	6,859	6,859	6,859
Greater Everglades (WCA 3 and ENP)	180,426	177,096	182,512	190,875
Florida Bay	58,463	56,830	72,171	82,359
Average Annual System Wide HUs	245,748	240,785	261,542	280,094
Average Annual Cost/Average Annual Habitat Units	\$376	\$449	\$434	\$381
Cost Effective	YES			YES

Notes: Values for alternatives are differences between “Without” plan and “With” plan on an average annual basis. Alternatives are arranged by increasing costs.

Table 4-10 shows that there are two best buy plans for the combined system-wide HU production, Alts 1 and 4. Alt 1 has the lowest cost per unit of output of any of the alternatives (\$376 per combined HU produced). The next best alternative in terms of average cost per combined HU is Alt 4 (\$381). Alt 4 provides an increment of 34,346 additional average annual HUs produced over Alt 1 at an incremental cost of over \$14,300,000 (incremental cost of \$416 per HU). Alt 4 provides approximately 14% greater benefits for a cost increase of 15%.

Table 4-10. Results of Incremental Cost Analysis

	Average Annual Cost	Average Annual Habitat Units	Cost Per Average Annual Habitat Units	Incremental Average Annual Cost Increase	Incremental Average Annual Habitat Unit Increase	Incremental Average Annual Cost/Average Annual Habitat Unit
Alt 1	\$92,500,000	245,748	\$376	\$92,500,000	245,748	\$376
Alt 4	\$106,800,000	280,093	\$381	\$14,300,000	34,345	\$416

4.2.3.2 Efficiency Analysis

Following the results of the system-wide CE/ICA analysis, a more detailed examination of alternative components following the spatial perspective would:

- Provide insight into the efficiency of specific components,
- Provide logic and opportunity to modify alternatives to maximize benefits while minimizing costs
- Identify information that would support selection of a more expensive cost effective plan (will help identify if the additional benefit is worth the additional cost)

Northern Estuaries

No component refinements resulted from the efficiency analysis of the Northern Estuaries. The benefits accruing to the Northern Estuaries are realized primarily due to the construction of the FEB and Lake Okeechobee operations. However, it should be noted that without the project components in the Greater Everglades and corresponding seepage management features, benefits to the estuaries will not be realized. All alternatives included the same infrastructure and cost (\$765 million) relating to the FEB and operations, and so there is no difference in benefits between alternatives for the Northern Estuaries.

Greater Everglades - WCA 3A

The components providing benefits to Northern WCA 3A include the HRF and Miami Canal infrastructure needed to distribute the water delivered from the upstream FEBs and STAs. The HRF is the primary difference between Alt 1 (HRF west of the S-8 pump station) and Alts 2, 3 and 4 (HRF both west and east of the S-8 pump station).

As can be noted in **Table 4-11**, Alt 1 was the highest performing alternative for WCA 3A, with little overall difference between alternatives. Alt 1 also had the least amount of infrastructure, and consequently the lowest costs to achieve the benefits in WCA 3A. There is minimal spread in benefits between the alternatives (~2% difference) with a large cost difference (~25%).

The main difference in benefits among the alternatives occurs in the northern zones of WCA 3A (3A-NE, 3A-MC and 3A-NW). As the available water flows south, the hydrology and associated ecological benefits equilibrate across the system regardless of where the water entered northern WCA 3A, as noted by the equal benefits occurring in the central zone (3A-C). The minor differences among alternatives in southern WCA 3A are attributed to differences in infrastructure in delivering water from WCA 3A to WCA 3B and/or ENP.

Table 4-11. Capital Costs and Habitat Unit Lift per Alternative for WCA 3A

Zone	Alt 1	Alt 2	Alt 3	Alt 4
Capital Cost	\$520,000,000	\$650,000,000		
3A-NE	66,677	66,677	66,677	66,677
3A-MC	30,501	29,719	28,937	29,719
3A-NW	24,636	23,228	23,228	23,228
3A-C	4,117	4,117	4,117	4,117
3A-S	0	-825	-825	0
Total WCA 3A	125,931	122,916	122,134	123,741

*Note: Benefits in this table are lift over the FWO and are not annualized; costs are non-annualized planning level construction costs that were used in the calculation of the project first cost

The HRF and Miami Canal infrastructure included in Alt 1 are the features that most efficiently minimize costs while providing greater benefits than the other alternatives. Consequently, Alts 2, 3 and 4 were recommended to be modified to include the HRF and Miami Canal infrastructure (and associated costs) contained in Alt 1.

Greater Everglades - WCA 3B and ENP

No infrastructure modifications were recommended to be made to any of the alternatives. However, it is recognized that operational changes to the L-67 structures could provide greater benefits to WCA 3B

and the recommended plan should further investigate the operational changes during the creation of the draft operations plan.

4.3 SUMMARY OF OUTPUTS FOR THE PRINCIPLES AND GUIDELINES EVALUATION CRITERIA

Based on the information included in the preceding descriptions of the Principles and Guidelines evaluation criteria, the following table (**Table 4-12**) rates each plan on the ability of each plan to meet the specified criteria (Ø not applicable; ≠ does not meet; + partially meets; ++ fully meets). Both Alt 1 and 4 are rated as highly functional, with Alt 4 rated slightly higher than Alt 1. **Section 4.1.1** showed that all alternatives were similar in their effectiveness, with Alt 4 more effective than the others. **Section 4.1.2** showed that the alternatives had similar acceptability, with Alt 3 slightly less acceptable than the others. **Section 4.1.3** showed that all alternatives have the same completeness since all alternatives depend on implementation of the same set of CERP and non-CERP projects. **Section 4.2.1** showed that Alts 1 and 4 were cost effective while the other two alternatives were not cost effective.

Table 4-12. Principles and Guidelines Evaluation Criteria

Evaluation Criteria	FWO	Alt 1	Alt 2	Alt 3	Alt 4
Effectiveness (Section 4.1.1)	≠	+	+	+	++
Acceptability (Section 4.1.2)	≠	+	+	≠	+
Completeness (Section 4.1.3)	Ø	+	+	+	+
Efficiency (Section 4.2.1)	Ø	++	≠	≠	++

4.4 RECOVER SYSTEM WIDE EVALUATION

CERP's interagency science group (RECOVER) conducted a broad-scale evaluation of ecological effects of Alts 1 through 4 on Lake Okeechobee, the Everglades, and the related estuaries, as required in the Programmatic Regulations. The scope of the review covers all areas expected to be improved by CERP, beyond the boundaries expected to be improved by CEPP, and includes a broad range of evaluation tools, performance measures, and best professional judgment that reach beyond the tools and expertise of the traditional USACE planning process. The tools and professional backgrounds of the reviewers represented decades of experience studying and modeling the ecology of south Florida. The purpose of the review is three-fold: to provide insight into whether some alternatives performed better ecologically than others, to indicate whether alternatives may lead to unintended ecological conditions, and to investigate for unintended effects beyond CEPP's boundaries that could potentially contradict CERP on a regional scale.

Key Findings:

- All areas that CEPP intends to improve can be improved by the proposed alternatives. These include the Northern Estuaries, the Greater Everglades, and the southern coastal systems.
- The CEPP planning team's intent was to remain within the existing water schedule for Lake Okeechobee and thereby not impact the Lake's ecology. Modeling indicated that there are periods where the Lake's water level is held approximately 6 to 12 inches higher than ECB or FWO levels, while remaining within the current schedule. The higher water events are expected to be rare enough to avoid significant ecological effects.
- Modeling of the hydrology, salinity, and associated ecology of the St. Lucie and Caloosahatchee Estuaries, referred to collectively as the Northern Estuaries, showed a small reduction in fresh water discharges from Lake Okeechobee to the Northern Estuaries. Although the difference was

not statistically significant, RECOVER concurred that the change is ‘in the right direction’ for reducing peak flow events. Ecological projections for oysters and seagrasses, key species in the estuaries, indicated improvements with CEPP implementation. Modeling indicated less fresh water entering the St. Lucie Estuary during low-flow times, when small amounts of fresh water are needed. CEPP operations and future increments of CERP should remain aware of the need for small amounts of base flow into the estuaries during drier times. Future operations of the Indian River Lagoon-South project can be optimized to help provide these base flows.

- In the Greater Everglades, all CEPP alternatives provide significant improvement towards restoration, compared to the FWO. All alternatives showed improved ecological performance for fish, wading birds, and apple snails in northern and central WCA 3A and Shark River Slough. Improved hydroperiods and sheetflow in WCA 3A, WCA 3B, and ENP result in less soil oxidation, which promotes peat accretion necessary to rebuild the complex mosaic of habitats across the landscape. There are some differences among the alternatives based on where and how the water will be distributed, e.g., Alt 1 may provide sheetflow to a larger area in WCA 3A, while Alts 3 and 4 provide more water to Shark River Slough and the southern marl prairies, improving conditions for fish, wading birds, alligators, tree islands and ridge and slough habitat. Overall, Alt 4 appears to make the most ‘efficient’ use of the water CEPP is adding to the Everglades according to the surface flow vectors, sheetflow information, and wading bird, small fish performance measure outputs. Concerns were expressed about the Blue Shanty Levee in Alt 4 potentially limiting restoration of WCA 3B in the future. Suggestions were made to not include the Blue Shanty Levee or move it eastward from the Blue Shanty Canal location initially identified for Alt 4 in order to align with the eastern end of the 2.6 mile Tamiami Trail Next Steps bridge span opening, avoid potential impacts from levee construction to tree islands located along the Blue Shanty Canal alignment, and to follow the landscape directionality to the northern intersection of the levee with the L-67A Levee. Given these concerns, and consistent with the CERP Programmatic Regulations Section 385.31, adaptive management will be employed to inform decisions and coordination regarding WCA 3B based on results and knowledge gained as CEPP structures are completed and operated. For example, water flow and restoration effects from the first CEPP structure installed in the L67s will help to determine the true need for, best use of, and best placement of other L67 structures and the Blue Shanty Levee. The role of adaptive management in informing steps in WCA 3B is discussed in **Section 6** and in **Annex D Part 1**. A preference was also expressed to use passive structures rather than pumps in order to lower operations/maintenance and increase the natural aspects of Everglades restoration.
- The Southern Coastal Systems are estuaries on the southern end of Florida, which require fresh water inputs to reduce salinity levels and maintain ecologically favorable brackish conditions. All CEPP alternatives showed decreased salinity compared to the FWO in Florida Bay, with associated ecological improvements for key species such as sea trout, pink shrimp, and crocodiles. Alt 4, which yielded more flow through Shark River Slough, improves estuarine salinity conditions over the other alternatives. The differences among alternatives were much less than the differences between each alternative and the FWO. Based on the hydrologic connections between Shark River Slough and the southwest coastal areas of Florida, there is high likelihood that the southwest coastal areas will experience significant ecological benefits from any CEPP alternative; however, these could not be quantified to be added to CEPP evaluations due to the lack of salinity and ecological models in that area of the estuaries. Biscayne Bay may have reduced fresh water flows in the dry season compared to ECB and FWO in the area of CERP’s Biscayne Bay Coastal Wetlands Project and Biscayne National Park, which

could have adverse ecological effects. This will require additional investigation during operational refinement of the recommended plan.

- Overall, it appears that the alternatives that provide the most water to ENP provide the least volume to Biscayne National Park, and vice versa, almost certainly due to the type of seepage management and operational protocols employed. This will be addressed in the Savings Clause and Assurances analyses and will continue to be addressed with adaptive management during CEPP's implementation and operation.
- There was consensus that proceeding with an adaptive management approach can further increase the benefits of CEPP and positively influence the implementation of CEPP in sensitive areas. Adaptive management provides a means to learn during implementation and operations, improves delivery of benefits, and can minimize impacts, and therefore adaptive management is a significant source of ecological risk buy-down for CEPP.

4.5 SUMMARY OF OUTPUTS FOR THE FOUR ACCOUNTS

Upon identification of the final array of alternatives, each alternative plan and the FWO were evaluated and compared to identify the expected effects on the environment, the economy, society, and how well each plan met project objectives and avoided constraints.

4.5.1 National Economic Development

NED benefits are defined as increases in the economic value of the goods and services that result directly from a project. These are benefits that occur as a direct result of the project and are national in perspective. Benefit categories considered by the analysis include recreation, water supply, and flood control. These three categories represent important national considerations; however, the primary formulation of CEPP is ecosystem restoration.

While selecting a plan is predicated on the degree and significance of environmental restoration efforts, the health of the environment has a correlation with economic and social well being. The environmental restoration efforts of CEPP are expected to improve conditions in the Northern Estuaries, central Everglades and Florida Bay, which will lead to both direct and indirect economic benefits to commercial fisheries, property value, tax revenue, tourism and other significant economic sectors. It is recognized that further actions are needed to achieve the restoration envisioned in CERP that will have a direct correlation to the economic and social well being of south Florida.

Water supply is a stated objective of CERP and CEPP; however, no water supply improvements were realized during the initial formulation of Alts 1-4. Through operational refinements and optimization of the recommended plan, further consideration to identify additional water availability for LOSA and the LEC was undertaken. Recreation benefit quantification is necessary because those benefits would be used to justify costs of construction of proposed recreation features. Flood control is a constraint of the project, and while no additional benefits are realized, the alternatives successfully maintained the level of service for flood protection. No impacts to Lake Okeechobee navigation will be realized with the implementation of any alternative.

4.5.2 Environmental Quality

The EQ account is used to present non-monetary effects on ecological, cultural, and aesthetic resources including the positive and adverse effects of ecosystem restoration plans. The EQ outputs for this project are displayed in **Section 5**, and as HUs that were assessed for cost effectiveness and incremental cost analysis in **Section 4.2**.

4.5.3 Regional Economic Development

All alternatives are anticipated to provide RED benefits. In particular, the construction of any recommended features would have a beneficial effect on employment and demand for local goods and services during the construction period. In addition, if recreational features are included it is anticipated that some lasting benefits would accrue to the area as a result of additional recreational use and the associated economic activity.

The expenditures are related to construction activities and the employment that will occur when the expenditures are executed (**Table 4-13**). The total jobs created are based on State-wide impacts of construction expenditures and estimated using 15.3 jobs per \$1 million spent and was developed using the impact analysis for planning (IMPLAN) input/output software. Impacts may vary depending on when construction funding is expended.

Table 4-13. Jobs Generated from CEPP Expenditures: Employment Created by Construction Expenditures

Alt 1	Alt 2	Alt 3	Alt 4
21,800	25,600	26,900	25,300

4.5.4 Other Social Effects

Potential areas of social effects have been assessed as part of the study process. The key areas analyzed to date are summarized below. Relatively similar impacts would be anticipated for all alternatives.

Prime and Unique Farmland: The majority of land within the project area is ridge and slough, sawgrass marsh, coastal wetlands and nearshore/open bay habitat with minimal potential for reduction in unique farmland. All project lands are State owned. Coordination is ongoing with the United States Department of Agriculture (USDA) and National Resources Conservation Service (NRCS) to meet the requirements of the Farmland Protection Policy Act. When detailed design information that locates each of the plan components is completed, it can then be determined how many acres of unique farmland would be affected by the Project. The Everglades Agricultural Area (EAA) area proposed for conversion to a FEB is prime and unique farmland and represents the greatest adverse impact on this resource.

Environmental Justice: *Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires the Federal Government to achieve environmental justice by identifying and addressing high, adverse and disproportionate effects of its activities on minority and low-income populations. It requires the analysis of information such as the race, national origin and income level for areas expected to be impacted by environmental laws, regulations and policies. It also requires Federal agencies to identify the need to ensure the protection of populations relying on subsistence consumption of fish and wildlife, through analysis of information on such consumption patterns and the communication of associated risks to the public. CEPP would provide benefits to quality of life by improving the estuarine environment and contribute to hydrological and water quality improvements in the historic Everglades. The project would improve the quality of human life by providing improved estuarine conditions for fish and wildlife. It would translate into aesthetic and economic benefits for sport fishing and other recreational communities. No homeowners would be displaced by the project.

The CEPP project does not present any environmental impacts that are high, adverse and disproportionate to low income, minority, or Tribal populations. The activity does not (a) exclude

persons from participation in, (b) deny persons the benefits of, or (c) subject persons to discrimination because of their race, color, or national origin. The activity would not impact "subsistence consumption of fish and wildlife." Through the public participation process of the outreach and National Environmental Policy Act (NEPA) scoping, no high or adverse impacts were identified. There was sufficient public input to feel confident that scoping was successful and that the breadth of the potential impacts were communicated and understood by the public. Environmental Impacts to Tribal populations are discussed in **Section 5.3**.

Protection of Children: Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, requires each Federal agency to "identify and assess environmental risks and safety risks [that] may disproportionately affect children and ensure that its "policies, programs, activities, and standards address disproportionate risks to children that results from environmental health risks or safety risks." The proposed project will not result in environmental health risks or safety risks that may have a disproportionate affect on children. Children will not be in the vicinity of any of the construction operations and activities should not have an impact on children.

Safety/Health: All alternatives would be designed to dam safety requirements. All alternatives would maintain the WCA 3A Zone A regulation schedule, the LORS management bands, and the level of service for flood protection in the LEC.

Community Cohesion: Community cohesion would not change. No additional land purchase is proposed. No real estate relocations of residences are proposed.

Recreation: All alternatives would reduce fishing opportunities in the backfilled portion of the Miami Canal. All alternatives include an FEB which adds 15,000 acres of recreational opportunities. No alternatives impact fishing access in the L-67A. Alts 2, 3 and 4 would lead to greater impact on recreational terrestrial mammal hunting than Alt 1 due to the HRF location.

4.6 IDENTIFICATION OF THE NATIONAL ECOSYSTEM RESTORATION PLAN

The overarching goal of CEPP is the environmental restoration of an Everglades ecosystem considered to be of both national and international significance. An alternative plan that reasonably maximizes ecosystem restoration benefits compared to costs, consistent with the Federal objective, is identified as the NER. Selecting the NER plan requires careful consideration of the plan that meets planning objectives and constraints and reasonably maximizes environmental benefits while passing tests of cost effectiveness and incremental cost analyses, significance of outputs, acceptability, completeness, efficiency, and effectiveness. In accordance with USACE guidance, the selected plan must be shown to be cost effective and justified to achieve the desired level of output (ER-1105-2-100 **Appendix E, paragraph E-41**).

4.6.1 Modification of the Final Array and Identification of the National Ecosystem Restoration Plan

Resulting from the efficiency analysis (**Section 4.3.2.1**), HRF and Miami Canal infrastructure modifications were recommended to Alts 2, 3 and 4, to match the infrastructure proposed in Alt 1, and the descriptor "M" was added to the title to represent the modification. This modification included only incorporating a HRF west of the S-8 pump station, and leaving the northern most portion of the Miami Canal open conveyance.

Modifications to the HRF and Miami Canal infrastructure for Alts 2M, 3M, and 4M, resulted in cost reductions of \$176,000,000 (when accounting for additional PED and S/A savings) for these alternatives (**Table 4-14**). Since there was no significant difference between alternatives for the area influenced by the HRF and Miami Canal backfill, benefits were not recalculated and consequently, these alternatives were not re-modeled. Alt 1 and Alt 4M are cost effective for the revised system-wide evaluation, and Alts 2M and 3M are not cost effective since they cost more than Alt 4M yet provide fewer benefits. The original Alts 2, 3 and 4 would no longer be cost effective since the costs of the modified alternatives decreased while the benefits were unchanged.

Table 4-14. Modified Alternative Construction, Real Estate and OMRR&R Cost

	Alt 1	Alt 2M	Alt 3M	Alt 4M
Construction Costs	\$1,854,000,000	\$1,998,000,000	\$2,106,000,000	\$1,971,000,000
Real Estate	\$41,000,000	\$39,000,000	\$39,000,000	\$39,000,000
Total First Cost	\$1,895,000,000	\$2,037,000,000	\$2,145,000,000	\$2,010,000,000
Total Project Investment*	\$2,041,000,000	\$2,193,000,000	\$2,309,000,000	\$2,164,000,000
OMRR&R	\$5,500,000	\$6,400,000	\$6,900,000	\$6,500,000
Average Annual Cost	\$92,500,000	\$99,900,000	\$105,300,000	\$98,800,000
System-Wide Average Annual Habitat Unit Lift	245,748	240,785	261,542	280,094
Average Annual Cost/Average Annual Habitat Unit	\$376	\$415	\$403	\$353
Cost Effective	YES			YES
Best Buy				YES

*Total project investment includes interest during construction

The Institute for Water Resources (IWR) Planning Suite was used to conduct a CE/ICA on the modified alternatives. The results of the efficiency analysis (CE/ICA) demonstrate that Alt 1 and Alt 4M are viable for implementation since they are both cost effective alternatives. Alt 4M is the lowest cost per HU alternative at producing system-wide benefits, and is therefore the only best buy alternative. While an incremental cost analysis is traditionally only conducted for “best buy” alternatives, an incremental analysis was conducted (**Table 4-16**) to display the substantial reduction in the incremental cost per HU lift of Alt 4M when compared to Alt 1. Alt 4M provides an increment of 34,346 additional average annual HUs produced over Alt 1 at an incremental average annual cost of over \$6,300,000 (incremental cost of \$183 per HU). Alt 4M increases benefits over Alt 1 by 14% while only increasing average annual costs by 7%.

Table 4-15. Results of Incremental Cost Analysis

	Average Annual Cost	Average Annual Habitat Units	Cost Per Average Annual Habitat Units	Incremental Average Annual Cost Increase	Incremental Average Annual Habitat Unit Increase	Incremental Average Annual Cost/Average Annual Habitat Unit
Alt 1	\$92,500,000	245,748	\$376	\$92,500,000	245,748	\$376
Alt 4M	\$98,800,000	280,094	\$353	\$6,300,000	34,346	\$183

From an efficiency perspective, this assessment provides significant justification for identifying Alt 4M as the NER Plan. The updated cost effectiveness evaluation of the modified alternatives demonstrated that Alt 4M is the most efficient and effective at meeting project objectives, while improving acceptability by reducing impacts on recreational access in Northern WCA 3A.

4.6.2 Operational Refinements of the National Ecosystem Restoration Plan

The results of the NER analysis identified Alt 4M infrastructure as providing the greatest overall benefits with the least cost per HU; however, the evaluation identified the need to revise the operations of Alt 4M to ensure the project savings clause constraints are met, minimize localized adverse ecological effects, and identify additional opportunities to provide for other water related needs. Three modeling scenarios were conducted to identify project effects resulting from operational changes.

Alt 4R: The first refinement, Alt 4R, focused on operation changes to avoid potential impacts to water supply levels of service in the LOSA and LEC. Refinements included alleviating potential ecological impacts from lowered water depths in WCA 2B by retaining a small portion of the water in WCA 2B that Alt 4M had diverted to WCA 3A. Increases in low flow events to the St. Lucie Estuary, minimized reductions in freshwater flows to Biscayne Bay, and improved water depths in eastern WCA 3B for purposes of improving environmental conditions were also considered.

Alt 4R changed assumptions from Alt 4M by including:

- St Lucie Reservoir (C-44) backflow to Lake Okeechobee
- Made additional minor class limit adjustments to Lake Okeechobee inflow and climate forecasts to reduce the magnitude of allowable discharges from the Lake to re-balance Lake Okeechobee, water supply, and Northern Estuary objectives
- Reduced the frequency and magnitude of CEPP L-6 Diversion operations in Alt4R relative to Alts 1 through 4
- Increased utilization of S-144, S-145 and S-146 relative to the S-11s
- Increased seepage out of eastern ENP
- Increased discharges into WCA3B and reduced utilization of the S-12s
- Updated modeling for proposed L-4 degrade length (2.9 miles) and simulation of proposed new pump station on the L-4 Canal (S-630)

The Alt 4R refinement resulted in an alternative that lessened concerns over meeting constraints yet there remained room for improvement in LOSA water supply and the spatial distribution of groundwater and canal discharges in the LEC to provide greater confidence in meeting legal requirements of the savings clause. This alternative did not fully address the low flow events to the St. Lucie Estuary nor did it identify additional opportunities for other water related needs. Alt 4R maintains the majority of the system benefit identified for Alt 4M in the final array evaluation and demonstrates a substantial hydrologic improvement over the baselines; however, Alt 4R represented a 6% decrease in overall project benefits due to competing demands for the allocation of water in the regional system.

Alt 4R1: The second refinement, Alt 4R1, was performed to determine if water supply cutbacks for the LOSA could be further reduced and if increases in the LEC public water supply over the FWO project condition could be met while maintaining the natural system performance realized from the adjustments that were made for Alt 4R. The PWS demands utilized in the alternative are based on per capita demand increases proportional to Florida's Bureau of Economic and Business Research (BEBR) medium population projections.

Alt 4R1 changed assumptions from Alt 4M by including:

- Increased public water supply demand for LECSA 2 from 277 million gallons per day (MGD) to 295 MGD
- Increased public water supply demand for LECSA 3 from 412 MGD to 465 MGD
- Reduced Regulation Schedule releases within the assumed flexibility of LORS 2008
- Operational updates to CERP's Indian River Lagoon-South project, consistent with recent SFWMD reservations work; this provides low-flow salinity discharges to help meet St. Lucie estuary targets
- Operational updates to the Broward Water Preserve Areas project were incorporated to better represent that project's intent in the modeling representation
- Refinement of backflows from C-44 reservoir to Lake Okeechobee to send more water during low Lake stage events
- Updated modeling for proposed L-4 degrade length (2.9 miles) and simulation of proposed new pump station on the L-4 Canal (S-630)

Alt 4R1 was successful in delivering additional water supply to LECSA 2 and LECSA 3 while maintaining the benefits identified for Alt 4R, but caused potentially adverse impacts by reducing freshwater flows to Biscayne Bay. Additionally, the higher rate of increased pumpage was found to cause groundwater drawdown in the vicinity of regional canals which could lead to increased saltwater intrusion and potential impacts to local wetlands. These negative effects compelled further operational refinement, and Alt 4R1 was removed from further consideration.

Alt 4R2: The third refinement, Alt 4R2 was also performed to determine if increases in LEC public water supply (over FWO project conditions) could be met while maintaining the natural system performance realized from the adjustments that were made for Alt 4R without the negative effects to LEC groundwater and Biscayne Bay that Alt 4R1 realized. This refinement limited the increase in public water supply deliveries by reducing the demand in the model.

Alt 4R2 included the same Alt 4R infrastructure but changed assumptions from Alt 4M by including:

- Revised public water supply demand for LECSA 2 from 277 MGD to 289 MGD
- Revised public water supply demand for LECSA 3 from 412 MGD to 417 MGD
- Reduced Regulation Schedule releases within the assumed flexibility of LORS 2008
- Operational updates to CERP's Indian River Lagoon-South project, consistent with recent SFWMD reservations rules; this provides low-flow salinity discharges to help meet St. Lucie estuary targets
- Operational updates to the Broward Water Preserve Areas project were incorporated to better represent that project's intent in the modeling representation
- Enabled backflows from C-44 reservoir to Lake Okeechobee to send more water during low Lake stage events
- Updated modeling for proposed L-4 degrade length (2.9 miles) and simulation of proposed new pump station on the L-4 Canal (S-630)

Alt 4R2 was successful in making available an additional 12 MGD to LECSA 2 and 5 MGD to LECSA 3 public water supply, maintaining FWO freshwater flows to Biscayne Bay, and slightly improving the HUs over Alt 4R (**Table 4-16**). Alt 4R2 also provided approximately 210,000 acre-feet average annual flow to the Everglades system, which is almost 6 kac-ft more than Alt 4R.

Table 4-16. Habitat Unit Results for Alt 4R and 4R2

Project Region (Zone)	Habitat Units			
	ECB*	FWO**	Alt 4R**	Alt 4R2**
Caloosahatchee Estuary (CE-1)	2,839	34,070	39,038	39,038
St. Lucie Estuary (SE-1)	2,099	2,399	5,098	8,247
Total Northern Estuaries	4,938	36,469	44,136	47,285
Northeast WCA 3A (3A-NE)	44,451	29,634	92,606	91,372
WCA 3A Miami Canal (3A-MC)	32,847	27,373	54,746	54,746
Northwest WCA 3A (3A-NW)	30,970	30,266	54,198	54,198
Central WCA 3A (3A-C)	108,414	105,669	109,786	111,159
Southern WCA 3A (3A-S)	69,247	68,423	68,423	68,423
WCA 3B (3B)	55,697	48,842	58,268	59,125
Northern ENP (ENP-N)	57,557	55,054	98,847	98,847
Southern ENP (ENP-S)	124,068	126,454	169,400	169,400
Southeast ENP (ENP-SE)	79,711	81,062	85,116	83,764
Total Greater Everglades (WCA 3 and ENP)	602,962	572,777	791,390	791,034
Florida Bay West (FB-W)	23,693	20,534	39,488	41,068
Florida Bay Central (FB-C)	9,025	8,205	13,948	14,769
Florida Bay South (FB-S)	16,614	14,659	27,364	28,341
Florida Bay East Central (FB-EC)	21,984	20,225	33,416	34,295
Florida Bay North Bay (FB-NB)	2,154	2,028	2,534	2,661
Florida Bay East (FB-E)	9,440	8,685	9,818	9,818
Total Florida Bay	82,910	74,336	126,568	130,952
Total All Regions	690,810	683,582	962,094	969,271

* HU values for the ECB represent those calculated in the year 2010.

** HU values for the FWO and Alts 4R and 4R2 are calculated for the full ecological response time.

The costs of 4R and 4R2 are equal, yet Alt 4R2 provides slightly improved environmental benefits, and better meets the project objective of increasing public water supply opportunities and alleviates concerns over meeting constraints of the project.

4.6.3 Identifying the Recommended Plan

The operational refinements ecosystem benefits analysis indicate a reduction in alternative performance (approximately 6%) for Alt 4R and 4R2 when incorporating the operational refinements, compared to Alt 4 and Alt 4M. This reduction in benefits is a direct result of meeting project constraints. A similar reduction in benefit trends is expected for any of the alternatives in the final array if the operational modifications required to ensure legal requirements were being met were similarly applied. Alt 4R2 would remain the only best buy alternative and consequently the NER plan.

Although Alts 1, 2M and 3M were not re-modeled, there is reasonable confidence that the performance trends observed moving from Alt 4M to Alt 4R and Alt 4R2 would also be observed in re-modeled versions of the other alternatives. This assertion is based on the fact that in order to honor the identified constraints from a water budget perspective, some of the water that is sent to WCA 3A, WCA 3B and ENP in the first three alternatives would need to be sent to WCA 2A, WCA 2B and the LEC. This redirection of water would provide enough water in the WCA 2 and LEC system (as well as the downstream Biscayne Bay) to ensure adequate performance in these regions, but would mean that less water was entering or being retained in areas where project benefits are quantified. Some of the benefit quantified by having additional water in the WCA 3 and ENP system in Alts 1, 2M and 3M would be reduced. The level of reduction in benefit across the alternatives would be expected to be somewhat proportional to their identified lift, but even if the first three alternatives only realized a 2% reduction in benefits as opposed to the 6% realized in Alt 4R2, Alt 4R2 would still be a cost effective alternative and fulfill the requirements for justifying a recommended plan as described in WRDA 2000.

There are also substantial benefits that Alt 4R2 exhibits in the Blue Shanty flowway that are not captured in the HU calculation, yet are significant and compelling reasons for identifying Alt 4R2 as the recommended plan and are further described in **Section 3.2** and **Appendix G, Section G.2**.

Alt 4R2 (**Figure 4-6**) is being recommended for the following reasons:

- Best performing operational refinement of the NER plan.
- Meets the legal requirement for maintaining flood protection in the LEC.
- With adjustments to LORS releases (including class limit adjustments), the recommended plan maintains water availability for existing users in the LOSA, and increases available water supply (17 MGD) in the LEC, while maintaining FWO flows to Biscayne Bay.
- Meets Seminole Tribe of Florida's compacts.
- The flowway generated by the Blue Shanty Levee in Alt 4R2 would increase flows through western WCA 3B (**Appendix G, Figure G-36**) while maintaining protective water depths in eastern WCA 3B. Alt 4R2 best achieves the goal of re-establishing hydrologic and ecologic connectivity of WCA 3A, WCA 3B, and ENP by degrading the L-67 C and L-29 Levees west of the Blue Shanty Levee. Long, continuous and uninterrupted patterns of sheetflow from north to south are a defining characteristic of the Everglades. The flowway restores sheetflow consistent with the landscape patterns of the natural system.

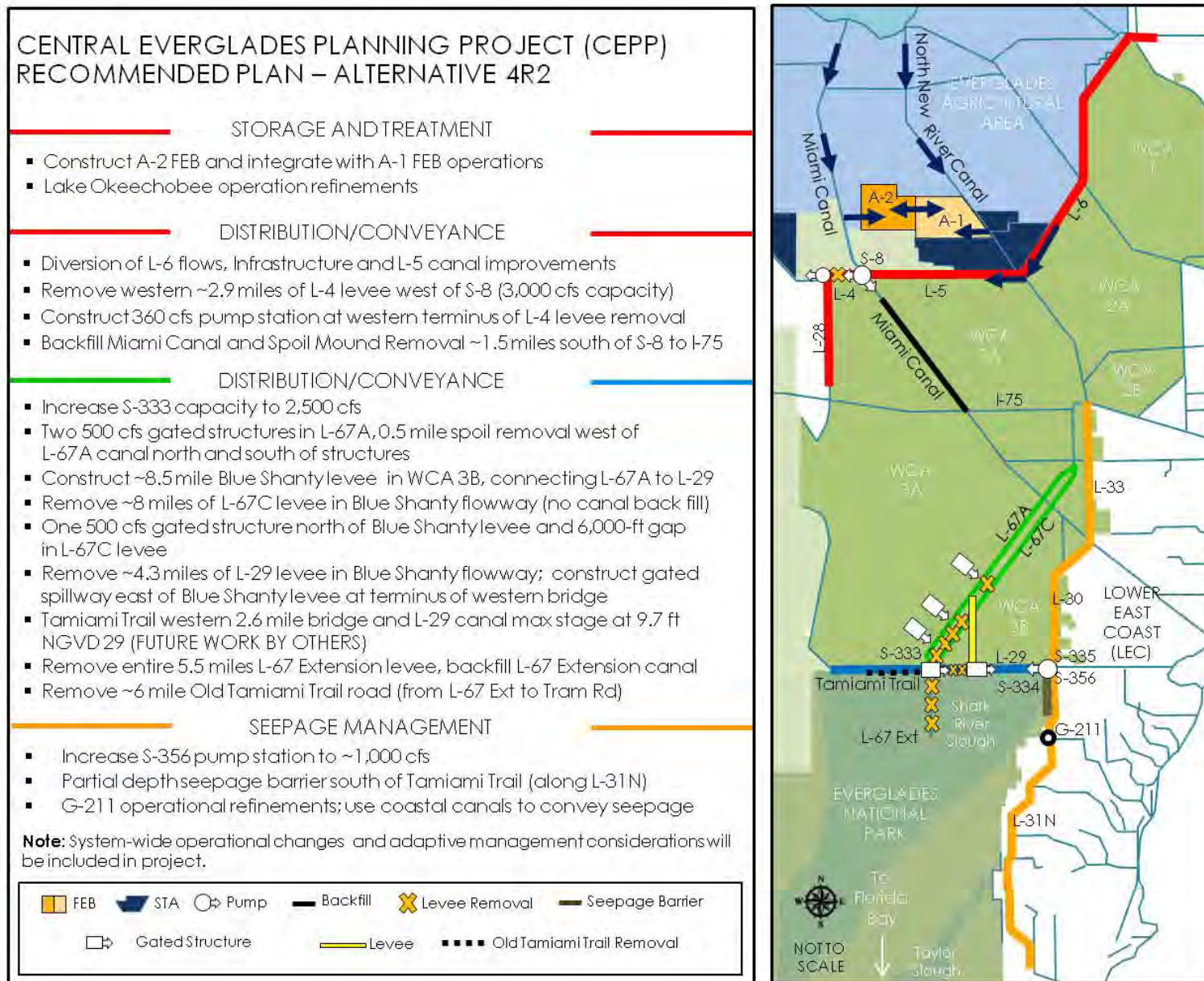


Figure 4-6. The CEPP Recommended Plan

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CENTRAL EVERGLADES PLANNING PROJECT FINAL ARRAY OF ALTERNATIVES	
1	<div>STORAGE AND TREATMENT</div> <ul style="list-style-type: none">Construct A-2 FEB & integrate with A-1 FEB operationsLake Okeechobee operation refinements within LORS <div>DISTRIBUTION/CONVEYANCE</div> <ul style="list-style-type: none">Diversion of L-6 flows, Infrastructure and L-5 canal improvementsRemove western ~2.9 miles of L-4 levee (west of S-8 3,000 cfs capacity)Construct 360 cfs pump station at western terminus of L-4 levee removalBackfill Miami Canal & Spoil Mound Removal ~1.5 miles south of S-8 to I-75Gap in L-28 levee south of I-75 and canal backfill <div>DISTRIBUTION/CONVEYANCE</div> <ul style="list-style-type: none">Increase S-333 capacity to 2,500 cfsOne 700 cfs gated structures in L-67A, 0.5 mile spoil removal west of L-67A canal north and south of structuresTamiami Trail western 2.6 mile bridge and L-29 canal max stage at 9.7 ft NGVD 29 (FUTURE WORK BY OTHERS)Remove entire 5.5 miles L-67 Extension levee, backfill L-67 Extension canalRemove ~6 mile Old Tamiami Trail road (from L-67 Ext to Tram Road) <div>SEEPAGE MANAGEMENT</div> <ul style="list-style-type: none">Increase S-356 pump station to ~1,000 cfsTwo 250 cfs pumps along L-31NG-211 operational refinements; use coastal canals to convey seepage
	<div>STORAGE AND TREATMENT</div> <ul style="list-style-type: none">Same as Alternative 1 <div>DISTRIBUTION/CONVEYANCE</div> <ul style="list-style-type: none">Diversion of L-6 flows, Infrastructure and L-5 canal improvementsSpreader canals 3 miles west of S-8 (3,000 cfs), 3 miles east of S-8 (800 cfs), and 1.5 miles east of G-206 (400 cfs)Construct 360 cfs pump station at western terminus of L-4 levee removalBackfill Miami Canal and Spoil Mound Removal S-8 to I-75 <div>DISTRIBUTION/CONVEYANCE</div> <ul style="list-style-type: none">Increase S-333 capacity to 2,500 cfsOne 750 cfs and two 500 cfs gated structures in L-67A, 0.5 mile spoil removal west of L-67A canal north and south of structures6,000-ft gap in L-67C levee at each structureOne additional 500 cfs gravity structure in the L-29 levee at WCA 3BTamiami Trail western 2.6 mile bridge and L-29 canal max stage at 9.7 ft NGVD 29 (FUTURE WORK BY OTHERS)Remove entire 5.5 miles L-67 Extension levee, backfill L-67 Extension canal <div>SEEPAGE MANAGEMENT</div> <ul style="list-style-type: none">Remove ~6 mile Old Tamiami Trail road (from L-67 Ext to Tram Road)Increase S-356 pump station to ~1,000 cfsFull depth seepage barrier from S-335 to S-334Partial depth seepage barrier, 2-mile long, south of Tamiami Trail (along L-31N)One 250 cfs pump station on L-31N into ENPG-211 operational refinements; use coastal canals to convey seepage
	<div>STORAGE AND TREATMENT</div> <ul style="list-style-type: none">Same as Alternative 1 <div>DISTRIBUTION/CONVEYANCE</div> <ul style="list-style-type: none">Diversion of L-6 flows, Infrastructure and L-5 canal improvementsSpreader canals 3 miles west of S-8 (3,000 cfs), 3 miles east of S-8 (800 cfs), and 1.5 miles east of G-206 (400 cfs)Construct 360 cfs pump station at western terminus of L-4 levee removalBackfill Miami Canal and Spoil Mound Removal S-8 to I-75 <div>DISTRIBUTION/CONVEYANCE</div> <ul style="list-style-type: none">Increase S-333 capacity to 2,500 cfsFour 500 cfs gated structures in L-67A, 0.5 mile spoil removal west of L-67A canal north and south of structures6,000-ft gaps in L-67C levee at each structureTwo 500 cfs pumps out of WCA-3B at existing agricultural canals with improvements to agricultural canals in WCA 3BTamiami Trail western 2.6 mile bridge and L-29 canal max stage at 9.7 ft NGVD 29 (FUTURE WORK BY OTHERS)Remove entire 5.5 miles L-67 Extension levee, backfill L-67 Extension canal <div>SEEPAGE MANAGEMENT</div> <ul style="list-style-type: none">Remove ~6 mile Old Tamiami Trail road (from L-67 Ext to Tram Road)Increase S-356 pump station to ~1,000 cfsFull depth seepage barrier from S-335 to S-334Partial depth seepage barrier south of Tamiami Trail 5 miles along L-31NG-211 operational refinements; use coastal canals to convey seepage
	<div>STORAGE AND TREATMENT</div> <ul style="list-style-type: none">Same as Alternative 1 <div>DISTRIBUTION/CONVEYANCE</div> <ul style="list-style-type: none">Diversion of L-6 flows, Infrastructure and L-5 canal improvementsSpreader canals 3 miles west of S-8 (3,000 cfs), 3 miles east of S-8 (800 cfs), and 1.5 miles east of G-206 (400 cfs)Construct 360 cfs pump station at western terminus of L-4 levee removalBackfill Miami Canal and Spoil Mound Removal ~1.5 miles south of S-8 to I-75 <div>DISTRIBUTION/CONVEYANCE</div> <ul style="list-style-type: none">Increase S-333 capacity to 2,500 cfsTwo 500 cfs gated structures in L-67A, 0.5 mile spoil removal west of L-67A canal north and south of structuresConstruct ~8.5 mile levee in WCA 3B, connecting L-67A to L-29Remove ~8 miles of L-67C levee in Blue Shanty flowway (no canal back fill)One 500 cfs gated structure north of Blue Shanty levee and 6,000-ft gap in L-67C leveeRemove ~4.3 miles of L-29 levee in Blue Shanty flowway; construct divide structure east of Blue Shanty levee at terminus of western bridgeTamiami Trail western 2.6 mile bridge and L-29 canal max stage at 9.7 ft NGVD 29(FUTURE WORK BY OTHERS)Remove entire 5.5 miles L-67 Extension levee, backfill L-67 Extension canal <div>SEEPAGE MANAGEMENT</div> <ul style="list-style-type: none">Remove ~6 mile Old Tamiami Trail road (from L-67 Ext to Tram Rd)Increase S-356 pump station to ~1,000 cfsPartial depth seepage barrier south of Tamiami Trail 5 miles along L-31NG-211 operational refinements; use coastal canals to convey seepage <div>Note: System wide operational changes and adaptive management considerations will be included in project</div> <div><div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div></div> <div><div></div><div></div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div><div></div><div></div></div>

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5.0 EFFECT OF THE FINAL ARRAY OF ALTERNATIVES AND THE RECOMMENDED PLAN

5.1 EFFECTS OF THE FINAL ARRAY OF ALTERNATIVES

This assessment of environmental effects evaluates the anticipated environmental effects of the alternative actions described in **Section 3.0** and **Section 4.0**. Since the final array of alternatives contained a no action alternative (for consistency of the report the **No Action Alternative** is referred to as the **Future Without [FWO]** for the remainder of the report), the other four action alternatives were compared to and evaluated against the FWO to describe changes to existing conditions with implementation of each Central Everglades Planning Project (CEPP) action alternative. These potential effects are summarized within this section. Details regarding effects are provided within this section and full details are discussed in **Appendix C.2.1**.

For this analysis, intensity was rated as follows:

Negligible-effect to the resource or discipline is barely perceptible and not measurable and con-fined to a small area

Minor-effect to the resource or discipline is perceptible and measurable and is localized

Moderate-effect is clearly detectable and could have appreciable effect on the resource or discipline; or the effect is perceptible and measurable throughout the project area

Major-effect would have a substantial, highly noticeable influence on the resource or discipline on a regional scale

Duration: The duration of the effects in this analysis is defined as follows:

Short term-when effects last less than one year

Long term-effects that last longer than one year

No duration – no effect

5.1.1 Climate

Implementation of any of the CEPP alternatives would have a short-term, negligible and less than significant effect on climate within the action area. Minor, localized effects to microclimate may occur under all CEPP action alternatives as a result of redistribution of water and shifts in vegetation. Potential effects may include increases in evapotranspiration, increases in localized rainfall and temperature changes.

5.1.2 Geology and Soils

On the A-2 FEB footprint, with all the action alternatives, there would be short-term, minor and less than significant geologic effects within the project area from the removal of surface cover (i.e. vegetation and soil), potential removal of caprock using blasting, and removal of limestone to obtain material for construction of levees, canals and roads. All action alternatives would result in conversion of relatively flat, uniform agricultural lands to a FEB (4 feet maximum operating depth) with exterior levees up to 10 feet above existing grade). Improved hydroperiods and sheetflow in WCA 3A, WCA 3B, and ENP reduce soil oxidation, which promotes peat accretion necessary to rebuild the complex mosaic of habitats across the landscape. All action alternatives show an increase in inundation duration over FWO that will significantly decrease soil oxidation, subsidence and peat fires. All action alternatives improved hydrologic conditions in northern WCA 3A in comparison to the FWO by increasing stages and extending hydroperiods within the area. All action alternatives improved hydrologic conditions in northern and southern ENP (Zones ENP-N and ENP-S) in comparison to the FWO by significantly increasing depths and extending hydroperiods in Northeast Shark River Slough (NESRS) (**Table G-14**, and

Table G-15). Consistent with other regions of the Greater Everglades, alternatives scored significantly higher than the FWO in terms of meeting the desired targets for measures of inundation duration, drought intensity, and slough vegetation suitability. Within southern ENP, Alts 3 and 4 produced slightly greater depths, compared to Alts 1 and 2, as depicted by the normalized weekly stage duration curve for Indicator Region 130 (**Figure G-23**). Alt 4 produced slightly greater depths than Alt 3. Alt 4 generally produced improved inundation patterns in southern ENP. Alt 4 improved the number and duration of dry events in NESRS relative to the remaining alternatives at several of the IRs in Zone ENP-S (**Table G-17**). Improved inundation patterns in southern ENP resulted in better suitability for slough vegetation for Alt 4 (**Figure G-24**). In summary, increases in inundation duration throughout the Greater Everglades, particularly within northern WCA 3A and ENP would enable soil conservation through reduction in soil oxidation and fire frequency, and promotion of peat accretion.

5.1.3 Vegetation

Negligible, short-term and less than significant adverse effects to vegetation within Lake Okeechobee, the Northern Estuaries, and the Everglades Agricultural Area (EAA) are anticipated due to implementation of any of the alternatives. As compared with FWO, all CEPP action alternatives show a slight performance improvement within the Northern Estuaries as indicated by fewer high volume flow months, providing a minor beneficial effect. Reduction in high flows and accompanying flow velocities would result in lower suspended solids, color and colored dissolved organic matter, thereby allowing greater light penetration to promote growth of submerged aquatic vegetation (SAV). Refer to **Appendix C.2.1** for a detailed comparison of potential effects to vegetation.

Due to changes in the quantity, quality, distribution, and timing of water entering the Greater Everglades ecosystem, moderate, long-term and significant effects on wetland hydrology and vegetation would potentially occur under each alternative. The primary factors influencing the distribution of dominant freshwater wetland plant species of the Everglades are soil type, soil depth, and hydrological regime (FWS 1999). All four action alternatives improved hydroperiods and sheetflow in WCA 2A, WCA 3A, WCA 3B, and ENP which result in reduced soil oxidation and promoting of peat accretion necessary to rebuild the complex mosaic of habitats across the landscape. All four action alternative provide moderate improvements in hydroperiods in WCA 2A compared to FWO. However, all action alternatives had a moderate, long-term adverse effect in WCA 2B by significantly decreasing stages compared to FWO. In the L-28 Triangle, all action alternatives showed an improvement in hydroperiod over FWO, with Alt 1 having greater improvement than Alts 2-4. Differences among alternatives were found within northern WCA 3A, WCA 3B and southern ENP. These differences may be attributed to the location of project features and varied spatial distribution of water across the landscape. For example, Alt 1 includes a 3 mile spreader canal west of S-8 that provides the greatest improvements in northwestern WCA 3A. In comparison, Alts 3 and 4 provide more water to SRS and the southern marl prairies, improving conditions for tree islands and ridge and slough habitat within ENP and salinity within Florida Bay. Alt 1 performed slightly better than Alts 2, 3, and 4 in northern WCA 3A.

Implementation of any of the CEPP action alternatives is expected to rehydrate much of northern WCA 3A by redistributing treated STA discharges from the L-4 and L-5 Canals north of WCA 3A in a manner that promotes sheetflow and by removing the drainage effects associated with the Miami Canal. Variation in the spatial distribution of inflows into northern WCA 3A and backfill of the Miami Canal did not significantly influence performance among alternatives. Resumption of sheetflow and related patterns of hydroperiod extension and increased water depths will significantly help to restore and sustain the microtopography, directionality, and spatial extent of ridges and sloughs and improve the health of three islands in the ridge and slough landscape. All alternatives provide a major, long-term,

beneficial effect through the backfilling of the Miami Canal. Although none of the alternatives would provide the necessary inundation pattern for complete slough vegetation restoration, all action alternatives act to rehydrate northern WCA 3A, promoting peat accretion, reducing the potential for high intensity fires and promoting transition from upland to wetland vegetation.

Alternative performance varied greatly within WCA 3B due to structural and operational variations among alternatives with respect to construction of conveyance features within L-67 A, L-67 C and L-29 levees, along with associated levee removal or levee gaps. Alt 2 scored the highest in terms of meeting the desired performance measure targets within this area, followed by Alts 1, 3 and 4 respectively. All action alternatives provide a long-term, minor beneficial effect through improved hydrologic conditions in WCA 3B in comparison to FWO by increasing stages and extending hydroperiods within the area as measured by the RECOVER Slough Vegetation Performance Measure (refer to **Appendix G, Figure G-19**). Increases in stages and hydroperiods would promote wetland vegetation transition, through contraction of sawgrass marshes and expansion of wet prairies, and in deeper water areas, sloughs. Plant species diversity would also likely increase in WCA 3B with species composition in wet prairies determined largely by peat depth and substrate type (Powers 2005). Submerged aquatic plants are commonly associated with sloughs, providing structure for growth of periphyton, the main source of primary production (the production of organic compounds from atmospheric or aquatic carbon dioxide) within the freshwater Everglades (Gunderson 1994; Powers 2005).

Although none of the alternatives met the desired dry and wet season water depths for slough vegetation in WCA 3B, Alt 2 improved inundation patterns within WCA 3B and slightly improved conditions for slough vegetation relative to Alts 3, 1, and 4 by increasing water depths in both the wet and dry season (refer to **Appendix G, Figure G-18** and **Figure G-19**). The increased ability of Alt 2 to rehydrate WCA 3B and further increase hydroperiods, especially relative to Alt 4, may come at a potential loss of tree islands. The potential moderate adverse effect is greatest for Alt 2 and Alt 3 because a third of the population of tree islands in WCA 3B are only 0.7-1.1 feet above the surrounding sloughs. When water depths on tree islands exceed one foot for greater than 120 days, even the most water tolerant species are affected (Wu et al. 2002).

Implementation of any of the CEPP action alternatives is expected to rehydrate much of NESRS by redistributing flows from WCA 3A and WCA 3B to ENP and provide a moderate, long-term, beneficial effect. Resumption of sheetflow and related patterns of hydroperiod extension will significantly help to restore pre-drainage patterns of water depths and the complex mosaic of Everglades' vegetation communities. As compared with FWO, all action alternatives produced significantly greater depths and inundation durations (refer to **Appendix G, Figure G-21** and **Figure G-22**). Within northern ENP, alternative performance was similar with reduction in the number of dry events within SRS and extending average hydroperiods by 35 to 90 days depending upon location; this would reduce soil oxidation, decrease fire potential, promote peat accretion, and aid in restoration of historic wetland communities. Within southern ENP, Alts 3 and 4 produced slightly greater water depths as compared with Alts 2, 1 and FWO (refer to **Appendix G, Figure G-23**). Inundation patterns improved with Alt 4 in southern ENP resulting in better suitability for slough vegetation, providing a minor beneficial effect. Although none of the alternatives met the desired dry and wet season water depths for slough vegetation in southern ENP. Alt 4 slightly improved conditions for slough vegetation relative to Alts 1, 2, and 3 by increasing water depths in both the wet and dry season within this region.

Rehydration within northern WCA 3A, new point source discharges of water into WCA 3B and increased discharges at S-333 have the potential to mobilize nutrients within the water column, thereby negatively

affecting water quality. The overall change in phosphorus loads in most areas is expected to be minor and vegetation shifts driven by water quality should be localized. Phosphorus loadings alter the Everglades plant communities through increased plant productivity, tissue phosphorus storage, soil phosphorus enrichment and shifts in plant species composition (Chaing et al. 2000). Substantial vegetation changes may result from elevated phosphorus concentrations. Water quality within the CEPP project area will continue to be monitored following implementation, as described in **Annex D**, to determine any associated changes.

Mangrove communities and seagrass beds associated with Florida Bay may likely show a minor, long-term and less than significant benefit under all alternatives from an increase in freshwater input resulting in decreased salinities. Mangrove communities and seagrass beds associated with Biscayne Bay under Alt2 is the only alternative that may likely show a minor benefit from an increase in freshwater input resulting in decreased salinities. Alts 1, 3, and 4 are likely to have negligible to minor adverse effects.

Non-native and invasive plant infestations in the action area may be exacerbated by soil disturbance, increased nutrients and hydrological modification. Construction and hydrological modification under each alternative may potentially influence the growth of non-native plant species and have a minor adverse effect. Refer to **Appendix C, Section C.2.4** for additional invasive species information.

5.1.4 Threatened and Endangered Species

Federally threatened, endangered, and candidate species that may occur within the study area include: Florida panther (*Puma concolor coryi*), Florida population of West Indian Manatee (Florida manatee) (*Trichechus manatus*) and its critical habitat, Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*) and its critical habitat, Everglade snail kite (*Rostrhamus sociabilis plumbeus*) and its critical habitat, Northern crested caracara (*Caracara cheriway*), piping plover (*Charadrius melodus*), red-cockaded woodpecker (*Picoides borealis*), roseate tern (*Sterna dougallii dougallii*), wood stork (*Mycteria americana*), American alligator (*Alligator mississippiensis*), Florida bonneted bat (*Eumops floridanus*), American crocodile (*Crocodylus acutus*) and its critical habitat, Eastern indigo snake (*Drymarchon corais couperi*), Miami black-headed snake (*Tantilla oolitica*), Schaus swallowtail butterfly (*Heraclides aristodemus ponceanus*), Miami blue butterfly (*Cyclargus thomasi bethunebakeri*), Florida leafwing butterfly (*Anaea troglodyta floridae*), Bartram's hairstreak butterfly (*Strymon acis bartrami*), Stock Island tree snail (*Orthalicus reses* [not incl. *nesodryas*]), crenulate lead-plant (*Amorpha crenulata*), Cape Sable thoroughwort (*Chromolaena frustrata*) deltoid spurge (*Chamaesyce deltoidea* ssp. *deltoidea*), Garber's spurge (*Chamaesyce garberii*), Okeechobee gourd (*Cucurbita okeechobeensis* ssp. *okeechobeensis*), Small's milkpea (*Galactia smallii*), tiny polygala (*Polygala smallii*), smalltooth sawfish (*Pristis pectinata*) and its critical habitat, Gulf sturgeon (*Acipenser oxyrinchus desotoi*) and its critical habitat, blue whale (*Balaenoptera musculus*), finback whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), sei whale (*Balaenoptera borealis*), sperm whale (*Physeter macrocephalus*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Dermochelys coriacea*), Kemp's ridley sea turtle (*Lepidochelys kempii*), loggerhead sea turtle (*Caretta caretta*), Johnson's seagrass (*Halophila johnsonii*) and its critical habitat, elkhorn coral (*Acropora palmata*) and its critical habitat, and staghorn coral (*Acropora cervicornis*) and its critical habitat.

Threatened and endangered species that the Corps anticipated that the project may affect were compared to the FWO and all action alternatives with their potential effects summarized in **Table 5.1-1**. Further details on the life history of each species and their effects determinations can be found in the Biological Assessments in **Annex A**. For a more detailed analysis, please refer to **Appendix C.2.1**.

Table 5.1-1. Effects of Alts 1 though 4 on Threatened and Endangered Species

Threatened and Endangered Species (Please refer to Biological Assessment (Annex A) for further details on life history of each species.)					
Species	FWO	Alt 1	Alt 2	Alt 3	Alt 4
Everglade Snail Kite and it's critical habitat	WCA 3A would continue to suffer from loss of sheet flow and over drying within northern WCA 3A, WCA 3B and ENP. If water levels become too low and food resources become too scarce, adults will abandon their nest sites and young. Southern WCA 3A would continue to experience extended hydroperiods due to ponding along the L-67a and L-29. High water levels and extended hydroperiods have resulted in vegetation shifts within WCA 3A, degrading Everglade snail kite critical habitat.	Rehydration and vegetation shifts within northern WCA 3A, WCA 3B and increased hydroperiods within ENP would increase suitable habitat for apple snails, thereby increasing spatial extent of suitable foraging opportunities for snail kites providing a moderate and significant beneficial effect. Based on this single metric, in WCA 3B, Alt 4 performed the best overall, followed by Alts 3, 1, and 2 respectively. All alternatives may affect Everglade snail kite critical habitat.			
Cape Sable Seaside Sparrow (Hydroperiod and Nesting condition) and it's critical habitat	Hydroperiods would remain the same. Hydroperiods for the western population (CSSS- A) would remain too wet preventing successful nesting, while eastern populations would remain too dry which can cause adverse habitat change from unseasonable fire frequencies. Nesting: Number of dry nesting days would remain the same, which is marginal in CSSS-A, but generally suitable over the rest of sparrow habitat.	Implementation of any alternative, with currently defined operations, has the potential to provide a major adverse affect and significant and unavoidable effect on hydroperiods within the marl prairies adjacent to NESRS. Longer hydroperiods than the FWO are predicted within CSSS-E and southern portions of CSSS-A. Hydroperiods within northern CSSS-A are slightly reduced over the FWO, providing slightly better, but overall too wet conditions for marl prairie habitat and nesting CSSS. Alt 2 is slightly better performing overall, followed by Alts 1, 3, and 4. Nesting: Nesting condition (or number of dry nesting days) proved to be a less sensitive metric than hydroperiod. Minor improvements were seen in northern CSSS-A and CSSS-F while performance was reduced in southern CSSS-A and E. Alts 1 and 2 were slightly better performing than Alts 3 or 4. All alternatives may adversely affect CSSS critical habitat.			
Wood Stork	Western and southern WCA 3A and ENP would continue to suffer from loss of freshwater flows, shorter hydroperiods, and increased saltwater intrusion.	In northeastern and western 3A, Alt 1 performed best with appropriate foraging depths during the dry season. Implementation is expected to provide moderate beneficial and significant effects for improved conditions for wood storks throughout much of the Greater Everglades. Overall, Alts 3 and 4 perform better in comparison with Alts 1 and 2.			
Eastern Indigo Snake	Maintenance of current water levels would not affect upland habitat.	Loss of 14, 000 acres of upland habitat within the FEB provides a major adverse effect and a significant and unavoidable effect. Potential loss of upland habitat due to backfilling the Miami Canal in WCA 3A.			

Threatened and Endangered Species (Please refer to Biological Assessment (Annex A) for further details on life history of each species.)					
Species	FWO	Alt 1	Alt 2	Alt 3	Alt 4
American Alligator (similarity of appearance to the American Crocodile)	Drainage of peripheral wetlands and increasing salinity in mangrove wetlands limits the occurrence of alligators to canals and deeper slough habitats.	All action alternatives provide minor beneficial effects on habitat suitability for American alligator, with Alt 4 performing the best.			
American Crocodile and it's critical habitat	Salinity fluctuations due to lack of freshwater flow would continue to reduce habitat suitability for American crocodile.	All action alternatives provide minor beneficial effects and improve habitat suitability for American crocodile, with Alt 4 performing the best. All alternatives may affect, but are not likely to adversely affect, critical habitat for the American crocodile.			
Manatee and it's critical habitat	Freshwater high volume flows into the Northern Estuaries would continue to degrade seagrasses. Salinity fluctuations in Florida Bay and southern estuaries would continue, potentially reducing quality sea grasses for foraging.	Reduction in high volume discharge events from Lake Okeechobee to the Northern Estuaries would reduce stress on seagrass beds, thereby increasing foraging potential for manatee within this region and provide minor beneficial effects to the manatee and its critical habitat. Increased flows to Florida Bay and southwest coastal estuaries would improve salinity, thereby reducing stress on seagrasses important to foraging manatees and provide minor beneficial effects to the manatee and its critical habitat. All alternative may affect, but are not likely to adversely affect designated critical habitat for the Florida manatee.			
Panther	Maintenance of current water levels would not affect upland habitat.	Loss of 14, 000 acres of upland habitat due to FEB provides a minor adverse effect. Potential loss of upland habitat due to backfilling the Miami Canal in WCA 3A. However, increases in forage base due to hydrological improvements provide a minor beneficial effect.			
Smalltooth Sawfish and its critical habitat	In the absence of land-based water storage facilities disruptions caused by flood control regulatory freshwater releases would continue to cause extreme salinity fluctuations in the northern estuaries; while current water management operations have caused in an inland migration of saline conditions in groundwater and surface waters and prolonged dry season conditions in the southern estuaries resulting in an escalation of salinities unsuitable for estuarine biota.	All of the alternatives have the potential to provide a minor beneficial effect to the smalltooth sawfish and its critical habitat by reducing the volume of high level flows from Lake Okeechobee to the Caloosahatchee River thereby improving the overall salinity regime throughout the Caloosahatchee estuary; and by improving freshwater delivery to coastal wetlands and downstream estuaries in ENP and Florida Bay, subsequently reducing the duration and occurrence of hypersaline conditions.			

Threatened and Endangered Species (Please refer to Biological Assessment (Annex A) for further details on life history of each species.)					
Species	FWO	Alt 1	Alt 2	Alt 3	Alt 4
Green Sea Turtle, Hawksbill Sea Turtle, Leatherback Sea Turtle, Kemp's Ridley Sea Turtle, Loggerhead Sea Turtle	Current water management operations and possibly sea level change have caused in an inland migration of saline conditions in groundwater and surface waters and prolonged dry season conditions in the southern estuaries resulting in an escalation of salinities unsuitable for estuarine biota.	The increased freshwater flows may alter seagrass species composition but should have a negligible and less than significant effect on the overall biomass available for sea turtle feeding habits.			

5.1.5 State Listed Species

The CEPP project area contains habitat suitable for the presence, nesting, and/or foraging of 16 State-listed threatened and endangered species and 18 species of special concern. Threatened and endangered animal species include the Big Cypress fox squirrel (*Sciurus niger avicennia*), Florida mastiff bat (*Eumops glaucinus floridanus*), Florida black bear (*Ursus americanus floridanus*), Everglades mink (*Mustela vison evergladensis*), Florida sandhill crane (*Grus canadensis pratensis*), snowy plover (*Charadrius alexandrius*), Southeastern American kestrel (*Falco sparveriuspaulus*), least tern (*Sterna antillarum*), white-crowned pigeon (*Columba leucocephalus*), and Miami black-headed snake (*Tantilla oolitica*). Species of special concern include the Florida mouse (*Podomys floridanus*), Shermans fox squirrel (*Sciurus niger shermani*), American oystercatcher (*Haematopus palliatus*), brown pelican (*Pelecanus occidentalis*), black skimmer (*Rynchops niger*), burrowing owl (*Athene cunicularia*), limpkin (*Aramus guarauna*), reddish egret (*Egretta rufescens*), snowy egret (*Egretta thula*), little blue heron (*Egretta caerulea*), tricolored heron (*Egretta tricolor*), white ibis (*Eudocimus albus*), roseate spoonbill (*Platalea ajaja*), osprey (*Pandion haliaetus*), mangrove rivulus (*Kryptolebias marmoratus*), mangrove gambusia (*Gambusia rhizophorae*), gopher tortoise (*Gopherus polyphemus*), and the Florida tree snail (*Liguus fasciatus*).

Threatened and endangered plant species include the pine-pink orchid, which frequents the edges of the farm roads just above wetland elevation; the lattice-vein fern which is found occasionally in the forested wetlands; Eaton's spikemoss, and Wright's flowering fern, both found in the Frog Pond natural area; along with the Mexican vanilla plant and Schizaea tropical fern located on tree islands in the upper Southern Glades region.

While small foraging or nesting areas utilized by many of these animal species may be affected by this project, Alts 1-4 are not likely to adversely affect protected State species and have a less than significant and short-term effect on protected State species. Impacts to wading bird species will be similar to those affecting the wood stork. Subtle changes in water quality can also support the prey base so that net effects on forage availability can be variable. Overall, negligible adverse impacts are anticipated to State listed species as a result of this project. For a more detailed analysis, please refer to **Appendix C.2.1**.

5.1.6 Wildlife

A comparison of FWO and CEPP alternatives and their potential effects on wildlife within the CEPP action area are summarized below. For a more detailed analysis, please refer to **Appendix C.2.1.4**. Fur-

ther details on the effects of the alternatives can be found in the Fish and Wildlife Coordination Act Report in **Annex A**.

Effects on State and Federally listed species are described in further detail in **Section C.2.1.4**. Changes in water quality also have the potential to affect prey forage base by altering vegetation composition or structure. Elevated nutrient concentrations in surface water have adversely affected the prey forage base in some portions of the Everglades Protection Area by altering the dominant vegetation coverage from sawgrass to cattails. Nutrient concentrations may be reduced as a result of CEPP and other projects over the next 50 years. Lower nutrient discharges should slow or halt the expansion of cattail acreage which should result in maintained or improved prey forage base over the long-term. Water quality will continue to be monitored under CEPP, and potential effects are largely uncertain at this time.

5.1.6.1 Invertebrates

Short-term, negligible and less than significant effects to the invertebrate community within Lake Okeechobee or EAA are anticipated under any CEPP action alternative. As compared with FWO, all CEPP action alternatives show a minor beneficial effect with performance improvement within the Northern Estuaries as indicated by fewer high volume flow months. Reductions in high volume discharges and salinity fluctuations would likely benefit oysters within the Northern Estuaries. In the St. Lucie Estuary a minor adverse effect is expected due to increases in low flow violations during the dry season. Recent oyster monitoring data during extended dry conditions in the area has shown an increase in oyster disease related to the duration and severity of high salinity conditions. Although these extreme dry spells are rare in the St. Lucie Estuary, supplemental flows during dry times may be warranted and have been accounted for in the IRLS water reservation process.

Within the Greater Everglades aquatic invertebrates would rapidly colonize newly re-hydrated areas with implementation of any alternative providing a long-term, moderate and significant beneficial effect, directly benefitting aquatic invertebrates within the action area. Increase in stages and hydroperiods within WCA 2, northern WCA 3A, WCA 3B, and ENP would promote wetland vegetation transition, increasing periphyton. Periphyton is a primary component of invertebrate diets, including apple snails. In addition to the potential for increased foraging opportunities, changes in vegetation resulting in expansion of wet prairie and increases in emergent vegetation would also provide habitat structure critical for apple snail aerial respiration and egg deposition (Turner 1996; Darby et al. 1999).

Crayfish are important components within the Everglades food web, serving as primary dietary components of higher trophic level species including fish, amphibians, alligators, wading birds, and mammals such as raccoons and river otters (Kushlan and Kushlan 1979). Increases in hydroperiod associated with implementation of any alternative would likely increase crayfish density within northern WCA 3A, WCA 3B, and ENP, particularly within the marl prairies. All action alternatives, especially Alts 4 and 3, would increase hydroperiods within this region resulting in significantly increased native crayfish productivity having a long-term, moderate beneficial effect.

Invertebrate populations associated with Florida Bay may likely show a long-term, minor beneficial effect under all alternatives from an increase in freshwater input resulting in decreased salinities. Invertebrate populations and seagrass beds associated with Biscayne Bay under Alt 2 may likely show a minor beneficial effect from an increase in freshwater input resulting in decreased salinities. Alts 1, 3, and 4 are likely to have a negligible or minor adverse effect.

5.1.6.2 Fish

Implementation of any alternative is expected to significantly improve conditions for fish species throughout much of the Greater Everglades and have a long-term, moderate beneficial effect. The largest percent gains in daily average fish density were predicted within northern WCA 3A and NESRS. In these areas fish densities increased in excess of 30%, with extremes over 80%. Other areas within SRS also experienced appreciable gains in fish density due to increased flows. In comparison, all action alternatives resulted in lower fish densities within WCA 3A along L-67A. Regional percent changes in fish densities were highest in SRS (16-23%) and southern marl prairies (17-31%) as compared with FWO, with Alts 3 and 4 exhibiting the largest percent increases. Taylor Slough experienced negligible positive changes (<1%) (Catano and Trexler 2013).

Introduction or expansion of non-native fish species due to changes in water distribution and increased connectivity within WCA 3A, WCA 3B, and ENP is likely to occur; however, the extent of invasion is uncertain at this time providing a minor adverse effect. In contrast to FWO, new access points will be created under each alternative, with the highest connectivity achieved under Alts 3 and 4. Alt 1 would provide the fewest new access points, thus limiting the potential for spread of invasive and or exotic fish species as compared with the other action alternatives. Additional analysis of invasive and exotic fish can be found in **Section 5.1.17**.

Fish populations associated with Florida Bay may likely show a long-term, minor beneficial effect under all alternatives from an increase in freshwater input resulting in decreased salinities. Fish populations and seagrass beds associated with Biscayne Bay under Alt2 may likely show a minor beneficial effect from an increase in freshwater input and decreased salinities. Alts 1, 3, and 4 are likely to show a negligible or minor adverse effect.

5.1.6.3 Amphibians and Reptiles

Long-term, minor beneficial effects to the amphibian and reptile communities are anticipated under each alternative. All action alternatives showed improved conditions for amphibians within WCA 3 and ENP as compared with FWO. Rehydration within previously dry areas within northern WCA 3A would increase spatial extent of suitable habitat for aquatic amphibian species in this area. Similarly, increased hydroperiods within ENP would also benefit aquatic amphibian species. As hydrology improves within WCA 3 and ENP it is expected that amphibian species richness will also change. However, declines in some amphibian species will be offset by favorable habitat conditions for other species. Increase in forage prey availability (i.e. crayfish and other invertebrates, fish) in areas rehydrated by CEPP implementation will also directly benefit amphibian and reptile species.

5.1.6.4 Birds

The freshwater wetlands of the Everglades are noted for their abundance and diversity of colonial wading birds. Nesting and foraging activities of resident bird species are anticipated to show a long-term, moderate and significant beneficial effect with implementation of any CEPP alternative. Impacts to the Cape Sable seaside sparrow, snail kite, and wood stork are further discussed in **Appendix C.2.1, Section C.2.1.5, and Annex A**. Changes in water quality also have the potential to affect birds through alteration of vegetation composition or structure or impacts to their forage base. Water quality will continue to be monitored under CEPP and potential effects are uncertain at this time.

As predicted by the Trophic Hypothesis (RECOVER 2004), an increase in density of small fishes will directly benefit higher trophic level predators such as wading birds. Therefore, it is predicted that the alternatives that provide the greatest benefit to small fishes as described in **Section C.1.3** will also

perform best overall for wading birds. Crayfish are a particularly important forage resource for nesting white ibis (*Eudocimus albus*). Appropriate foraging conditions and crayfish densities within core foraging areas of nesting wading bird colonies can reduce foraging flight distance, thereby enhancing overall body condition. As indicated in **Section C.1.1**, increases in hydroperiod associated with implementation of any CEPP action alternative would likely increase crayfish density within northern WCA 3A, WCA 3B and ENP, particularly within the marl prairies. Historically, the short hydroperiod wetlands within ENP have been important for wood stork foraging during the pre-breeding season with wood storks shifting to longer hydroperiod wetlands as the dry season progresses. Hydrological patterns that produce a maximum number of patches with high prey availability (i.e. high water levels at the end of the wet season and low water levels at the end of the dry season) are necessary for high reproductive outputs (Gawlik 2002; Gawlik et al. 2004). Depending upon the elevation and microtopography throughout WCA 3 and ENP, implementation of any of the CEPP action alternatives would produce a variety of wetland habitats that would support prey densities conducive to successful wading bird foraging and nesting.

5.1.6.5 Mammals

As compared with FWO, potential long-term, minor beneficial effects to mammals within CEPP action area are anticipated with implementation of any CEPP alternative. Small mammals including raccoons and river otters would benefit from increased crayfish and small prey fish biomass. The increase in water availability and rehydration within northern WCA 3A, WCA 3B, and ENP under all action alternatives will likely benefit Everglades mink (*Mustela vison evergladensis*) as a result of increased forage with Alts 4 and 3 providing the greatest improvements within ENP.

CEPP implementation may negatively affect some mammals dependent upon upland habitat. Due to increased water flow and changes in water distribution it is anticipated that overdrained areas in northern WCA 3A will be rehydrated, triggering a vegetation transition from upland to wetland habitat. Although mammals occurring within the action area are adapted to the naturally fluctuating water levels in the Everglades, there is an increased potential for this vegetation transition to have a short-term significant, adverse, and unavoidable effect on some mammals using upland habitat. This is a particular concern for deer populations within northern WCA 3A that utilize tree islands. However, as discussed in **Section C.2.1.4.4**, no significant effects on tree islands within WCA 3A and ENP are anticipated to occur under any alternative; but, lower elevation tree islands within WCA 3B may be adversely affected by CEPP implementation, with Alts 2 and 3 resulting in the greatest potential impact. Deer populations that utilize the lower elevation tree islands within WCA 3B may suffer from habitat loss. In addition, deer that utilize levees slated for removal (L-67C, L-29, and L-67 Extension) also have the potential to be negatively affected. Loss of these levees may be offset by the construction of the Blue Shanty Levee in WCA 3B. Deer are highly mobile and will migrate to find suitable habitat. No significant negative effects on mammals in the remainder of the CEPP action area are anticipated under any of the alternative.

5.1.7 Essential Fish Habitat

The Caloosahatchee and St. Lucie estuaries will continue to be subjected to high-level freshwater discharges during the wet season, causing salinities to drop below preferred ranges for estuarine biota which could negatively impact species utilizing essential fish habitat in the FWO. Alts 1 through 4 perform similarly in the Northern Estuaries and have the potential to reduce the frequency and volume of high level flows from Lake Okeechobee to the Caloosahatchee River Estuary and the St. Lucie Estuary; thus reducing the potential for impacts to estuarine and nearshore biota associated with essential fish habitat, providing a minor beneficial effect.

For the Southern Estuaries, current operations in the project area have resulted in an inland migration of saline conditions in both groundwater and surface waters. This has caused the expansion of moderate to high salinity zones and has diminished the spatial extent of freshwater wetland habitats in the project area. Under the FWO, less water will be available to contribute to the existing water budget necessary to realize estuarine and nearshore habitat restoration potential. The proposed project components would improve freshwater delivery to coastal wetlands and adjacent estuaries, providing a minor beneficial effect. Implementation of the project would redistribute flow to salt water wetlands and nearshore bay areas and result in favorable changes to salinity levels. These changes may affect essential fish habitat, although the impacts to the aquatic resources are anticipated to be beneficial. Alt 2 performs the best overall for southeastern Biscayne Bay while providing the least restoration benefits to Florida Bay. In contrast, Alt 4 provides the best benefits to Florida Bay, with Alt 3 second. With the increase in benefits to Florida Bay however, Alts 3 and 4 suggest a reduction in hydration within the northern Biscayne Bay. There is no effect for any of the alternatives in Lake Okeechobee, EAA, or the Greater Everglades. A detailed analysis of the Essential Fish Habitat can be found in the National Marine Fisheries Service Biological Assessment (**Annex A**) and in **Appendix C.4.33.6.8.1**.

5.1.8 Hydrology

A summary of the anticipated long-term hydrologic effects of the alternative actions, which were described in **Section 3**, is presented in **Table 5.1-2**. Comprehensive discussion of the anticipated long-term hydrologic effects of the alternative actions is provided in **Section C.2.1.7** of **Appendix C.2.1**. Alts 1 through 4 are compared to the FWO; similarly, the hydrologic effects of the FWO are described based on comparison to the Existing Condition Baseline (ECB). The summary of regional hydrologic differences includes quantitative comparisons between the ECB and FWO and between the FWO and Alts 1 through 4 based on the Regional Simulation Model (RSM)-BN and RSM-GL CEPP modeling representations of these baselines and alternatives. The determination of the directionality of the long-term hydrologic change (improvements and/or adverse hydrologic change) within each specified geographic region is principally based on the results of the ecological evaluation, which are described in **Section 4.2.2**.

Table 5.1-2. Effects of Alts 1 through 4 on Hydrology

Geographic Region	Alt	Hydrologic Effects
Lake Okeechobee	FWO	Moderate hydrologic change, with improvements from reducing the frequency of high lake stages and adverse effect from increasing the frequency of low lake stages. Significant stage reduction of 0.1-0.5 feet for the upper 75% of the stage duration curve. Number of days with stages above 16 feet NGVD is reduced from 870 to 696 during the 1965-2005 period of simulation.
	All Alts	Moderate hydrologic change, with improvements from reducing the frequency of low lake stages and adverse effect from increasing the frequency of high lake stages. Significant stage increase by 0.2-0.4 feet for the upper 60% of the stage duration curve, excluding extreme wet hydrologic conditions. Number of days with stages above 16 feet NGVD is increased from 696 to 1096 during the 1965-2005 period of simulation.
Northern Estuaries	FWO	Caloosahatchee Estuary: Major improvement. Mean monthly flows above 2800 cfs and above 4500 cfs are reduced by 13 and 10 months, respectively (14% and 23% reductions, respectively). Mean monthly flows less than 450 cfs are reduced by 89 months (77%). St. Lucie Estuary: Major improvement. Mean monthly flows above 2000 cfs and above 3000 cfs are reduced by 10 and 12 months, respectively (11% and 28% reductions, respectively).
	All Alts	Caloosahatchee Estuary. Moderate improvement. Mean monthly flows above 2800 cfs and 4500 cfs are reduced by 13 and 2 months, respectively (16% and 6% reductions,

Geographic Region	Alt	Hydrologic Effects
		respectively). St. Lucie Estuary. Major hydrologic change, with improvements for high volume discharges and adverse effect for low volume discharges. Mean monthly flows above 2000 cfs and above 3000 cfs are reduced by 22 and 3 months, respectively (26% and 10% reductions, respectively). Mean monthly flows less than 350 cfs are increased by 30 months (33%).
Greater Everglades: WCA-2A and WCA-2B	FWO	WCA-2A (2A-17): Minor adverse effect. Stages are increased by 0.1-0.2 feet under all hydrologic conditions. WCA-2B (2B-Y): Moderate improvement. Stages within WCA-2B are significantly increased by 0.25-0.50 feet under nearly all hydrologic conditions, excluding extreme wet conditions.
	All Alts	WCA-2A (2A-17): Moderate improvement. Stages are decreased by 0.1-0.3 feet under all hydrologic conditions. WCA-2B (2B-Y): Major adverse effect. Stages are decreased by 0.50-0.75 feet under nearly all hydrologic conditions, excluding extreme wet conditions.
Greater Everglades: WCA 3A and WCA 3B	FWO	a) L-28 Triangle: Negligible effect. b) Northwest WCA 3A (3A-NW): Negligible effect. Stages slightly increased during the wettest 20% of conditions. c) Northeast WCA 3A (3A-NE): Minor to Moderate adverse effect. Stages are decreased by 0.1-0.2 feet, with no significant change during extreme wet or extreme dry conditions. d) East-Central WCA 3A (3A-3): Minor to Moderate adverse effect. Stages are generally decreased by 0.1-0.2 feet, with no significant change during extreme wet or extreme dry conditions. e) Central WCA 3A (3A-4): Minor to Moderate adverse effect. Stages are generally decreased by 0.1-0.2 feet, with no significant change during extreme wet or extreme dry conditions. f) Southern WCA 3A (3A-28): Moderate adverse effect. Stages are generally decreased by 0.2-0.3 feet, with no significant change during extreme wet or extreme dry conditions. g) WCA 3B (Site 71): Minor to Moderate adverse effect. Stages are decreased by 0.1-0.2 feet during normal to dry conditions.
	Alt 1	a) L-28 Triangle: Moderate to major improvement. Stages within the Triangle are increased by 0.2-0.5 feet during nearly all hydrologic conditions, excluding the driest 25% of hydrologic conditions. b) Northwest WCA 3A (3A-NW): Major improvement. Stages are increased by 0.6-0.8 feet. c) Northeast WCA 3A (3A-NE): Major improvement. Stages increased by 0.4-0.7 feet, with no significant change during extreme wet conditions and a slight increase in stage for extreme dry conditions. d) East-Central WCA 3A (3A-3): Major improvement. Stages are increased by 0.2-0.6 feet, with no significant change during the wettest 20% of conditions. e) Central WCA 3A (3A-4): Minor to Moderate improvement. Stages are increased by 0.1-0.2 feet during average to dry conditions, with a slight stage reduction during the wettest 10% of conditions and no significant change during extreme dry conditions. f) Southern WCA 3A (3A-28): Minor improvement. Stages are decreased by 0.1-0.2 feet during the wettest 5% of conditions and slightly decreased during normal to dry conditions. g) WCA 3B (Site 71): Minor to Moderate improvement. Stages are increased by 0.1-0.2 feet during the wettest 10% of conditions and during normal to dry conditions.
	Alt 2	a) L-28 Triangle. Minor improvement. Stages increased by 0.1-0.2 feet during normal to dry conditions.

Geographic Region	Alt	Hydrologic Effects
		b) Northwest WCA 3A (3A-NW): Major improvement. Stages are increased by 0.5-0.7 feet. c) Northeast WCA 3A (3A-NE): Major improvement. Stages increased by 0.5-0.8 feet, with no significant change during extreme wet conditions and a slight increase in stage for extreme dry conditions. d) East-Central WCA 3A (3A-3): Same as Alt 1. e) Central WCA 3A (3A-4): Same as Alt 1. f) Southern WCA 3A (3A-28): Minor adverse effect. Stages are decreased by 0.1-0.2 feet during the wettest 5% of conditions and decreased by 0.1-0.2 feet during wet, normal, and dry conditions. g) WCA 3B (Site 71): Major improvement. Stages significantly increased by 0.3-0.5 feet under all conditions.
	Alt 3	a) L-28 Triangle: Same as Alt 2. b) Northwest WCA 3A (3A-NW): Same as Alt 2. c) Northeast WCA 3A (3A-NE): Same as Alt 2. d) East-Central WCA 3A (3A-3): Same as Alt 1. e) Central WCA 3A (3A-4): Same as Alt 1. f) Southern WCA 3A (3A-28): Minor adverse effect. Stages decreased by 0.1-0.2 feet during the wettest 5% of conditions and decreased 0.1-0.2 feet during normal to dry conditions. g) WCA 3B (Site 71): Major improvement. Stages are significantly increased by 0.2-0.3 feet during the wettest 10% of conditions and during normal to dry conditions.
	Alt 4	a) L-28 Triangle: Same as Alt 2. b) Northwest WCA 3A (3A-NW): Same as Alt 2. c) Northeast WCA 3A (3A-NE): Same as Alt 2. d) East-Central WCA 3A (3A-3): Same as Alt 1. e) Central WCA 3A (3A-4): Same as Alt 1. f) Southern WCA 3A (3A-28): Same as Alt 1. g) WCA 3B (Site 71): Minor to Moderate improvement. Stages are slightly increased during the wettest 10% of conditions and increased by 0.1-0.2 feet during normal to dry conditions.
Greater Everglades: ENP	FWO	a) Northwest ENP (NP-201): Minor improvement. Stages are increased by 0.1-0.2 feet during normal to dry conditions. b) Northeast ENP (NESRS-2): Minor adverse effect. Stages are slightly reduced during normal to dry conditions. c) Central ENP (P-33): Negligible effect. d) Taylor Slough: Minor to Moderate improvement. Stages are increased by 0.1-0.3 feet during nearly all hydrologic conditions.
	Alt 1	a) Northwest ENP (NP-201): Moderate to Major adverse effect. Stages are decreased by 0.1-0.4 feet under all hydrologic conditions. b) Northeast ENP (NESRS-2): Major improvement. Stages are increased by 0.7-1.0 under all hydrologic conditions. c) Central ENP (P-33): Major improvement. Stages are increased by 0.2-0.6 feet under all hydrologic conditions. d) Taylor Slough: Minor improvement. Stages are slightly increased by approximately 0.1 feet during the wettest 20% of hydrologic conditions.
	Alt 2	a) Northwest ENP (NP-201): Moderate adverse effect. Stages are slightly decreased during wet conditions, slightly increased during normal conditions, and decreased by 0.1-0.3 feet under normal to dry conditions. b) Northeast ENP (NESRS-2): Same as Alt 1. c) Central ENP (P-33): Same as Alt 1.

Geographic Region	Alt	Hydrologic Effects
		d) Taylor Slough: Same as Alt 1.
	Alt 3	a) Northwest ENP (NP-201): Same as Alt 2. b) Northeast ENP (NESRS-2): Same as Alt 1. c) Central ENP (P-33): Same as Alt 1. d) Taylor Slough: Same as Alt 1.
	Alt 4	a) Northwest ENP (NP-201): Minor to Moderate adverse effect. Stages are slightly decreased during extreme wet conditions, increased by 0.1-0.2 feet during normal conditions, and decreased by 0.1-0.2 feet under normal to dry conditions. b) Northeast ENP (NESRS-2): Same as Alt 1. c) Central ENP (P-33): Same as Alt 1. d) Taylor Slough: Minor adverse effect. Stages are slightly decreased by 0.1 feet during the wettest 30% of hydrologic conditions.
Southern Estuaries	FWO	a) Biscayne Bay: Moderate improvement. Average annual canal discharges to northern Biscayne Bay (S-27, S-28, and S-29) are increased by 66,000 acre-feet (66 kAF; 19%). b) Florida Bay: Moderate adverse effect. Combined average annual overland flows from Southern ENP to Florida Bay (Transect 23) are decreased by 14 kAF (5%).
	Alt 1	a) Biscayne Bay: Moderate adverse effect. Combined total average annual canal discharges to central and southern Biscayne Bay (S-336, S-338, S-194, S-196, S-197) are reduced by 23-24 kAF (21%). b) Florida Bay: Minor improvement. Combined average annual overland flows from Southern ENP to Florida Bay (Transect 23) are increased by 7 kAF (3%).
	Alt 2	a) Biscayne Bay: Minor to Moderate adverse effect. Combined total average annual canal discharges to central and southern Biscayne Bay are reduced by 23-24 kAF (21-22%). Average annual canal discharges to northern Biscayne Bay are increased by 14 kAF (3%). b) Florida Bay: Same as Alt 1.
	Alt 3 & 4	a) Biscayne Bay: Moderate to Major adverse effect. Combined total average annual canal discharges to central and southern Biscayne Bay are reduced by 37-44 kAF (34-40%). b) Florida Bay: Moderate improvement. Combined average annual overland flows from Southern ENP to Florida Bay (Transect 23) are increased by 9-10 kAF (4%).

5.1.9 Water Quality

The assessment of project impacts to water quality is summarized in **Table 5.1-3** below. The detailed analyses are found in **Appendix C.1**, **Appendix C.2.1**, and **Appendix C.2.2** as well as **Annex F**.

Table 5.1-3. Effects of Alts 1 through 4 on Water Quality

Geographic Regions	Alts	Water Quality
Lake Okeechobee	FWO	WQ is expected to improve relative to present conditions as the result of implementation of Total Maximum Daily Loads (TMDLs), and implementing the associated BMAPs for the basins discharging to the lake.
	All Alts	Relative to FWO, no significant change to lake water quality is expected; however, additional backflow into the lake at S-308 increases the phosphorus load slightly. Changes in phosphorus loads will be addressed holistically throughout the watershed via the Florida Department of Environmental Protection's Lake Okeechobee Basin Management Action Plan (BMAP) process (Section 403.067, Florida Statutes). The BMAP is a currently under development via a public stakeholder driven process.
Northern Estuaries	FWO	Number of low salinity events reduced for both Caloosahatchee and St. Lucie relative to baseline conditions. Number of high salinity events reduced for the Caloosahatchee

Geographic Regions	Alts	Water Quality
		Estuary and St. Lucie Estuary. Improved nutrient and dissolved oxygen conditions expected to result from reduced high flow events from Lake Okeechobee, improved Lake Okeechobee nutrient levels, and improved estuary basin runoff quality.
	All Alts	Relative to FWO, number of low and high salinity events for Caloosahatchee is reduced. Number of high flow events reduced in St. Lucie, however, the number of low flow events increased. Improved nutrient and dissolved oxygen conditions expected to result from reduced high flow events from Lake Okeechobee, improved Lake Okeechobee nutrient levels, and improved estuary basin runoff quality due to implementation of TMDLs for nutrients.
EAA	FWO	Relative to existing conditions improvement in nutrient concentrations due to implementation of additional storm water treatment areas (STAs). Slight reduction in sulfate due to additional removal in STAs as well as expected reduction in future farming activities due to Restoration Strategies Implementation and reduced flow. Dynamic Model for Stormwater Treatment Areas (DMSTA) water quality modeling indicates that SFWMD's Restoration Strategies Program is expected to result in compliance with the 2012 water quality-based effluent limits (WQBEL) for total phosphorus. The Restoration Strategies plan is scheduled for completion in 2029.
	All Alts	Relative to FWO condition, integration of the A2 FEB with the State of Florida's A1 FEB, STA 3/4 and STA2 allows for the delivery of restoration flows. The DMSTA water quality model prediction shows compliance with the WQBEL. CEPP plan increases flows through the Central flow path, but it also provides increased FEB storage. Based on DMSTA modeling, the additional FEB storage provided in the central flow path by CEPP, in combination with the A-1 FEB, STA-2, and STA-3/4, is sufficient to handle the additional CEPP flows (approximately 215 kac-ft/yr) and still achieve the WQBEL.
Greater Everglades	FWO	<p>Relative to baseline conditions, expect reduction in nutrient concentrations entering Everglades Protection Area due to implementation of new STAs in EAA. Reduced sulfate load expected as a result of reduced flows and reduction of farming activities in Restoration Strategy project lands.</p> <p>Relative to baseline conditions, increased frequency of meeting the water quality 1991 Settlement Agreement compliance requirements for Loxahatchee, and Shark River Slough. This is a result of construction of additional STAs in the EAA and S9 Basin as well as further progress on implementation of nutrient BMPs in developed areas adjacent to the Everglades.</p> <p>Mercury load available for methylation is likely to increase as a result of increased offshore Hg atmospheric load. This will be moderated somewhat by the implementation of FDEP Total Hg TMDL and new EPA Clean Air Act standards for emissions of Hg.</p>
	Alt 1 & 4	<p>WCA 3A: Backfilling of northern portion of Miami Canal and re-direction of water into the northern marsh areas will result in greater uptake of nutrients and sulfate in northern WCA 3A. Increased flows and new flow patterns may result in increased water column phosphorus concentrations at one or more TP rule stations; however, this should have minimal impact on TP rule compliance. Reduced incidence of dry out of the northern marsh should limit peat oxidation and nutrient re-mobilization. Lower phosphorus and sulfate concentrations should occur in southern WCA 3A. Redistribution of flows into the northern marsh and away from the Miami Canal will result in a change in locations of methylmercury "hotspots" identified as areas where methylmercury concentrations are high in fish.</p> <p>WCA 3B: Reduction in dry out events relative to FWO will result in reduced peat oxidation</p>

Geographic Regions	Alts	Water Quality
		<p>/ re-mobilization of nutrients. Additional flows into WCA 3B through the S-631 structure may result in increased water column phosphorus concentrations at one or more TP rule stations; however, this should have minimal impact on TP rule compliance.</p> <p>ENP: It is uncertain how changes in flow distributions proposed under CEPP will impact compliance with Appendix A of the 1991 Settlement Agreement. Over the long-term, distributing the flow over the northern WCA-3A marsh, reducing short-circuiting down the canals to ENP, adding more flow from the lake that is treated to the WQBEL, and distributing these flows over the marsh should result in improvements by lowering the flow weighted mean total phosphorous concentration entering the Park. In the short-term, to address the uncertainty in compliance with Appendix A, the Technical Oversight Committee (TOC) is currently reviewing applicability of the current Appendix A compliance methodology for a restored ecosystem. Relative to FWO, no changes to Settlement Agreement compliance for Loxahatchee and Taylor Slough are expected.</p>
Southern Estuaries	FWO	Base salinity conditions in Florida Bay are poor - current or FWO conditions are far from the restoration target. Relative to baseline condition, slight reduction in salinities in nearshore zones. Nutrient loading from upland areas not expected to change significantly relative to baseline conditions.
	All Alts	Improved salinity conditions relative to FWO condition. With-project mean salinity moves closer to the target with a 2 psu decrease in the bay's central zone and an average salinity decrease of 1.5 psu among all bay zones for wet and dry seasons. While this appears to be a small change, this grand mean of salinity improvement (over a simulated 36 year period) is still a major step toward the restoration target.

5.1.10 Air Quality

Comparison of the FWO and alternatives is summarized in **Table 5.1-4**. A detailed analysis of project impacts on air quality compliance and to emissions of CO₂ is provided in **Appendix C.2.1**.

Table 5.1-4. Effects of Alts 1 through 4 on Air Quality

Air Quality					
Geographic Regions	FWO	Alt 1	Alt 2	Alt 3	Alt 4
Lake Okeechobee ----- Northern Estuaries	Relative to existing conditions baseline, population growth in area expected to increase air pollution; however, air quality compliance is expected.	Negligible and less than significant effect relative to FWO condition.			
EAA	No change in compliance with Air Quality Standards is expected relative to baseline condition.	Negligible and less than significant effect in air quality compliance. Reduction in farming equipment use on A-2 FEB lands in FWO condition will be offset by increase in air pollutants from pump stations. Particulate loading should be reduced since sugar cane cultivation no longer done on FEB lands and thus annual burning during harvesting will no longer be done. Conversion of A-2 FEB lands from agriculture will result in decrease in CO ₂ emissions due to annual burning and an increase in CO ₂ capture through peat soil accretion.			

Air Quality					
Geographic Regions	FWO	Alt 1	Alt 2	Alt 3	Alt 4
Greater Everglades	Increased LEC development will result in air quality degradation relative to baseline conditions. Enforcement of CAA should limit impacts.	Minor beneficial effect with decrease in drying event severity relative to FWO condition should result in reduced fire incidence within wetlands which should improve air quality. Rehydration of wetlands expected to result in increased CO ₂ sequestration through peat accretion.			
Southern Estuaries	No change				

5.1.11 Hazardous, Toxic and Radioactive Waste

A summary comparison of Hazardous, Toxic, and Radioactive Waste (HTRW) is in **Table 5.1-5**. The expanded HTRW assessment is found in **Appendix C.1**. HTRW reports and correspondence are found in **Annex H**. The residual agricultural chemical policy assessment is found in **Appendix C.2.2**.

Table 5.1-5. Effects of Alts 1 through 4 on HTRW

HTRW					
Geographic Regions	FWO	Alt 1	Alt 2	Alt 3	Alt 4
Lake Okeechobee	Increased development within basin may result in increase in new HTRW sites while existing ones should continue to be remediated.				
Northern Estuaries	Increased development within Caloosahatchee and St. Lucie basins may result in new HTRW sites while existing ones should continue to be remediated.				
EAA	A-2 FEB lands continue to be farmed which may result in new HTRW releases on these lands as well as additional pesticide application to cultivated areas.	A-2 FEB lands converted to wetlands so potential for new HTRW or pesticide application to soils is reduced relative to FWO condition.			
Greater Everglades	FDEP identified HTRW sites are remediated and new sites are documented and eventually remediated. Potential for illegal waste disposal remains high.				
Southern Estuaries	FDEP identified HTRW sites are remediated and new sites are documented and eventually remediated.				

5.1.12 Noise

All action alternatives would result in minor and short-term increases in noise during construction as compared with the FWO and a less than significant effect. All action alternatives include additional pump stations which would result in long-term, localized increases in noise. Alt 3 would have the greatest effect with the addition of 5 pump stations.

5.1.13 Aesthetics

In the Northern Estuaries, the action alternatives would increase the aesthetic value due to decreased high flow events and provide a long-term, minor beneficial effect. Reductions in high volume discharges to the estuaries would result in lower suspended solids, increased water clarity and improvements to the salinity envelopes that maintain healthy SAV beds. These benefits could also lead to an increase in wildlife viewing opportunities. With the EAA, wetland vegetation is anticipated to colonize the A-2 FEB, increasing wildlife utilization and opportunities for wildlife viewing within the area, providing a long-term, major beneficial and significant effect. In the Greater Everglades, Alts 3 and 4 had a greater effect on aesthetics as compared with Alts 1, 2, and FWO due to the addition of two pump stations along the L-29 levee in Alt 3 and the construction of a new levee (Blue Shanty Levee) in Alt 4. The action alterna-

tives would result in temporary, short-term, minor effects to aesthetics during construction of all features. The action alternatives show a long-term, major beneficial and significant effect with an increase in aesthetic value over the FWO due to restoration of hydropatterns and sheetflow throughout the project area. The restoration of sheetflow provides additional habitat for native plants and animals and increased opportunities for wildlife viewing. Restoration of flows within Florida Bay and the southwestern coastal estuaries would reduce extreme salinity ranges and improve habitat within these regions, increasing potential opportunities for wildlife viewing providing a long-term, minor beneficial effect.

5.1.14 Land Use

All of the land in consideration for CEPP is in public ownership. Land being converted from agricultural production to wetlands within the A-2 FEB accounts for the only significant long-term, land use change.

5.1.14.1 Wetlands

Effects on wetlands and uplands are summarized for the final array of alternatives in **Table 5.1-6**. The action alternatives show a long-term, major beneficial and significant effect with an increase in wetland/upland habitat and wetland function over FWO with minor differences between alternatives. The differences stem from different project features (lengths of backfilling, gaps, number of structures, etc) as detailed below. While there is a long-term, minor adverse effect due to the construction of some features, most notably the Blue Shanty Levee in WCA 3B, the construction of other features, the degradation of levees, and the backfilling of canals) reconnects and adds wetland acreage and provides the needed topography for sheetflow to restore the natural system. Also, shifting approximately 14,000 acres of former agricultural land (currently classified as agriculture land cover and wetland soils) to a higher quality wetland within the A-2 FEB increases the quality of the existing wetland habitat as well as the functionality. The WCA 3B flowway achieves a central goal of Comprehensive Everglades Restoration Plan (CERP) and of CEPP: restoration of continuous sheet-flow, over long distances, and in the original flow directionality. If the new levee is not constructed and water stages are not raised substantially within WCA 3B, then significant southward movement of water into NESRS from WCA 3B cannot be achieved by gravity flow alone due to higher wet season stages in the L-29 Canal associated with the implementation of the TTNS Project implementation; it must instead be driven by pumps. These pumps in turn would require additional dredging of former remnant agricultural ditches within southern WCA 3B to create expanded intake canals. The disturbance footprint would potentially be similar to that of the new levee. Focusing instead on Alt 4, we note that creation of the new levee enables the removal of a similar length of existing levee (L-67C). A detailed description of the differences in wetland/upland acres is provided in **Appendix C.2.1**. In addition to the long-term benefit of increased wetland/upland acres, the wetland function increases as well due to backfilling the Miami Canal and the restoration of sheetflow across WCA 3A and 3B into ENP. The initial construction may have a temporary, short-term adverse affect on the wetland function in the construction areas, but once the project is complete, all alternatives would increase wetland function based on the acres of wetlands gained.

Table 5.1-6. Effects of Alts 1 through 4 on Wetlands (acres)

Project Feature	FWO Acres of Wetland Gain (Loss)	Alt 1 Acres of Wetland Gain (Loss)	Alt 2 Acres of Wetland Gain (Loss)	Alt 3 Acres of Wetland Gain (Loss)	Alt 4 Acres of Wetland Gain (Loss)
L-4 Degrade	0	35	35	35	35
Miami Canal Backfill	0	417	469	469	469
Miami Canal Spoil Mounds	0	45	49	49	49
L-67A Culverts	0	(4.5)	(13.5)	(18)	(13.5)
L-67C Gaps	0	9	27	36	9
L-67C Flow Way Degrade	0	0	0	0	49
L-29 Degrade	0	0	0	0	32
Blue Shanty Levee	0	0	0	0	(84)
L-67 Extension Backfill	0	29	104	104	104
Old Tamiami Trail Road Degrade	0	0	0	0	0
Total Net Change	0	531	671	675	650

5.1.14.2 Agriculture

Modest expansion in overall agricultural acreage, along with a very slight rise in water use, is expected in the study area within FWO as compared to the existing condition. Agricultural acreage declines slightly in Miami-Dade County, primarily due to urbanization. Broward County and Palm Beach County's Coastal sub-basin expect a slight increase. Irrigated acreage in the EAA remains stable since it is fully developed and permitted. The number of acres cultivated in any given year is driven by market forces and cultivation practices such as rotating crops (SFWMD Draft LEC Water Supply Plan, 2013).

The entire CEPP project area consists of lands currently under public ownership; however, the A-2 footprint is currently under lease for sugarcane production. For all action alternatives the A-2 FEB footprint of agriculture land will be converted into an FEB. The A-2 footprint will continue to be farmed in the FWO.

As described in **Section 5.1.8**, short-term, negligible and less than significant changes were noted for water stages within the South Dade Conveyance System; therefore no effects on agriculture within this region are anticipated. Coordination with the United States Department of Agriculture (USDA) and National Resources Conservation Service (NRCS) to meet the requirements of the Farmland Protection Policy Act, is ongoing. When detailed design information that locates each of the plan components is completed, it can then be determined how many acres of unique farmland would be affected by the Project. See **Appendix C.4.12** for more information.

5.1.15 Socioeconomics**5.1.15.1 Population**

The CEPP study area population is expected to increase by 18 percent from 2010 to 2030 with Palm Beach and Miami-Dade counties attracting the greatest number of new residents. Monroe County is expected to experience a small reduction in permanent residents over the next 20 years. When aggregated, the total population is projected to increase by 1 million people. This is a slower rate of

growth than projected previously in CERP planning efforts. Population projections are not anticipated to differ between the FWO and alternative conditions.

Congress enacted the 1996 Federal Agriculture Improvement and Reform Act (Farm Bill) and provided funds on April 4, 1996 (Public Law 104-127, 110 Statue 1022). Under Section 390 of the Farm Bill, the Secretary of the Interior was authorized to use funds made available to conduct restoration activities in the Everglades ecosystem in south Florida, including but not limited to the acquisition of real property and interests in real property located within the Everglades ecosystem. The Farm Bill provided that the Secretary of the Interior could transfer funds to the USACE, the State of Florida, or the SFWMD to conduct the aforementioned restoration activities. The A-2 site was purchased with Farm Bill monies. The loss of agricultural production in the A-2 FEB and potential effects on socioeconomic conditions and low income/minority populations were addressed during the land acquisition. CEPP does not present any environmental impacts that are high, adverse and disproportionate to low income, or minority populations.

There will be no impacts to Lake Okeechobee commercial navigation with this project. The hydrologic modeling conducted for all CEPP alternatives to optimize system-wide performance incorporated the current Regulation Schedule management bands of the 2008 LORS. The hydrologic modeling of the CEPP alternatives included proposed revisions to the 2008 LORS flow chart guidance of maximum allowable discharges, which are dependent on the following criteria:

- Class limits for Lake Okeechobee inflow and climate forecasts, including tributary hydrologic conditions, seasonal climate outlook, and multi-seasonal climate outlook
- Stage level, as delineated by the Regulation Schedule management bands
- Stage trends (whether water levels are receding or ascending)

Most of the 2008 LORS refinements applied in the CEPP modeling lie within the bounds of the operational limits and flexibility available in the current 2008 LORS, with the exception of the adjustments made to the class limits for the Lake Okeechobee inflow and climate forecasts. Under some hydrologic conditions, the class limit adjustments made to the Lake Okeechobee inflow and climate forecasts reduced the magnitude of allowable discharges from the Lake, thereby resulting in storage of additional water in the Lake in order to optimize system-wide performance and ensure compliance with Savings Clause requirements. However, these class limit changes represent a change in the flow chart guidance that extends beyond the inherent flexibility in the current 2008 LORS. Additional information and documentation of the CEPP recommended plan modeling assumptions for Lake Okeechobee operations are found in the **Appendix A**. The authorized C&SF project depths for Lake Okeechobee navigation are based on 12.56 ft NGVD.

5.1.15.2 Socioeconomics: Water Supply and Flood Control

A summary of the anticipated long-term effects on water supply and flood control of the alternative actions is presented in **Table 5.1-7**. Alts 1 through 4 are compared to the FWO; similarly, the water supply and flood control effects of the FWO are described based on comparison to the ECB. The summary of regional performance differences (**Table 5.1-7**) includes quantitative comparisons between the ECB and FWO and between the FWO and Alts 1 through 4 based on the RSM-BN and RSM-GL CEPP modeling representations of these baselines and alternatives. The period of simulation (1965-2005) used for the CEPP hydrologic modeling encompasses a wide range of historical climatologic and meteorologic conditions that are representative of south Florida hydrology. This analysis period includes

several moderate wet and moderate dry periods, as well as less frequent and potentially more impactful periods of both extreme high rainfall and extreme drought conditions.

Table 5.1-7. Effects of Alts 1 through 4 on Water Supply and Flood Control

Geographic Region	Alts	Water Supply and Flood Control
Lake Okeechobee	FWO	Moderate adverse effect. Compared to the ECB, mean annual Everglades Agricultural Area (EAA) water supply demands not met are increased from 7% to 8%. Lake Okeechobee Service Area (LOSA) water supply cutback percentage is increased for 3 of the 8 years with the largest water supply cutbacks.
	All Alts	Minor improvement. Compared to the FWO, mean annual EAA water supply demands not met are decreased from 8% to 7%. LOSA water supply cutback percentage is increased for 1 of the 8 years with the largest water supply cutbacks.
Greater Everglades	FWO	Major flood control improvement. Compared to the ECB, the frequency of WCA 3A stages within Zone A of the Regulation Schedule is significantly reduced from 32% to 18% of the 1965-2005 period of simulation.
	All Alts	Moderate flood control improvement. Compared to the FWO, the frequency of WCA 3A stages within Zone A of the Regulation Schedule is moderately increased from 18% to 20-22% of the 1965-2005 period of simulation. Stages within the wettest 10% of hydrologic conditions, however, are generally reduced by 0.2-0.3 feet.
Lower East Coast Service Area 1 (Palm Beach)	FWO	Moderate adverse effect. 3 additional water years with 3 or more consecutive months with restrictions, which result from lower Lake Okeechobee stages and not local groundwater conditions. Local groundwater stages east of WCA 1 reduced by 0.2-0.5 feet for the driest 10% of hydrologic conditions. Local groundwater stages south of the Site 1 CERP project reduced by 0.2 feet for normal to dry conditions and by up to 1.0 feet during extreme dry conditions.
	All Alts	Minor improvement. 1 fewer water years with 3 or more consecutive months with restrictions. No significant changes to local groundwater stages.
Lower East Coast Service Area 2 (Broward)	FWO	Minor adverse effect. 1 additional water year with 3 or more consecutive months with restrictions which results from lower Lake Okeechobee stages and not local groundwater conditions. Local groundwater stages slightly reduced for the driest 10% of hydrologic conditions.
	All Alts	Minor adverse effect. No change in the number of water years with 3 or more consecutive months with restrictions. No significant changes to local groundwater stages which are prevalent through normal to dry hydrologic conditions. Reduced stages are indicated during the driest 5-10% of hydrologic conditions for some monitoring gages located east of WCA-2A and WCA-2B.
Lower East Coast Service Area 3 (Miami-Dade)	FWO	Moderate to major adverse effects. a) 3 additional water years with 3 or more consecutive months with restrictions, which result from lower Lake Okeechobee stages and not local groundwater conditions. b) L-30 canal stages are reduced by 0.2-0.4 feet for normal to extreme dry conditions. c) L-31N canal stages are slightly reduced by 0.1-0.2 feet for extreme dry conditions. Slight increase to flood control stages within the wettest 10% of hydrologic conditions. d) C-111 canal stages between S-176 and S-18C are generally lowered by 0.2-0.5 feet for normal to extreme dry conditions.

Geographic Region	Alts	Water Supply and Flood Control
	Alt 1	<p>Moderate improvement, with no anticipated adverse effect.</p> <ul style="list-style-type: none"> a) Decrease of 2 water years with 3 or more consecutive months with restrictions. b) L-30 canal stages are generally increased by 0.2-0.4 feet for normal to extreme dry conditions (similar to existing condition baseline). General moderate reduction of 0.2 feet to flood control stages within the wettest 10% of hydrologic conditions. c) L-31N canal stages are increased by 0.3-0.5 feet for dry conditions. Significant reduction to flood control stages within the wettest 5% of hydrologic conditions d) No significant change to C-111 canal stages between S-176 and S-177 and increase by 0.2 feet between S-177 and S-18C during normal hydrologic conditions.
	Alt 2	<p>Moderate to significant change, with general improvements for water supply and flood control; potential increased flood control risk along L-30 (to the adjacent Pennsuco wetlands, adjacent Miccosukee Tribe reservation, and Miami-Dade urban areas located several miles east of the Pennsuco) during normal to wet conditions and potential increased water supply risk along L-31N during normal to dry conditions.</p> <ul style="list-style-type: none"> a) Decrease of 2 water years with 3 or more consecutive months with restrictions. b) L-30 canal stages are generally increased by 0.3-1.0 feet for normal to extreme dry conditions. General moderate reduction of 0.3 feet in flood control stages within the wettest 10% of hydrologic conditions. c) L-31N canal stages are lowered by 0.2-0.3 feet for normal to dry conditions. Significant reduction in flood control stages within the wettest 5% of hydrologic conditions. d) Same as Alt 1 for C-111 canal stages.
	Alt 3	<p>Moderate change, with general improvements for water supply and flood control; potential increased water supply risk along L-31N during normal to dry conditions.</p> <ul style="list-style-type: none"> a) Decrease of 2 water years with 3 or more consecutive months with restrictions. b) L-30 canal stages are generally increased by 0.3-0.7 feet for normal to extreme dry conditions. General moderate reduction of 0.2 feet in flood control stages within the wettest 10% of hydrologic conditions. c) L-31N canal stages are lowered by 0.2-0.3 feet for wet, normal, and dry conditions. Significant reduction to flood control stages within the wettest 5% of hydrologic conditions. d) Same as Alt 1 for C-111 canal stages.
	Alt 4	<p>Moderate change, with general improvements for water supply and flood control; potential increased water supply risk along L-31N during normal to dry conditions.</p> <ul style="list-style-type: none"> e) Decrease of 2 water years with 3 or more consecutive months with restrictions. a) L-30 canal stages are generally increased by 0.1-0.2 feet for normal to extreme dry conditions. General moderate reduction of 0.2 feet in flood control stages within the wettest 10% of hydrologic conditions. b) L-31N canal stages are lowered by 0.2-0.3 feet for wet, normal, dry, and extreme dry conditions. Significant reduction in flood control stages within the wettest 5% of hydrologic conditions. c) Same as Alt 1 for C-111 canal stages.

5.1.15.3 Recreation

Alternative effects on recreation are presented in **Table 5.1-8** with additional details provided in **Appendix C.2.1.15. Table 5.1-9, Table 5.1-10,** and provide information on when the Florida Fish and Wildlife Commission (FWC) considers closures in the Everglades and Francis S. Taylor Wildlife Management Areas (EWMA) due to high or low water stages. Comprising WCAs 2A, 2B, 3A, and 3B, the EWMA totals 671,831 acres, or 82% of the WCAs in south Florida and roughly 30% of the remaining Everglades landscape south of the EAA. A closure event for these tables is one or more consecutive days when high or low water criteria are met based on the two gauge average for WCA 3A-2 and WCA 3A-3.

Table 5.1-8. Effects of Alts 1 through 4 on Recreation

Recreation		
Geographic Regions	FWO	With Project Conditions
Lake Okeechobee	No effect	Negligible and less than significant effects for Alts 1-4. There will be no impacts to recreational navigation with this project.
Northern Estuaries	No effect	Reductions in high flows to the estuaries resulting from Alts 1-4 would provide minor and less than significant beneficial effects by enhancing utilization of estuaries by fish and subsequently improve related recreational opportunities such as fishing, boating and kayaking.
EAA	Currently no recreation exists on A-2 parcel.	The FEB feature included in Alt 1-4 will add 14,000 acres of recreational opportunities and facilities, providing a minor and less than significant beneficial effect.
Greater Everglades	Minimal effect on recreational fishing. No effect on hiking, biking and camping. Degraded wetlands and aesthetic values could impact wildlife viewing and nature study. Peat loss to oxidation and fire would degrade current habitat further and impact hunting opportunities.	<p>Alts 1-4's improved hydrology will enhance wildlife populations through improved survival and reproduction, subsequently resulting in a minor and less than significant beneficial effect for outdoor recreation opportunities. Proposed facilities will enhance the public's ability to access into and within the Greater Everglades. Increased hydration in the very northern WCA 3A areas that have been drier may have a short-term significant, adverse and unavoidable effect on hunting (deer, hog, and rabbit). Conversely, a long term major significant benefit occurs due to increased fire protection for the peat soils, thus diminishing the potential for loss of this same area. Of the three alternatives, Alt 1 has the least negative effect on northern WCA 3A mammal hunting opportunities. For Alts 1, 2 and 3 in the northern dry areas public access is often limited to track vehicles; rehydration will increase public access through improved conditions favorable to airboats.</p> <p>Access for recreational fishing by power boats will have a major adverse and significant effect through backfilling of the Miami Canal between S-8 and I-75. This affects 14 of the 33 miles of the Miami Canal in the WCA 3. Fishing opportunities throughout the Greater Everglades will have a major beneficial effect by the improvements in boat access and the addition of access points around the proposed structures. Improved trailheads for access and designation of blue and greenway trails will be positive.</p> <p>Alt 4's Blue Shanty Levee will bisect L67C. Recreational fishing by prop boat to the northern end of L67C canal would continue to be available from a new public boat ramp located in the northern end of L67C at the S151, providing a minor beneficial effect. Also at the S151 a new public boat ramp will allow access into the northern 5 miles of the Miami Canal south of S151 not previously served by a public boat ramp. The Blue Shanty Levee will have an airboat crossing at full height so as to not bisect the airboat use within WCA3B. The removal of a segment of the L-29 levee will create a marsh connection between WCA 3B and the L-29 Canal and enhance fishing. A boat ramp will be added near S333 to provide access to the L-29 Canal so the L-29 divide structure (S-355W) does not prevent boat access. The L-29 divide structure will also serve as a pedestrian and vehicle access to the remaining eastern L-29 Levee. The Blue Shanty Levee will serve as a reroute connection for greenways</p>

Recreation		
Geographic Regions	FWO	With Project Conditions
		trail users when the L-29 levee segment is removed, to ensure contiguous connection east to west between S333 and S334.
Southern Estuaries	No effect	Access to the Southern Estuaries would not change based on CEPP, however, increase in flows to Florida Bay would enhance fish populations and subsequently significantly improve related recreational opportunities such as fishing, boating and kayaking, providing a minor beneficial effect.

Table 5.1-9. Closures over the Period of Record (POR) in the EWMA for the ECB, FWO and Alts 1 through 4

Alt	High Stage Closures over POR			Fire Closures over POR			Total High Water and Low Water Closures			
	(2 Gauge avg. > 11.6' ft)			(2 gauge avg. <= 9.30' ft)						
	Closure Days	Closure Events	Avg. Closure Duration (Days)	Closure Days	Closure Events	Avg. Closure Duration (Days)	Closure Days	Closure Events	Avg. Closure Duration (Days)	% of POR-Closure
ECB	511	15	34.1	599	19	31.5	1,110	34	32.6	7.4%
FWO	441	12	36.8	677	21	32.2	1,118	33	33.9	7.5%
Alt 1	635	19	33.4	230	7	32.9	865	26	33.3	5.8%
Alt 2	610	18	33.9	247	5	49.4	857	23	37.3	5.7%
Alt 3	589	18	32.7	247	5	49.4	836	23	36.3	5.6%
Alt 4	613	16	38.3	246	5	49.2	859	21	40.9	5.7%

Notes:

* 2 Gauge avg. is based on cells WCA 3A-2 and WCA 3A-3.

*3A-2 & 3A-3 average ground surface elevation = 9.66 ft NGVD (closure thresholds are indicated in Table 5.1-9)

Table 5.1-10. High Water Event Changes from the FWO for Alts 1 through 4 in the EWMA for each Month of the Year

Month	ECB	FWO	Alt 1	Alt 2	Alt 3	Alt 4	Month
1	0	0	0	0	0	0	1
2	1	0	2	2	1	2	2
3	0	0	1	0	0	0	3
4	0	0	0	0	0	0	4
5	0	0	0	0	0	0	5
6	0	0	3	3	3	3	6
7	2	0	3	2	2	1	7
8	0	0	1	1	1	1	8
9	0	0	-1	-1	-1	-1	9
10	0	0	-2	-1	-2	-2	10
11	0	0	0	0	1	0	11
12	0	0	0	0	1	0	12
Total	3	0	7	6	6	4	Total

Table 5.1-11. High Water Events for the ECB, FWO, and Alts 1 through 4 in the EWMA for each Month of the Year

Month	ECB	FWO	Alt 1	Alt 2	Alt 3	Alt 4	Month
1	0	0	0	0	0	0	1
2	1	0	2	2	1	2	2
3	1	1	2	1	1	1	3
4	0	0	0	0	0	0	4
5	0	0	0	0	0	0	5
6	2	2	5	5	5	5	6
7	3	1	4	3	3	2	7
8	0	0	1	1	1	1	8
9	2	2	1	1	1	1	9
10	5	5	3	4	3	3	10
11	1	1	1	1	2	1	11
12	0	0	0	0	1	0	12
Total	15	12	19	18	18	16	Total

5.1.16 Cultural Resources

Alternatives 1 through 4 effects to cultural resources are presented in **Table 5.1-12**. Criteria used to evaluate the alternatives are found in **Section 5.1**. A description of full preliminary analysis, background information and descriptions of terms are presented in **Appendix C.2 (Section C.2.1.17)**.

In conjunction with the National Historic Preservation Act (NHPA), formal consultation was initiated with the Seminole Tribe of Florida's Tribal Historic Preservation Office (THPO); the Miccosukee Tribe of Indians of Florida's NAGPRA Representative; the Florida State Historic Preservation Office (SHPO); Everglades National Park's, Chief of Cultural Resources; and the Florida Bureau of Archaeological Research (**Appendix C.5**). During formal consultation, a number of conclusions were drawn: (1). It was determined that additional surveys were needed to identify cultural resources within specific areas of potential effect, (2). It was decided that as the CEPP project progressed, additional surveys may be needed, specifically during the PED phase, when feature designs were finalized and construction staging areas were determined, and (3). Section 106 compliance with the NHPA would be conducted separately from NEPA and would not be completed during the current feasibility phase of the project, however would be complete prior to construction of each feature.

Under the NEPA process (Section 40CFR1501.2(d) (2)), formal consultation regarding cultural resources has been completed and is final for the CEPP feasibility study. For consideration under the NHPA, determinations of potential effects and mitigation of those effects on cultural resources listed in **Table 5.1-12** are preliminary and should not be considered final. As required under the NHPA, further Section 106 (36 CFR Part 800) consultation is required and will be completed during the PED phase. The CEPP is currently in compliance with the procedural requirements of the NHPA and will remain in compliance with the NHPA pre and post construction.

Avoidance of adverse effects to cultural resources is the Corps preference, therefore, throughout the planning process for CEPP, the project archaeologist, engineers, and plan formulators have worked closely to determine alternatives and features of alternatives that reduce or eliminate impacts to cultural resources. Pursuant to 36 CFR 800.1, where possible, the project design will be modified to avoid impacting significant historic properties and culturally significant sites. Where avoidance is not possible, other mitigation measures will be considered, which could include but are not limited to data

recovery excavations. The mitigation measures will be developed in consultation with SHPO, tribal groups and other interested parties as established in implementing regulations for Section 106 of the NHPA.

The use of the term cultural resources includes historic properties that are eligible or potentially eligible for NRHP listing, and culturally significant sites. For definitions of terms see **Section 10**.

Table 5.1-12. Effects of Alts 1 through 4 on Cultural Resources

Cultural Resources (Please refer to Cultural Resources in Appendix C.2.1 for further details)					
Geographic Regions	FW0	Alt 1	Alt 2	Alt 3	Alt 4
Lake Okeechobee	No effect on cultural resources.				
Northern Estuaries	No effect on cultural resource.				
EAA, including Associated Canals and Structures	Long-term adverse effect on cultural resources 8PB16039 and 8PB16040.	Major long-term adverse effects on cultural resources sites 8PB16039 and 8PM16040. Mitigation of effects for historic property 8PB16039 potentially reduced to no effect. Mitigation of effects for culturally significant site 8PB16040 is unknown.			
L-4 Spreader Feature	No effect on cultural resources.	The L-4 (8BD5098) is not significant, therefore no effect on cultural resources.			
S-8 Pump Station Complex	No effect on cultural resources.	Unknown effects on historic property 8BD5092. More work needed to determine NRHP eligibility. If applicable, mitigation could potentially reduce effects.			
L-5 Deepening/Widening and Spreader Feature	No effect on cultural resources.			The L-5 (8BD5099) is not significant, therefore no effect. Potential major long term effects on cultural resources 8BD4836-4838. Mitigation could potentially reduce effects In addition to being historically significant, all three sites contain material deemed culturally sensitive to both tribes	
L-6 Deepening/Widening	No effect on cultural resources.	Unknown – assessment needed for the L-6 levee and associated canal. If applicable, mitigation could potentially reduce effects.			
Miami Canal	No effect on cultural resources.	Major long-term adverse effect on historic properties 8PB4840/8BD5097. Mitigation could potentially reduce effects.			
L-67A Levee and Canal	No effect on cultural resources.	Potentially major to moderate long-term adverse effect to sites with cultural significance to members of the Miccosukee Tribe of Indians of Florida. If unable to avoid, mitigation unknown. The L-67A (8BD5100) is not significant. No effect on historic properties.			
L-67C Levee and Canal	No effect on cultural resources.				

Cultural Resources (Please refer to Cultural Resources in Appendix C.2.1 for further details)					
Geographic Regions	FW0	Alt 1	Alt 2	Alt 3	Alt 4
L-29 Levee	No effect on cultural resources.		Major long-term adverse effect on sites culturally significant to the Miccosukee Tribe of Indians of Florida and that are potential historic properties. Potential mitigation could reduce effect.		
New Levee (L-67D) within WCA3B and Flow Way (Blue Shanty Flow Way)	No effect on cultural resources.				Potentially major adverse effect on cultural resources / Unknown - survey needed. Mitigation could reduce effect.
S-333 Pump Station	No effect on cultural resources.				
Old Tamiami Trail	No effect on cultural resources.				
L-67 Ext. Levee and Canal	No effect on cultural resources.				
L-31N Levee	No effect on cultural resources.	Potentially major long-term adverse effect on site 8DA2104. Potentially mitigation could reduce effect.			
S-356 Pump Station	No effect on cultural resources.				
L-28 Levee and Canal	No effect on cultural resources.	Unknown - survey needed.	No effect on cultural resources		
G-211 Operational Refinements	No effect on cultural resources.				
S-334 to S335 Seepage Barrier	No effect on cultural resources.				
Draft Preliminary Operations Plan	Unknown overall effects to cultural resources. Approximately 350 cultural resources sites including five districts, two traditional cultural properties, multiple culturally significant properties and one World Heritage site (ENP) within APE for CEPP. ERTIP investigations are projected to be completed ca. 2016. ¹ Mitigation unknown.				

¹ ERTIP cultural resources investigations specified through the Corps' executed Programmatic Agreement dated August 2012, to identify effect (if any) to subsurface cultural resources material caused by fluctuating water will be completed ca. 2016. This information, including other updated research available at the time, will be utilized in advance of CEPP to determine additional mitigation needs (if any) for effects of fluctuating water on subsurface cultural resources materials above and beyond those already mitigated for ERTIP or as required by other actions.

5.1.17 Invasive Species

All action alternatives have the potential and likelihood for establishment and spread of non-native invasive and native nuisance species. A summary of comparisons is in **Table 5.1-13**. A more detailed description of the effects of each feature is provided in **Appendix C.2.1.18**. Proposed restoration activities may have a minor to major effect on the ecosystem drivers that directly or indirectly influence the spread of non-native species. These factors may affect invasive species positively or negatively,

depending on the unique characteristics of individual species and the environmental conditions for a given biological invasion (Doren et al. 2009). Disturbed areas resulting from construction are likely to become established with non-native invasive and native nuisance species. New flows created by operations of the proposed features may serve as vectors to spread invasive and native nuisance species into new areas. The large number of existing and potential invasive plant and animal species and the often incomplete knowledge of invasive mechanisms for each species create moderate to high uncertainty in this evaluation. Long-term monitoring in an adaptive management framework is critical to ensure efficient management of the most threatening non-native invasive species in the restoration footprint. Proposed management activities to address invasive species are provided in **Annex G**.

Table 5.1-13. Effects of Alts 1 through 4 on Invasive Species

Invasive Species					
Feature	FWO	Alt 1	Alt 2	Alt 3	Alt 4
Lake Okeecho-bee and Northern Es-tuaries	Negligible effect on actively managed invasive and nuisance species, continue to persist at base-line levels or decrease; Minor to moderate expansion of uncontrolled species; Invasion pathway to/from lake and estuaries.				
A-2 Flow Equalization Basin	Negligible effect on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species Vegetation management challenges in downstream STA's from continued stormwater pulses.	Moderate to major increase in Invasive and nuisance plant and fish species FEB; Management options limited to mitigating impacts to FEB operations; Potential invasion pathway to WCAs			
Diversion of L-6 Flows and L-5 Improve-ments	Negligible effect on invasive and nuisance vegetation and non-native fish species, continue to persist at base-line levels.	Negligible to moderate reduction of SAV; Minor to moderate habitat improvement for non-native tropical fish species.			
L-4/L-5 Spreader Canal and Levee Degradation	Moderate to major recruitment of existing invasive species in WCA 3A. O&M of canal/levee minimize colonization of certain invasive species.	Minor reduction in recruitment of some invasive and nuisance species; Moderate to major expansion of obligate wetland invasive species in spreader canal and south of spreader canal; Spreader canal is a potential invasion pathway for aquatic species; Portions of remaining levee are habitat for Burmese pythons.			
L-28 Degradation and Back-fill	Negligible effects to actively managed invasive and nuisance species, continue to persist in adjacent natural areas at baseline levels or decrease; Moderate expansion of uncontrolled species; O&M of canal levee will minimize colonization of certain invasive species.	Negligible effects on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Moderate to major expansion of uncontrolled species; Lack of O&M on remaining levee will promote colonization of certain invasive species.			

Invasive Species					
Feature	FWO	Alt 1	Alt 2	Alt 3	Alt 4
Increase Capacity of S-333	Negligible effects on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Invasion pathway for aquatic invasive species downstream.				
L-67A Gated Structures / Spoil Removal and L-67C Degradation	Negligible effects to actively managed invasive and nuisance species, continue to persist or decrease; Moderate expansion of uncontrolled species; Invasion pathway for aquatic invasive species downstream.	New invasion pathway for aquatic plant and animal species between WCA 3A and 3B; Moderate to major expansion of cattail downstream of structures; plant and animal habitat reduced by spoil removal. Isolated remnants of L-67C will create invasive plant and animal habitat.			
Outflow Structures out of WCA 3B	Invasive and nuisance species persist, negligible effects; barriers for water surface connectivity are present.	New invasion pathway for aquatic plant and animal species between WCA 3B and ENP. Potential for minor to moderate expansion of species.			
L-67 Extension Levee De-grade/Backfill	Invasive and nuisance species persist on levee and in canal, negligible effects; continued cattail expansion west of L-67 Extension.	Minor to moderate reduction in habitat for some invasive plants, fish and reptiles by levee removal and canal backfill; Improved habitat for obligate wetland invasive species, minor to moderate expansion of species.			
G-211 Operational Modifications / Coastal Canals Conveyance	Negligible effects on actively managed invasive and nuisance species, continue to persist or decrease; Minor expansion of uncontrolled species; Invasion pathway for aquatic invasive species downstream.				
Increase S-356 Capacity to 1,000 cfs	Negligible effects on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species.	Negligible reduction in invasive plant recruitment, minor to moderate improved conditions for obligate wetland invasive species, and potential expansion of cattail in northern ENP.			
Miami Backfill S-8 to I-75	Negligible effects on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species.	Alt 1: 1.5 miles of invasive plant and animal habitat persists; spoil mound removal/canal backfill reduces habitat for some invasive species, minor to moderate effects; Tree islands vulnerable to invasive plant and animal colonization, minor to moderate effects; Moderate to major expansion of obligate wetland invasive species in backfill area. Alts 2-4: mound removal/canal backfill- minor reduction of habitat for some invasive species; Tree islands vulnerable to invasive plant and animal colonization; Minor to moderate expansion of obligate wetland invasive species in backfill area.			

Invasive Species					
Feature	FWO	Alt 1	Alt 2	Alt 3	Alt 4
Build North South Levee in WCA 3B	Negligible effects on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species.	Alts 1-3 same as FWO. Alt 4: Moderate to major potential for increased invasive species due to levee construction; Increased cattail along levee in WCA 3B.			
L-29 degradation	Invasive and nuisance species persist; Invasion pathway for aquatic invasive species into ENP.	Alts 1-3: Same as FWO. Alt 4: New invasion pathway for aquatic plant and animal species between L-29 and WCA 3B, possible minor to major expansion.			
Divide Structure on L-29	Negligible effects on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species.	Alts 1-3: Same as FWO. Alt 4: Increased O&M management of aquatic invasive and nuisance plants, minor to moderate effects.			
Penetrating Seepage Barrier	Negligible effects on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species.	Alt 1: Same as FWO Alt 2: Minor reduction in invasive plant recruitment; minor improved conditions for obligate wetland invasive species. Alts 3-4: Moderate reduction in invasive plant recruitment; minor to moderately improved conditions for obligate wetland invasive species.			
L-31N - New Pump Stations	Negligible effects on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species.	Alts 1-2: New invasion pathway for aquatic plant and animal species from L-31N to ENP; Minor reduction in invasive plant recruitment; Minor improved conditions for obligate wetland invasive species; Potential expansion of cattail in ENP. Alts 3-4: Same as FWO.			

5.2 EFFECTS OF THE RECOMMENDED PLAN

Analysis of Alternatives 1-4 identified Alt 4 as cost effective and the National Ecosystem Restoration (NER) plan to be carried forward for further analysis. This assessment of environmental effects evaluates the anticipated environmental effects of the Alts 4R and 4R2 described in **Section 4.0**. The evaluation of Alts 1 through 4 identified the need to revise the operations of Alt 4 to ensure the project savings clause constraints are met, to minimize localized adverse ecological effects, and to identify additional opportunities to provide for other water related needs. Alt 4 was initially refined with operational changes to avoid potential impacts to water supply levels of service in the LOSA and LEC, resulting in Alt 4R. Alt 4R was then refined further to determine if water supply cutbacks to the LOSA could be further reduced and to determine the quantity of additional LECSA 2 and LECSA 3 public water supply able to be provided while maintaining the natural system performance realized for Alt 4R. Due to these changes in operations, Alts 4R and 4R2 were no longer comparable to Alts 1-4. Because they are not comparable, they were separated and placed in different matrices. Alts 4R and 4R2 were compared to and evaluated against the FWO (No Action Alternative under NEPA) to describe changes to existing conditions with implementation of each Central Everglades Planning Project (CEPP) action alternative. These potential effects are summarized within this section. Details regarding significant or non significant effects are provided within this section and full details are discussed in **Appendix C.2.2**. The same definitions described in Section 5.1 were used to evaluate the context, intensity, duration, and cumulative nature of impacts associated with Alts 4R and 4R2.

The CEPP PIR report documentation and the complete set of RSM-BN and RSM-GL hydrologic model performance measure output comparing the ECB baseline, the FWO baseline, Alt 4R, and Alt 4R2 is posted on the Everglades Plan public web site for the CERP:

http://www.evergladesplan.org/pm/projects/proj_51_cepp.aspx

Final CEPP hydrologic modeling products have been uploaded to the CERP Model Management System (MMS), a geographic information system (GIS) based application that includes model input data, select model output data, source code/executable files, and documentation. CEPP modeling products in MMS can be accessed directly at the MMS project page through the Everglades Plan public web site:

<http://cerpmap1.cerpzone.org/arcgisapps/CERPMMS/CerpReport/ProjectReport.aspx?projectID=687>

5.2.1 Climate

Features of Alts 4R and 4R2 are the same. Implementation of Alts 4R and 4R2 would have short-term, negligible and less than significant effects on climate within the action area. Minor, localized effects to microclimate may occur as a result of redistribution of water and shifts in vegetation. Potential effects may include localized increases in evapotranspiration, increases in localized rainfall, and temperature changes.

5.2.2 Geology and Soils

Features of Alts 4R and 4R2 are the same. On the A-2 FEB footprint, Alt 4R and Alt 4R2 would result in conversion of relatively flat, uniform agricultural lands to an FEB (4 feet maximum operating depth) with exterior levees up to 10 feet above existing grade. Alts 4R and 4R2 show an increase in inundation duration over the FWO that will significantly decrease soil oxidation, subsidence and peat fires in WCA 3A, providing a minor, long-term, beneficial effect. Alts 4R and 4R2 improve hydrologic conditions in northern WCA 3A in comparison to FWO by increasing stages and extending hydroperiods within the area (**Table G-22** and **Table G-24**). Inundation duration for Alt 4R ranged from 76% of the period of record (POR) to 96% of the POR in northern ENP (Zone ENP-N) and from 91% to 93% in southern ENP. Inundation duration for FWO within this same region varied from 78% to 83% of the POR in northern

ENP and from 86% to 91% in southern ENP. Alts 4R and 4R2 produced significantly deeper depths than the FWO as depicted by the normalized weekly stage duration curve for IRs 129 (**Figure G-38**) and IR 130 (**Figure G-39**); example IRs for northern and southern ENP. Alts 4R and 4R2 also consistently reduced the frequency and duration of dry events in NESRS in comparison to the FWO (**Table G-31**).

5.2.3 Vegetation

Long-term, negligible and less than significant effects on vegetation within Lake Okeechobee, the Northern Estuaries, and EAA are anticipated due to implementation of Alts 4R and 4R2. As compared with FWO, Alts 4R and 4R2 show a slight performance improvement within the Northern Estuaries as indicated by fewer high volume flow months. Reduction in high flows and accompanying flow velocities would result in lower suspended solid loading and decreased concentration of colored dissolved organic matter, thereby allowing greater light penetration to promote growth of submerged aquatic vegetation (SAV). Refer to **Appendix C.2.2** for a detailed comparison of potential effects to vegetation.

Due to changes in the quantity, quality, distribution and timing of water entering the Greater Everglades ecosystem, long-term, significant and moderate effects on wetland hydrology and vegetation would potentially occur with implementation of Alts 4R and 4R2. Alts 4R and 4R2 include features to distribute water through spreader canals in the L-4 across northern 3A and backfill portions of the Miami Canal north of Interstate 75, thereby increasing hydroperiods and depths within this area. CEPP implementation of Alts 4R and 4R2 would act to rehydrate WCA 2 and northern WCA 3A promoting peat accretion, reducing the potential for high intensity fires and promoting transition from upland to wetland vegetation. Alts 4R and 4R2 provide moderate improvements in hydroperiods in WCA 2A compared to FWO. However, Alt 4R had a moderate adverse effect in WCA 2B by significantly decreasing stages compared to FWO, while Alt 4R2 had a minor to moderate adverse effect compared to FWO. In the L-28 Triangle, Alts 4R and 4R2 showed an improvement in hydroperiod over FWO. As compared to Alt 4R, Alt 4R2 produced slightly lower depths during average hydrologic conditions in northeastern WCA 3A. Observed depths for Alt 4R2 in northeastern WCA 3A may be more conducive to shorter hydroperiods sawgrass marshes relative to Alt 4R.

Vegetation and patterning in the central portion of WCA 3A resembles pre-drainage conditions most closely and represents some of the best examples of remnant Everglades habitat in south Florida. These areas remain largely unaffected by Alts 4R and 4R2 with a negligible effect. Increases in depth within central WCA 3A were not as significant as increases in observed depths in northern WCA 3A; however maintenance of existing conditions within this region of the project area is desirable as ridge and slough habitat is well conserved.

The routing of flows through the marsh will likely result in the expansion of cattail vegetation in areas experiencing higher nutrient loads, particularly in the northern portion of WCA 3A, providing a minor adverse effect. Conversely, some areas directly adjacent to the Miami Canal will experience lower flows and nutrient loads under Alts 4R and 4R2 in comparison to the FWO condition. In southern WCA 3A, high water levels during the wet season are important in maintaining quality wet prairie and emergent slough habitat (FWS 2010). However, prolonged high water levels (i.e. during both wet and dry season) and extended hydroperiods have resulted in vegetation shifts within southern WCA-3A, negatively impacting tree islands and fragmenting sawgrass ridges, resulting in the loss of historic landscape patterning. Neither Alt 4R, Alt 4R2, or FWO would provide significant benefits to southern WCA 3A through reduction in high water levels or duration, therefore, significant shifts in vegetation are not anticipated within this region, providing a negligible effect.

Alts 4R and 4R2 include conveyance features and levee removal within L-67A and C, thereby providing new point source discharges of water into WCA 3B. However, it is anticipated that Broward County Water Preserve Areas (BCWPA) CERP Project would be constructed prior to CEPP implementation, thereby reducing discharges from S-9 into L-67A. Currently, total phosphorous (TP) within L-67A ranges between 10 and 20 psu, depending upon the time of year. With completion of the BCWPA CERP Project, it is anticipated that TP loading within L-67A will be greatly reduced and therefore minor adverse effects to vegetation due to changes in water quality are anticipated within WCA 3B. Cattail expansion will be monitored as outlined within **Annex D**. Tree islands contain extraordinarily high levels of TP in their soil suggesting that they may play a major role in the biogeochemical cycles of nutrients in the Everglades (Sah 2004; Troxler and Childers 2010; Troxler et al. 2009; Wetzel 2002; Wetzel et al. 2009, 2011). Wetzel et al. (2011) found that soil TP levels within WCA 3A and WCA 3B tree islands were approximately 4 times higher than the surrounding marsh TP levels. Tree islands within WCA 3B may help to capture and focus nutrients, assisting to minimize potential effects on sawgrass and wet prairie communities within this region (Wetzel et al. 2011).

Flows through SRS under current system compartmentalization and water management practices are greatly reduced when compared with pre-drainage conditions. The result has been lower wet season depths and more frequent and severe dry downs in sloughs and reduction in extent of shallow water edges. Over-drainage in the peripheral wetlands along the eastern flank of NESRS has resulted in shifts in community composition, invasion by exotic woody species, and increased susceptibility to fire. Implementation of CEPP is expected to rehydrate much of NESRS by providing a means for redistributing flows from WCA 3A and WCA 3B to ENP, providing minor beneficial effects. Resumption of sheetflow and related patterns of hydroperiod extension will significantly help to restore pre-drainage patterns of water depths and the complex mosaic of Everglades' vegetation communities.

As compared with the FWO, Alts 4R and 4R2 produced significantly higher depths and inundation durations (refer to **Appendix G, Figure G-38** and **Figure G-39**). Within northern ENP, performance of Alts 4R and 4R2 was similar with each alternative reducing the number of dry events within SRS and extending average hydroperiods by 35 to 90 days depending upon location. Reduction in the number and duration of dry events and extended hydroperiods will reduce soil oxidation, decrease fire potential, promote peat accretion and aid in restoration of historic wetland vegetation communities, providing minor beneficial effects. Improved inundation patterns produced by Alts 4R and 4R2 in northern ENP resulted in better suitability for slough vegetation. Although none of the alternatives met the desired dry and wet season water depths for slough vegetation in northern ENP, Alts 4R and 4R2 would provide minor benefits as compared with the FWO by increasing water depths in both the wet and dry season within this region. As compared to Alt 4R, Alt 4R2 produced slightly lower depths during average hydrologic conditions in southeastern ENP and slightly decreased overland flow through Taylor Slough.

Alts 4R and 4R2 include increasing capacity at S-333 from 1350 cfs to 2500 cfs. With an increase in S-333 flow, there would be a potential increase in total phosphorus loading entering NESRS. The Everglades, a phosphorus-limited system, historically received most inputs of phosphorus through rainfall, with average TP concentrations of less than 0.01 milligrams per liter (mg/L) (McCormick et al. 1996, Newman et al. 2004). However, more recently, areas within ENP, including NESRS, have been exposed to TP concentrations at or in excess of 0.10 mg/L (SFWMD 2010). These concentrations and any additional inputs resulting from implementation of any of Alt 4R or 4R2 (refer to **Section 5.2.9, Water Quality** for details), have the potential to result in vegetation changes within NESRS. Vegetation that can assimilate nutrients directly from the water column appears to be the most sensitive to nutrient enrichment and include periphyton and floating-leaved plants, such as spatterdock and water lily (Chaing et al. 2000;

Newman et al. 2004). Chaing et al, 2000 demonstrated that the periphyton-*Utricularia* complex may be quite sensitive to increased phosphorus, as illustrated by the disappearance of this complex from enriched study plots after the third year. Potential effects on vegetation and species community composition within NESRS and ENP cannot fully be determined at this time. Water quality within the CEPP action area will continue to be monitored, as described in **Annex D**, to determine any associated changes.

Mangrove communities and seagrass beds associated with Florida Bay may likely show a significant and minor beneficial effect under all Alts 4R and 4R2 from an increase in freshwater input resulting in decreased salinities. Invertebrate populations and seagrass beds associated with southern Biscayne Bay under Alt4R2 may likely show a beneficial effect from an increase in freshwater input resulting in decreased salinities. Alts4R is likely to show a minor adverse effect due to greatly decreased freshwater input to Biscayne Bay.

Construction and hydrological modification under Alts 4R and 4R2 may likely influence the spread and establishment of invasive and native nuisance plant species within the CEPP action area and have a minor adverse effect. Refer to **Section 5.2.23** and **Appendix C.2.2.18** for additional information.

5.2.4 Threatened and Endangered Species

Threatened and endangered species anticipated to be affected by the project are discussed below. Other species are discussed further in **Appendix C.2.2.4** and within the Biological Assessment in **Annex A**. The Corps entered formal consultation with USFWS on the Everglade snail kite (*Rostrhamus sociabilis plumbeus*), and its designated critical habitat, Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*), (CSSS) and its designated critical habitat, wood stork (*Mycteria americana*) and eastern indigo snake (*Drymarchon corais couperi*). A Programmatic Biological Opinion (BO) was received from USFWS on April 9, 2014, which clearly states that further consultation will be needed when more specific project details are finalized during PED. While this document does not authorize incidental take of three endangered avian species (CSSS, snail kite, and wood stork), it does describe the anticipated effects based on current information. Upon completing ESA Section 7 consultation for each PPA, USACE will undertake the agreed-to avoidance and minimization measures and implementing terms and conditions (TCs). When USACE is closer to constructing phases of CEPP that will affect listed species, FWS will provide separate consultation document(s) which may authorize incidental take, and provide applicable reasonable and prudent measures (RPMs) and TCs.

The preliminary conclusion is that the proposed project is not likely to jeopardize the continued existence of the species listed above and are not likely to adversely modify critical habitat, where designated. The USFWS Programmatic Biological Opinion concurred on the Corps' determination of may affect, but not likely to adversely affect the Florida panther (*Puma concolor coryi*), West Indian manatee (*Trichechus manatus*), and its critical habitat, American crocodile (*Crocodylus acutus*) and its critical habitat, deltoid spurge (*Chamaesyce deltoidea* ssp. *deltoidea*), Garber's spurge (*Chamaesyce garberii*), Small's milkpea (*Galactia smallii*), and tiny polygala (*Polygala smallii*). Furthermore, the USFWS concurred with all the "No Effect" determinations made by the Corps in regard to the applicable threatened or endangered species that are found in the action area. The National Marine Fisheries Service (NMFS) provided a Programmatic Biological Opinion for the Comprehensive Everglades Restoration Plan to the Corps on 17 December 2013 and concurred with the "No Effect" determinations for CEPP for the species under their purview.

5.2.4.1 American Alligator

A keystone species within the Everglades ecosystem, the American alligator (*Alligator mississippiensis*) is dependent on spatial and temporal patterns of water fluctuations that affect courtship and mating, nesting, and habitat use (Brandt and Mazzotti, 2000). Due to rehydration and decreased salinity of previously drained areas, particularly in northern WCA 3A, WCA 3B, and ENP, it is anticipated that implementation of CEPP Alts 4R and 4R2 would significantly improve alligator habitat suitability as compared with the FWO and provide a minor beneficial effect. Alligator habitat suitability for Alts 4R and 4R2 trend similarly; differences between alternatives within the project area are negligible. Major adverse effects on alligators that utilize the Miami Canal would occur due to its backfilling. However, these effects are expected to be short-term as alligators will expand into other areas of suitable habitat created as a result of CEPP implementation.

5.2.4.2 American Crocodile

A Habitat Suitability Index (HSI) for juvenile American crocodiles (*Crocodylus acutus*) was used to predict potential effects of the alternatives. The crocodile growth and survival index used in this analysis is one of the components of a crocodile HSI that characterizes suitable habitat for crocodiles based on habitat, location of known nest sites, salinity, and prey biomass. Results from applying the salinity data into the juvenile crocodile HSI is shown in **Figure C.2.2-47**. The plot shows the lift (Alts 4R and 4R2 minus FWO) of an index of juvenile crocodile growth and survival at sites along the northern Florida Bay shoreline for all years of the model runs. For the four sites with the highest predicted growth and survival, Alt 4R2 improves habitat suitability for juvenile crocodiles, providing a minor beneficial effect to crocodiles and their critical habitat.

5.2.4.3 Everglade snail kite

The snail kite has a highly specialized diet typically composed of apple snails, which are found in palustrine, emergent, long-hydroperiod wetlands. As a result, the snail kite's survival is directly dependent on the hydrology and water quality of its habitat (FWS 1999). As compared to FWO, rehydration and vegetation shifts within northern WCA 3A and increased hydroperiods within WCA 3B and ENP would increase habitat suitable for apple snails, thereby increasing the spatial extent of suitable foraging opportunities for snail kites, providing a significant and moderate beneficial effect. The number of years that Alts 4R and 4R2 fell within USFWS recommended depth ranges substantially increased from FWO, therefore increasing habitat suitability for snail kites (See **Table C.2.2-1 in C.2.2.4.1** or **Annex A**). Designated Everglade snail kite critical habitat would also be improved with increased sheetflow to WCAs and ENP. There would be no effect on Everglade snail kite designated critical habitat within Lake Okeechobee, WCA 1, or WCA 2 because CEPP is redirecting approximately 210,000 acre feet of additional water that currently flows into the St. Lucie and Caloosahatchee Estuaries to the historical southerly flow path south through FEBs and existing STAs.

5.2.4.4 Cape Sable Seaside Sparrow (Nesting Condition and Hydroperiod)

Implementation of Alts 4R and 4R2 has the potential to have a significant and unavoidable adverse effect on hydroperiods within the marl prairies adjacent to SRS. The Programmatic Biological Opinion located in Annex A addresses the required monitoring and recovery projects to reduce the impact. Modeling indicates an increase in hydroperiod within CSSS-E and southern portions of CSSS-A (refer to **Appendix C.2.2.4.2, Table C.2.2-7**). However, hydroperiods within northern CSSS-A are slightly reduced as compared with FWO, providing slightly better, but overall, too wet conditions for marl prairie habitat and nesting CSSS. Minor habitat improvements were seen in CSSS-F. A detailed analysis is provided in **Appendix C.2.2.4.2**. While there are slight improvements to critical habitat areas in CSSS-A, CSSS-F, and CSSS-B (some metrics), other areas show an adverse affect.

5.2.4.5 Wood stork

An analysis of wood stork foraging potential was performed to predict improvements to foraging habitat with CEPP implementation (South Florida Natural Resources Center 2013). Results from this analysis indicate that Alts 4R and 4R2 provide the greatest benefit over FWO within northern WCA 3A (CEPP zones 3A-NE and 3A-MC) and provide a moderate beneficial effect. The Beerens (2013) model showed improvement in stork habitat conditions in NESRS with Alts 4R and 4R2. When suitability scores are compared for FWO and Alts 4R and 4R2, (refer to **Appendix C.2.2.4.3, Figure C.2.2-38**) the magnitude of the scores is very similar, however, Alts 4R and 4R2 maintain a higher score for somewhat longer into the season. Historically, the short hydroperiod wetlands within ENP have been important for wood stork foraging during the pre-breeding season with wood storks shifting to longer hydroperiod wetlands as the dry season progresses. Hydrological patterns that produce a maximum number of patches with high prey availability (i.e. high water levels at the end of the wet season and low water levels at the end of the dry season) are necessary for high reproductive outputs (Gawlik 2002; Gawlik et al. 2004). Depending upon the elevation and microtopography throughout WCA 3 and ENP, implementation of CEPP Alt 4R2 would produce a variety of wetland habitats that would support prey densities conducive to successful wading bird foraging and nesting, providing a moderate beneficial effect. A detailed analysis is provided in **Appendix C.2.2.4.3**.

5.2.4.6 Eastern Indigo snake

Since Eastern indigo snakes occur primarily in upland areas, their presence within the Greater Everglades portion of the project area is somewhat limited, however, they have a high probability of occurrence within the proposed A-2 FEB site and as a result of construction of the A-2 FEB are likely to be displaced, thereby removing approximately 14,000 acres of potential habitat, a major adverse effect and a significant and unavoidable effect. The hydrologic effects of Alts 4R and 4R2 are expected to benefit existing or historic wetlands, which is what the FEB historically was. Once the Miami Canal is backfilled, created tree islands will be constructed, which would potentially provide habitat for the indigo snakes, perhaps offsetting the increased hydroperiods within WCA 3.

5.2.4.7 Florida manatee

As compared to FWO, Alts 4R and 4R2 would decrease damaging high volume flows to the Northern Estuaries, providing minor beneficial effects to manatees and their critical habitat. Decreased salinities within the Northern Estuaries that reduce stress on SAV and promote increases in seagrass shoots have the potential to increase foraging opportunities for manatees in this region. Similarly, increased freshwater flows to Florida Bay and the southwestern coastal estuaries would result in lowered salinity levels that better encompass seagrass salinity tolerance ranges. This lower-salinity effect would also increase foraging opportunities for manatees. Alt 4R2 would provide increased flows to Florida Bay and the southwestern coastal estuaries, improving salinities, therefore benefitting Florida manatee as compared with the FWO and providing minor beneficial effects to manatees and their critical habitat. Refer to **Section C.2.1.4.6** for further information.

5.2.4.8 Florida Panther

Alts 4R and 4R2 have the potential to have a minor adverse effect on both the Primary and Secondary Zones for Florida panther habitat. Construction of the 14,000 acre FEB within the A-2 parcel in EAA would result in conversion of upland habitat that could be potentially used by Florida panther to transverse the area to wetland habitat, thereby eliminating potential habitat within the panther secondary zone in this region. In addition, since potentially suitable habitat occurs within the action area, increased water deliveries under Alts 4R and 4R2 to ENP could have a minor adverse effect on

Florida panther habitat. However, as lands within the CEPP project area become restored to their more historic natural values, the improved forage base would result in greater use by the Florida panther utilizing these areas, providing a minor beneficial long-term effect.

5.2.4.9 Smalltooth Sawfish

The smalltooth sawfish resides in the Caloosahatchee River and adjacent Charlotte Harbor estuaries; and has the potential to be found in the southern estuaries where juveniles could potentially occur and feed in red mangrove wetlands. Alts 4R and 4R2 have the potential to provide a minor beneficial effect to the smalltooth sawfish and their critical habitat by reducing excessive freshwater flows and improving the salinity regime throughout the Caloosahatchee estuary; and by increasing freshwater flows into the coastal wetlands adjoining Florida Bay, subsequently reducing the duration and occurrence of hypersaline conditions.

5.2.4.10 Green Sea Turtle

Green sea turtles live in tropical and subtropical waters. Although green sea turtles are expected to be found foraging in nearshore seagrass habitats within Florida Bay, the increased freshwater flows associated with Alts 4R and 4R2 may alter seagrass species composition but should have a negligible and less than significant effect on the overall biomass available for 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.

5.2.4.11 Hawksbill Sea Turtle

The hawksbill lives in tropical and sub-tropical waters of the Atlantic, Pacific, and Indian Oceans. Although hawksbill sea turtles are expected to be found foraging near hardbottom habitats within Florida Bay, the increased freshwater flows associated with Alts 4R and 4R2 may reduce nearshore salinity concentrations but should have a negligible and less than significant 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.

5.2.4.12 Leatherback Sea Turtle

The leatherback lives in tropical and sub-tropical waters. Habitat requirements for juvenile and post-hatchling leatherbacks are virtually unknown. Although leatherback turtles are expected to be found foraging in nearshore habitats within Florida Bay, the increased freshwater flows associated with the Alts 4R and 4R2 may reduce nearshore salinity concentrations but should have a negligible and less than significant effect on jellyfishes 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.

5.2.4.13 Kemp's Ridley Sea Turtle

This species is a shallow water benthic feeder consuming mainly algae and crabs. Although Kemp's ridley sea turtles could be found foraging in nearshore habitats within Florida Bay, this species is not expected to be found within the direct area of influence associated with CEPP.

5.2.4.14 Loggerhead Sea Turtle

Loggerhead sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. Although loggerhead sea turtles are expected to be found foraging in nearshore habitats within Florida Bay, the increased freshwater flows associated with Alts 4R and 4R2 may reduce nearshore salinity concentrations but should have a negligible and less than

significant 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.

5.2.5 State Listed Species

The CEPP project area contains habitat suitable for the presence, nesting, and/or foraging of 16 State listed threatened and endangered species and 18 species of special concern. Threatened and endangered animal species include the Big Cypress fox squirrel (*Sciurus niger avicennia*), Florida mastiff bat (*Eumops glaucinus floridanus*), Florida black bear (*Ursus americanus floridanus*), Everglades mink (*Mustela vison evergladensis*), Florida sandhill crane (*Grus canadensis pratensis*), snowy plover (*Charadrius alexandrius*), Southeastern American kestrel (*Falco sparveriuspaulus*), least tern (*Sterna antillarum*), white-crowned pigeon (*Columba leucocephalus*), and Miami black-headed snake (*Tantilla oolitica*). Species of special concern include the Florida mouse (*Podomys floridanus*), Shermans fox squirrel (*Sciurus niger shermani*), American oystercatcher (*Haematopus palliatus*), brown pelican (*Pelecanus occidentalis*), black skimmer (*Rynchops niger*), burrowing owl (*Athene cunicularia*), limpkin (*Aramus guarauna*), reddish egret (*Egretta rufescens*), snowy egret (*Egretta thula*), little blue heron (*Egretta caerulea*), tricolored heron (*Egretta tricolor*), white ibis (*Eudocimus albus*), roseate spoonbill (*Platalea ajaja*), osprey (*Pandion haliaetus*), mangrove rivulus (*Kryptolebias marmoratus*), mangrove gambusia (*Gambusia rhizophorae*), gopher tortoise (*Gopherus polyphemus*), and the Florida tree snail (*Liguus fasciatus*).

Threatened and endangered plant species include the pine-pink orchid, which frequents the edges of the farm roads just above wetland elevation; the lattice-vein fern which is found occasionally in the forested wetlands; Eaton's spikemoss, and Wright's flowering fern, both found in the Frog Pond natural area; along with the Mexican vanilla plant and Schizaea tropical fern located on tree islands in the upper Southern Glades region.

While small foraging or nesting areas utilized by many of these animal species may be affected by this project, Alts 4R and 4R2 should have long-term, negligible and less than significant adverse effects on protected State species. Impacts to wading bird species will be similar to those affecting the wood stork. Subtle changes in water quality can also support the prey base so that net effects on forage availability can be variable. Overall, no long-term, adverse impacts are anticipated to State listed species as a result of this project. For a more detailed analysis, please refer to **Appendix C.2.2**.

5.2.6 Wildlife

A comparison of FWO and Alts 4R and 4R2 and their potential effects on wildlife within the CEPP action area are summarized below. Effects on State and Federally listed species are described in further detail in **Appendix C.2.2** and **Section C.2.2.5** and **Annex A**. Further details on the effects of the alternatives can be found in the Fish and Wildlife Coordination Act Report in **Annex A**. Changes in water quality also have the potential to affect prey forage base through altering of vegetation composition or structure. Water quality will continue to be monitored under CEPP; potential effects are largely uncertain at this time.

5.2.6.1 Invertebrates

Long-term, negligible and less than significant effects to the invertebrate community within Lake Okeechobee or EAA are anticipated under Alts 4R and 4R2. As compared with FWO, Alts 4R and 4R2 show a long-term, minor beneficial effect with performance improvement within the Northern Estuaries

as indicated by fewer high volume flow months. Reductions in high volume discharges and salinity fluctuations would likely benefit oysters within the Northern Estuaries.

Within the Greater Everglades aquatic invertebrates would rapidly colonize newly re-hydrated areas with implementation of Alts 4R and 4R2 providing a long-term, significant and moderate beneficial effect, directly benefitting aquatic invertebrates within the action area. Increases in stages and hydroperiods within WCA 2, northern WCA 3A, WCA 3B and ENP would promote wetland vegetation transition through contraction of sawgrass marshes and expansion of wet prairies, and in deeper regions, sloughs. Submerged aquatic plants are commonly associated with sloughs providing structure for growth of periphyton, the main source of primary production within the freshwater Everglades (Gunderson 1994; Powers 2005). Periphyton is a primary component of invertebrate diets, including apple snails. In addition to the potential for increased foraging opportunities, changes in vegetation resulting in expansion of wet prairie and increases in emergent vegetation would also provide habitat structure critical for apple snail aerial respiration and egg deposition (Turner 1996; Darby et al. 1999).

Crayfish are important components within the Everglades food web, serving as primary dietary components of higher trophic level species including fish, amphibians, alligators, wading birds and mammals such as raccoons and river otters (Kushlan and Kushlan 1979). Increases in hydroperiod associated with Alts 4R and 4R2 would likely significantly increase crayfish density within northern WCA 3A, WCA 3B, and ENP, particularly within the marl prairies. Research by Acosta (2001) revealed that crayfish productivity would increase substantially if hydroperiods within the marl prairie wetlands were extended by 3 to 4 months. Although Alts 4R and 4R2 would not extend hydroperiods within the marl prairies by 3 to 4 months, CEPP implementation would increase hydroperiods within this region resulting in increased native crayfish productivity having a long-term, moderate beneficial effect.

Invertebrate populations associated with Florida Bay may show a minor beneficial effect under Alts 4R and 4R2 from an increase in freshwater input resulting in decreased salinities. Invertebrate populations and seagrass beds associated with Biscayne Bay under Alt4R2 may show a long-term, minor beneficial effect from an increase in freshwater input resulting in decreased salinities. Alts4R is likely to show a major adverse effect due to greatly decreased freshwater input. A detailed analysis is provided in **Appendix C.2.2.5.1.**

5.2.6.2 Fish

Implementation of Alts 4R and 4R2 are expected to significantly improve conditions for fish species throughout much of the Greater Everglades and have a long-term, moderate beneficial effect. It is predicted that with implementation of Alt 4R and 4R2, the largest percent gains in daily average fish density would occur within northern WCA 3A and NESRS due to rehydration. Other areas within Shark River Slough are also expected to experience appreciable gains in fish density due to increased flows. It is also expected that regional percent changes in fish densities would be highest in SRS and southern marl prairies (17-31%) for Alt 4R and that Taylor Slough and Florida Bay would also be expected to experience positive changes as compared with FWO (Catano and Trexler 2013). Alt 4R predicted approximately 5% higher biomass than Alt 4R2 in SRS and the southern marl prairies. Long-term decreases in fish density, or negligible changes (3%), were predicted for Alts 4R and 4R2 in WCA 2A and the area of WCA 3A along the L-67 A canal. Negligible differences between Alts 4R and 4R2 were predicted in most other regions.

Fish populations associated with Florida Bay may show a long-term, minor beneficial effect under all Alts 4R and 4R2 from an increase in freshwater input resulting in decreased salinities. Invertebrate

populations and seagrass beds associated with Biscayne Bay under Alt4R2 may show a long-term, minor beneficial effect from an increase in freshwater input resulting in decreased salinities. Alts4R is likely to show a minor adverse effect due to greatly decreased freshwater input. A detailed analysis is provided in **Appendix C.2.2.5.2**.

Introduction or expansion of non-native fish species due to changes in water distribution and increased connectivity within WCA 3A, WCA 3B and ENP is likely to occur; however, the extent of invasion is uncertain at this time providing a minor adverse effect. In contrast to FWO, new access points will be created under CEPP.

5.2.6.3 Amphibians and Reptiles

Long-term, moderate and significant beneficial effects on amphibian and reptile communities are anticipated with CEPP implementation. Alts 4R and 4R2 showed improved conditions for amphibians within WCA 3 and ENP as compared with FWO. Rehydration within previously dry areas within northern WCA 3A would increase spatial extent of suitable habitat for aquatic amphibian species in this area. Similarly, increased hydroperiods within ENP would also benefit aquatic amphibian species. As hydrology improves within WCA 3A, WCA 3B and ENP, it is expected that amphibian species richness will also change. However, declines in some amphibian species will be offset by favorable habitat conditions for other species. Increase in forage prey availability (i.e. crayfish and other invertebrates, fish) in areas rehydrated by CEPP implementation will also directly benefit amphibian and reptiles species.

5.2.6.4 Birds

The freshwater wetlands of the Everglades are noted for their abundance and diversity of colonial wading birds. Nesting and foraging activities of resident bird species are anticipated to show a long-term, moderate beneficial effect with the implementation of Alts 4R and 4R2. Impacts on the Cape Sable seaside sparrow, snail kite, wading birds and shore bird species are further discussed in **Section 5.2.4** and **Appendix C.2.2.4**. Changes in water quality also have the potential to affect birds through alteration of vegetation composition or structure or impacts to their forage base. Water quality will continue to be monitored under CEPP and potential effects are largely uncertain at this time.

As predicted by the Trophic Hypothesis (RECOVER 2004) an increase in density of small fishes will directly benefit higher trophic level predators such as wading birds. Therefore, it is predicted that Alts 4R and 4R2 that provide a long-term, moderate and significant beneficial effect to small fishes as described in **Section 5.2.6.2** and **Appendix C.2.2.5.2**, will also perform well overall for wading birds. Crayfish are a particularly important forage resource for nesting white ibis (*Eudocimus albus*). Appropriate foraging conditions and crayfish densities within core foraging areas of nesting wading birds colonies can reduce foraging flight distance, thereby enhancing overall body condition. As indicated in **Section C.2.2.5.1**, increases in hydroperiod associated with implementation of Alts 4R and 4R2 would likely increase crayfish density within northern WCA 3A, WCA 3B, and ENP, particularly within the marl prairies. Depending upon the elevation and microtopography throughout WCA 3 and ENP, implementation of Alts 4R and 4R2 would produce a variety of wetland habitats that would support prey densities conducive to successful wading bird foraging and nesting.

5.2.6.5 Mammals

As compared with FWO, potential long-term, minor beneficial effects on mammals within the CEPP action area are anticipated with Alts 4R and 4R2. Small mammals including raccoons and river otters would benefit from increased crayfish and small prey fish biomass in rehydrated areas within northern

WCA 3A, WCA 3B and ENP. Effects on Federally listed species are described in further detail in **Section 5.2.4** and in **Section C.2.2.4** and within **Annex A**.

Anticipated benefits of Alts 4R and 4R2 include improving the quantity, timing, and distribution of water delivered to ENP. The increase in water availability and rehydration within northern WCA 3A, WCA 3B, and ENP under Alts 4R and 4R2 will likely benefit Everglades mink (*Mustela vison evergladensis*) as a result of increased prey availability (forage fish).

CEPP implementation, however, may negatively affect mammals dependent upon upland habitat in the short-term. As compared with the FWO, Alts 4R and 4R2 increased depths and resulting hydroperiods within northern WCA 3A. Due to increased water flow and changes in water distribution it is anticipated that overdrained areas in northern WCA 3A will be rehydrated, triggering a vegetation transition from upland to wetland habitat. Performance between Alts 4R and 4R2 was similar in northwestern WCA 3A; however Alt 4R2 showed slightly lower depths during average hydrologic conditions in northeastern WCA 3A. Although mammals occurring within the action area are adapted to the naturally fluctuating water levels in the Everglades, there is an increased potential for this vegetation transition to have a short-term significant, adverse and unavoidable effect on the mammals utilizing upland habitat. This is a particular concern for deer populations within northern WCA 3A that utilize tree islands. However, as discussed in **Appendix C.2.2.3.4.4**, no significant effects on tree islands within WCA 3A and ENP are anticipated to occur under Alts 4R and 4R2; however slightly lower water depths under Alt 4R2 relative to Alt 4R may be more favorable to deer populations in northeastern WCA 3A. Deer populations that utilize the lower elevation tree islands within WCA 3B may suffer from habitat loss, having a short-term significant, adverse and unavoidable effect. In addition, deer that utilize levees slated for removal (L-67A, L-29, and L-67 Extension) also may be adversely affected. Loss of these levees may be offset by the construction of the Blue Shanty Levee in WCA 3B. Deer are highly mobile and will migrate to find suitable habitat. No significant negative effects on mammals in the remainder of the CEPP action area are anticipated under Alts 4R and 4R2. Changes in water quality also have the potential to affect prey forage base through altering of vegetation composition or structure. Water quality will continue to be monitored under CEPP; potential effects are largely uncertain at this time.

5.2.7 Essential Fish Habitat

Alts 4R and 4R2 have the potential to reduce the frequency and volume of high level flows from Lake Okeechobee to the Caloosahatchee River Estuary and the St. Lucie Estuary; thus reducing the potential for adverse impacts on estuarine and nearshore biota associated with Essential Fish Habitat (EFH), providing a minor beneficial effect. This is a significant improvement for those estuarine systems compared to a FWO project scenario. Alts 4R and 4R2 would also improve freshwater delivery to coastal wetlands and downstream estuaries in Northern Biscayne Bay, ENP and Eastern Florida Bay, providing a minor beneficial effect. Model output indicates a minor beneficial effect on indicator species and estuarine habitats compared to a FWO scenario. Implementation of Alt 4R2 would increase freshwater flows to salt water wetlands and nearshore bay areas and result in favorable changes to salinity levels. These changes may affect EFH, although effects on the aquatic resources are anticipated to be significant and beneficial. The recommended plan will have no adverse effects on EFH in the northern estuaries of St. Lucie and Caloosahatchee; and the southern estuaries including Florida Bay and Biscayne Bay. A more detailed analysis of the EFH can be found in **Appendix C.2.2.6** and **Appendix C.4**.

5.2.8 Hydrology

A summary of the anticipated long-term hydrologic effects of Alt 4R and Alt 4R2, which were previously described in **Section 4.6.2**, is presented in **Table 5.2-1**. Comprehensive discussion of the anticipated

long-term hydrologic effects of Alt 4R and Alt 4R2 is provided in **Section C.2.2.7** of **Appendix C.2.2**. Alt 4R and Alt 4R2 are compared to the FWO; similarly, the hydrologic effects of the FWO are described based on comparison to the ECB. The summary of regional hydrologic differences includes quantitative comparisons between the ECB and FWO, the FWO and Alt 4R, and the FWO and Alt 4R2 based on the RSM-BN and RSM-GL CEPP modeling representations of these baselines and alternatives. The determination of the directionality of the long-term hydrologic change (improvements and/or adverse hydrologic change) within each specified geographic region is principally based on the results of the ecological evaluations, where available, which are described in **Section 4.6.2**. Alts 1 through 4 are separately compared to the FWO in **Section 5.1.8**.

Table 5.2-1. Environmental Effects of Alt 4R and Alt4R2 on Hydrology

Geographic Region	Alt	Hydrologic Effects
Lake Okeechobee	FWO	Moderate hydrologic change, with improvements from reducing the frequency of high lake stages and adverse effect from increasing the frequency of low lake stages. Significant stage reduction of 0.1-0.5 feet for the upper 75% of the stage duration curve. Number of days with stages above 16 feet NGVD is reduced from 870 to 696 during the 1965-2005 period of simulation.
	Alt 4R	Moderate hydrologic change, with improvements from reducing the frequency of low lake stages and adverse effect from increasing the frequency of high lake stages. Significant stage increase of 0.25-0.50 feet for the upper 60% of the stage duration curve, excluding extreme wet hydrologic conditions. Number of days with stages above 16 feet NGVD is increased from 696 to 1157 during the 1965-2005 period of simulation.
	Alt 4R2	Moderate hydrologic change, with improvements from reducing the frequency of low lake stages and adverse effect from increasing the frequency of high lake stages. Significant stage increase of 0.25-0.50 feet for the upper 70% of the stage duration curve, excluding extreme wet hydrologic conditions. Number of days with stages above 16 feet NGVD is increased from 696 to 1162 during the 1965-2005 period of simulation.
Northern Estuaries	FWO	Caloosahatchee Estuary: Major improvement. Mean monthly flows above 2800 cfs and above 4500 cfs are reduced by 13 and 10 months, respectively (14% and 23% reductions, respectively). Mean monthly flows less than 450 cfs are reduced by 89 months (77%). St. Lucie Estuary: Major improvement. Mean monthly flows above 2000 cfs and above 3000 cfs are reduced by 10 and 12 months, respectively (11% and 28% reductions, respectively).
	Alt 4R	Caloosahatchee Estuary: Moderate improvement. Mean monthly flows above 2800 cfs and 4500 cfs are reduced by 11 and 3 months, respectively (14% and 9% reductions, respectively). Mean monthly flows less than 450 cfs are reduced by 3 months (11%). St. Lucie Estuary: Moderate hydrologic change, with improvements for high volume discharges and adverse effect for low volume discharges. Mean monthly flows above 2000 cfs and 3000 cfs are reduced by 27 months and 5 months, respectively (32% and 16% reductions, respectively). Mean monthly flows less than 350 cfs are reduced by 2 months (2%).
	Alt 4R2	Caloosahatchee Estuary: Moderate improvement. Mean monthly flows above 2800 cfs and 4500 cfs are reduced by 11 months and 4 months, respectively (14% and 12% reductions, respectively). Mean monthly flows less than 450 cfs are reduced by 4 months (15%). St. Lucie Estuary: Moderate to significant improvement. Mean monthly flows above 2000 cfs and 3000 cfs are reduced by 29 months and 7 months, respectively (34% and 23% reductions, respectively). Mean monthly flows less than 350 cfs are reduced by 27 months (29%). Additional analysis for Savings Clause requirements is provided in Annex B .

Geographic Region	Alt	Hydrologic Effects
Greater Everglades: WCA 2A and WCA 2B	FWO	<p>WCA-2A (2A-17): Minor adverse effect. Stages are increased by 0.1-0.2 feet under all hydrologic conditions.</p> <p>WCA-2B (2B-Y): Moderate improvement. Stages within WCA-2B are significantly increased by 0.25-0.50 feet under nearly all hydrologic conditions, excluding extreme wet conditions.</p>
	Alt 4R	<p>WCA-2A (2A-17): Moderate improvement. Stages are decreased by 0.1-0.3 feet under all hydrologic conditions.</p> <p>WCA-2B (2B-Y): Moderate adverse effect. Stages within WCA-2B are significantly decreased by 0.25-0.50 feet under nearly all hydrologic conditions, excluding extreme wet conditions.</p>
	Alt 4R2	<p>WCA-2A (2A-17): Same as Alt 4R.</p> <p>WCA-2B (2B-Y): Minor adverse effect. Stages within WCA 2B are slightly decreased by less than 0.10 feet for wet to normal conditions and stages are decreased by 0.25 feet during the driest 20 percent of the stage duration curve. Compared to the ECB, stages within WCA 2B are moderately improved with significant increases of 0.10 - 0.25 feet under nearly all hydrologic conditions, excluding extreme wet conditions.</p>
Greater Everglades: WCA 3A and WCA 3B	FWO	<p>a) L-28 Triangle: Negligible effect (note: based on comparison of updated IORBL1 to the updated 2012EC, due to error correction in RSM-GL modeling; refer to Appendix C.2.2 for additional discussion).</p> <p>b) Northwest WCA 3A (3A-NW): Negligible effect. Stages slightly increased during the wettest 20% of conditions.</p> <p>c) Northeast WCA 3A (3A-NE): Minor to Moderate adverse effect. Stages are decreased by 0.1-0.2 feet, with no significant change during extreme wet or extreme dry conditions.</p> <p>d) East-Central WCA 3A (3A-3): Minor to Moderate adverse effect. Stages are generally decreased by 0.1-0.2 feet, with no significant change during extreme wet or extreme dry conditions.</p> <p>e) Central WCA 3A (3A-4): Minor to Moderate adverse effect. Stages are generally decreased by 0.1-0.2 feet, with no significant change during extreme wet or extreme dry conditions.</p> <p>f) Southern WCA 3A (3A-28): Moderate adverse effect. Stages are generally decreased by 0.2-0.3 feet, with no significant change during extreme wet or extreme dry conditions.</p> <p>g) WCA 3B (Site 71): Minor to Moderate adverse effect. Stages are decreased by 0.1-0.2 feet during normal to dry conditions.</p>
	Alt 4R	<p>a) L-28 Triangle: Minor improvement. Stages increased by 0.1-0.2 feet during all hydrologic conditions, excluding extreme wet conditions (note: based on comparison of updated IORBL1 to the updated 2012EC, due to error correction in RSM-GL modeling; refer to Appendix C.2.2 for additional discussion).</p> <p>b) Northwest WCA-3A (3A-NW): Major improvement. Stages are generally significantly increased by 0.6-0.8 feet.</p> <p>c) Northeast WCA-3A (3A-NE): Major improvement. Stages are increased by 0.4-0.7 feet, with no significant change during extreme wet conditions and a slight increase in stage for extreme dry conditions.</p> <p>d) East-Central WCA-3A (3A-3): Major improvement. Stages are generally increased by 0.2-0.5 feet, with no significant change during the wettest 20% of conditions.</p> <p>e) Central WCA-3A (3A-4): Minor to moderate improvement. Stages are generally increased by 0.1-0.2 feet during average to dry conditions, with a slight depth reduction during the wettest 10% of conditions and no significant change during extreme dry conditions.</p> <p>f) Southern WCA-3A (3A-28): Minor improvement. Stages are decreased by 0.1-0.2 feet</p>

Geographic Region	Alt	Hydrologic Effects
		<p>during the wettest 5% of conditions and slightly decreased during normal to dry conditions.</p> <p>g) WCA-3B (Site 71): Moderate to major improvement. Stages are increased under all hydrologic conditions, including stage increases of 0.1 feet during the upper 20% of the stage duration curve (wet to extreme wet conditions), stage increases of 0.2-0.3 feet for normal to dry conditions, and a slight stage increase during extreme dry conditions.</p>
	Alt 4R2	<p>a) L-28 Triangle: Same as Alt 4R.</p> <p>b) Northwest WCA-3A (3A-NW): Same as Alt 4R.</p> <p>c) Northeast WCA-3A (3A-NE): Same as Alt 4R.</p> <p>d) East-Central WCA-3A (3A-3): Same as Alt 4R.</p> <p>e) Central WCA-3A (3A-4): Same as Alt 4R.</p> <p>f) Southern WCA-3A (3A-28): Same as Alt 4R.</p> <p>g) WCA-3B (Site 71): Same as Alt 4R.</p>
Greater Everglades: ENP	FWO	<p>a) Northwest ENP (NP-201): Minor improvement. Stages are increased by 0.1-0.2 feet during normal to dry conditions.</p> <p>b) Northeast ENP (NESRS-2): Minor adverse effect. Stages are slightly reduced during normal to dry conditions.</p> <p>c) Central ENP (P-33): Negligible effect.</p> <p>d) Taylor Slough: Minor to Moderate improvement. Stages are increased by 0.1-0.3 feet during nearly all hydrologic conditions.</p>
	Alt 4R	<p>a) Northwest ENP (NP-201): Minor to moderate adverse effect. Stages are significantly decreased by 0.1-0.3 feet under both wet and dry hydrologic conditions; stages are slightly increased or unchanged for normal hydrologic conditions between approximately 35% and 55% on the stage duration curve.</p> <p>b) Northeast ENP (NESRS-2): Major improvement. Stages are significantly increased by 0.5-0.9 feet under all hydrologic conditions.</p> <p>c) Central ENP (P-33): Major improvement. Stages are increased by 0.2-0.4 feet under all hydrologic conditions.</p> <p>d) Taylor Slough: Minor adverse effect. Stages are slightly decreased by approximately 0.1 feet during the wettest 20% of hydrologic conditions and slightly increased by 0.1-0.2 feet during normal to dry hydrologic conditions.</p>
	Alt 4R2	<p>a) Northwest ENP (NP-201): Same as Alt 4R.</p> <p>b) Northeast ENP (NESRS-2): Same as Alt 4R.</p> <p>c) Central ENP (P-33): Same as Alt 4R.</p> <p>d) Taylor Slough: Same as Alt 4R.</p>
Southern Estuaries	FWO	<p>a) Biscayne Bay: Moderate improvement. Average annual canal discharges to northern Biscayne Bay (S-27, S-28, and S-29) are increased by 66 kAF (19%).</p> <p>b) Florida Bay: Moderate adverse effect. Combined average annual overland flows from Southern ENP to Florida Bay (Transect 23) are decreased by 14 kAF (5%).</p>
	Alt 4R	<p>a) Biscayne Bay: Minor adverse effect. Combined total average annual canal discharges to central and southern Biscayne Bay (S-336, S-338, S-194, S-196, S-197) are</p>

Geographic Region	Alt	Hydrologic Effects
		reduced by 9 kAF (8%). b) Florida Bay: Moderate improvement. Combined average annual overland flows from Southern ENP to Florida Bay (Transect 23) are increased by 27 kAF (11%).
	Alt 4R2	a) Biscayne Bay: Minor to moderate adverse effect. Combined total average annual canal discharges to central and southern Biscayne Bay are increased by 17 kAF (15%). Average annual canal discharges to northern Biscayne Bay are reduced by 46 kAF (11%). Additional analysis for Savings Clause requirements is provided in Annex B . b) Florida Bay: Moderate improvement. Combined average annual overland flows from Southern ENP to Florida Bay (Transect 23) are increased by 23 kAF (9%).

5.2.9 Water Quality

The assessment of project impacts to water quality are summarized in **Table 5.2-2** below. The detailed analyses are found in **Appendix C.2.1**, and **Appendix C.2.2** as well as **Annex F**.

Table 5.2-2. Environmental Effects of Alt 4R and 4R 2 on Water Quality

Water Quality		
Geographic Regions	FWO	Alt 4R and Alt 4R2
Lake Okeechobee	WQ is expected to improve relative to present conditions as the result of implementation of TMDLs, and implementing the associated BMAPs for the basins discharging to the lake.	Similar to FWO; slight changes to operations not expected to result in significant WQ impacts; however, additional backflow into the lake at S-308 increases the annual phosphorus load slightly. Changes in phosphorus loads will be addressed holistically throughout the watershed via the Florida Department of Environmental Protection's Lake Okeechobee Basin Management Action Plan (BMAP) process (Section 403.067, Florida Statutes). The BMAP is currently under development via a public stakeholder driven process.
Northern Estuaries	Number of low salinity events reduced for both Caloosahatchee and St. Lucie relative to baseline conditions. Number of high salinity events reduced for the Caloosahatchee Estuary. Improved nutrient and dissolved oxygen conditions expected to result from reduced high flow events from Lake Okeechobee, improved Lake Okeechobee nutrient levels, and improved estuary basin runoff quality from TMDL implementation.	Relative to FWO, number of low and high salinity events for Caloosahatchee and St. Lucie is reduced. Improved nutrient and dissolved oxygen conditions expected to result from reduced high flow events from Lake Okeechobee, improved Lake Okeechobee nutrient levels, and improved estuary basin runoff quality.
EAA	Relative to existing conditions there will be improvement in nutrient conditions due to implementation of water quality projects under the States Restoration Strategy Program to meet the WQBEL for STA discharges. See Annex F for details. Slight reduction in sulfate due to additional removal in STAs as well as potential reductions from reduced farming activities.	Use of A-2 FEB lands in project will slightly reduce total basin nutrient loads. Otherwise similar to FWO. CEPP plan increases flows through the Central Flow path, but it also provides increased FEB storage. Based on DMSTA modeling, the additional FEB storage provided in the central flow path by CEPP, in combination with the A-1 FEB, STA-2, and STA-3/4, is sufficient to handle the additional CEPP flows (approximately 210 kac-

Water Quality		
Geographic Regions	FWO	Alt 4R and Alt 4R2
	DMSTA water quality modeling indicates that SFWMD's Restoration Strategies Program is expected to result in compliance with the 2012 WQBEL for total phosphorus. The Restoration Strategies plan is scheduled for completion in 2029.	ft/yr) and still achieve the WQBEL. However, there are still uncertainties associated with treatment of CEPP flows using the existing conveyance features, STA facilities, and portion of A-1 FEB capacity. The CEPP adaptive management plan will address some of the uncertainties associated with operating the integrated A-1/A-2 FEB integrated system. It is expected that the A-2 FEB will accrete peat soils and capture carbon from the atmosphere.
Greater Everglades	<p>Relative to baseline conditions, expect reduction in nutrient concentrations entering Everglades Protection Area due to implementation in the Restoration Strategies project in the EAA. Reduced sulfate load expected as a result of reduced flows and additional removal in additional removal from STA/FEB expansion.</p> <p>Relative to baseline conditions, increased frequency of meeting the 1991 Settlement Agreement water quality compliance requirements for Loxahatchee, Shark River Slough, and Taylor Slough. This is as result of construction of Restoration Strategies project features in the EAA constructed as part of Restoration Strategies, the stormwater features constructed in the S9 Basin as part of the Broward County Water Preserve Area project, as well as further progress on implementation of BMPs in developed areas adjacent to the Everglades.</p> <p>Mercury available for methylation is likely to increase as a result of increased Hg atmospheric load from international sources. This will be moderated somewhat due to the implementation of FDEP Total Hg TMDL and new EPA Clean Air Act standards for emissions of Hg.</p>	<p>WCA 3A: Backfilling of northern portion of Miami Canal and re-direction of water into the northern marsh areas will result in greater uptake of nutrients and sulfate in northern WCA 3A. Increased flows and new flow patterns may result in increased water column phosphorus concentrations at one or more TP rule stations in the short term. The effect on TP rule compliance is uncertain; though the impact is likely to be minimal in the long term. Reduced incidence of dry out of the northern marsh should limit peat oxidation and nutrient re-mobilization. Lower phosphorus and sulfate concentrations should occur in southern WCA 3A. Redistribution of flows into the northern marsh and away from the Miami Canal may result in a change in locations of methylmercury "hotspots" identified as areas where methylmercury concentrations in fish are high. It is expected that the sawgrass prairie communities north of Alligator Alley will have a higher probability of succession which suggests positive peat soil accretion and carbon capture from the atmosphere.</p> <p>WCA 3B: Reduction in dry out events relative to FWO will result in reduced peat oxidation / re-mobilization of nutrients. Additional flows into WCA 3B through the S-631 structure may result in increased water column phosphorus concentrations at one or more TP rule stations in the short term; however, this should have minimal impact on TP rule compliance in the long term.</p> <p>ENP: It is uncertain how changes in flow distributions proposed under CEPP will impact compliance with Appendix A of the 1991 Settlement Agreement. Over the long-term, distributing the flow over the northern WCA-3A marsh, reducing short-circuiting down the canals to ENP, adding more flow from the lake that is treated to the WQBEL, and distributing these</p>

Water Quality		
Geographic Regions	FWO	Alt 4R and Alt 4R2
		flows over the marsh should result in improvements by lowering the flow weighted mean total phosphorous concentration entering the Park. In the short-term, to address the uncertainty in compliance with Appendix A, the Technical Oversight Committee (TOC) is reviewing applicability of the current Appendix A compliance methodology for a restored ecosystem. Relative to FWO, no change to Settlement Agreement compliance for Taylor Slough is expected.
Southern Estuaries	Base salinity conditions in Florida Bay are poor - current or FWO conditions are far from the restoration target. Relative to baseline condition, slight reduction in salinities in nearshore zones. Nutrient loading from upland areas not expected to change significantly relative to baseline conditions.	Improved salinity conditions relative to FWO condition. With-project mean salinity moves closer to the target with a 2 psu decrease in the bay's central zone and an average salinity decrease of 1.5 psu among all bay zones for wet and dry seasons. While this appears to be a small change, this grand mean of salinity improvement (over a simulated 36 year period) is still a major step toward the restoration target.

5.2.10 Air Quality

The total increases in air pollutants are relatively minor in relation to the existing point and nonpoint and mobile source emissions in Palm Beach, Broward, and Miami-Dade Counties. Effects from project related emissions for Alts 4R and 4R2 during construction and during the operational phase of the CEPP project would not significantly impact air quality within the air shed. Short-term loadings of internal-combustion engine exhaust gasses are expected to be negligible and not pose a threat to workers or local populations. The G-370 and G-372 pumps presently have air quality emissions permits. These permits may need modification to account for the additional operations and emissions. The project is expected to reduce green house gas emissions by capturing carbon through peat soil accretion that is expected to occur as a result of wetland rehydration. An air quality permit will be obtained prior to the construction of the expanded S-356 pump station. Because the project is located within a designated attainment area, U.S. Environmental Protection Agency's general conformity rule to implement Section 176 (c) of the Clean Air Act does not apply, and a conformity statement should not be required. Detailed analysis on air quality impacts and green house gas emissions are presented in **Appendix C.2.2.10**.

5.2.11 Hazardous, Toxic and Radioactive Waste

Table 5.2-3. Environmental Effects of Alts 4R and 4R2 on HTRW

HTRW		
Geographic Regions	FWO	Alt 4R and Alt 4R2
Lake Okeechobee	Increased development within basin may result in new HTRW sites while existing ones should continue to be remediated.	Similar to FWO
Northern Estuaries	Increased development within Caloosahatchee and St. Lucie basins may result in new HTRW sites being identified while response actions are expected to continue at existing sites.	Similar to FWO
EAA	A2 FEB lands continue to be farmed which may result in new HTRW releases on these lands as well as additional pesticide application to cultivated areas.	A-2 FEB lands are converted to aquatic habitat. This will reduce the possibility of future HTRW release on these lands.
Greater Everglades	Response actions are completed on FDEP identified HTRW sites and new sites are documented and eventually remediated. Potential for illegal waste disposal remains high.	Similar to FWO
Southern Estuaries	Response actions are completed on FDEP identified HTRW sites and new sites are documented and eventually remediated.	Similar to FWO

5.2.12 Noise

Features of Alts 4R and 4R2 are the same. During construction of Alts 4R and 4R2 there would be minor and short-term increases in noise during construction and a less than significant effect. Alts 4R and 4R2 each include construction of two additional pump stations which would result in long-term, localized increases in noise in comparison to FWO.

5.2.13 Aesthetics

Features of Alts 4R and 4R2 are the same. Alts 4R and 4R2 show a significant increase in aesthetic value over the FWO due to restoration of hydropatterns and sheetflow throughout the project area and provide long-term, minor beneficial effects. The restoration of sheetflow would provide additional habitat for native plants and animals and increased opportunities for wildlife viewing. There would be temporary, short-term, localized effects to aesthetics during construction of all features. In the Northern Estuaries, Alts 4R and 4R2 would increase the long-term aesthetic value due to decreased high flow events. Reductions in high volume discharges to the estuaries would result in lower suspended solids, increased water clarity and the correct salinity envelope that maintain healthy SAV beds. These benefits could also lead to an increase in long-term wildlife viewing opportunities. With the EAA, wetland vegetation is anticipated to colonize the A-2 FEB increasing wildlife utilization and opportunities for wildlife viewing within the area. In the Greater Everglades, while there would be a short-term, minor adverse effect on aesthetics due to the construction of the Blue Shanty Levee, there would be a long-term beneficial effect with an increase in aesthetics due to the creation of sheet flow in the Blue Shanty flow way. Restoration of flows within Florida Bay and the southwestern coastal estuaries would improve habitat within these regions, thereby increasing opportunities for wildlife viewing as well as providing a potential for the reduction in red tide occurrences. A more detailed description of the potential effects is provided in **Appendix C.2.13**.

5.2.14 Land Use

The entire CEPP project area consists of lands currently under public ownership; however, the A-2 footprint is currently being leased and used for agricultural purposes.

5.2.14.1 Wetlands

Much of the future development within the study area is expected to occur on lands that were formerly in agricultural use. **Table 5.2-4** summarizes effects on wetlands and uplands for Alts 4R and 4R2. Alts 4R and 4R2 each show a long-term, significant and major beneficial effect with an increase of 625 acres of wetland/upland habitat over the FWO as well as an increase in wetland function. There are some minor, short-term, adverse effects due to the construction of some CEPP features, most notably the Blue Shanty Levee in WCA 3B. However, the construction of other features, including the degradation of levees and the backfilling of canals, reconnects and adds wetland acreage and provides the needed topography for sheetflow to restore the natural system. In addition to gains in wetlands, Alts 4R and 4R2 each shift approximately 13,800 acres of agricultural land use with wetland soils to a higher quality wetland with the construction of the A-2 FEB. The A-2 FEB would alter the land use from agriculture to an FEB that includes wetland habitat. The WCA 3B flow-way achieves a central goal of CERP and of CEPP: restoration of continuous sheet-flow, over long distances, and in the original flow directionality. The creation of a new levee in Alts 4R and 4R2 make it possible to remove a similar length of existing levee (L-67C). A detailed description of the differences in wetland/upland acres is provided in **Appendix C.2.2.16**

In addition to the benefit of increased wetland/upland acres, the wetland function increases as well due to backfilling the Miami Canal and the restoration of sheetflow across WCA 3A and 3B into ENP. The initial construction may have a short-term, temporary adverse affect on the wetland function in the construction areas, but once the project is complete, all alternatives would increase wetland function based on the acres of wetlands gained.

Table 5.2-4. Effects on Wetlands (acres) for Alts 4R and 4R2

Project Feature	Alt 4R Acres of Wetland Gain (Loss) over FWO	Alt 4R2 Acres of Wetland Gain (Loss) over FWO
L-4 Degrade	35	35
Miami Canal Backfill	417	417
Miami Canal Spoil Mounds	45	45
L-67A Culverts	(13.5)	(13.5)
L-67C Gaps	9	9
L-67C Flow Way Degrade	64	64
L-29 Degrade	46	46
Blue Shanty Levee	(113)	(113)
L-67 Extension Backfill	104	104
Old Tamiami Trail Road Degrade	31	31
Total Net Change	625	625

5.2.14.2 Agriculture

Fourteen thousand acres of public land currently leased for agricultural use will be converted into a FEB for both Alt 4R and Alt 4R2. As described in **Section 5.2.8**, negligible and less than significant changes were noted for water stages within the South Dade Conveyance System; therefore no indirect effects on

agriculture within this region are anticipated. All of the agricultural acreage is considered unique farmland (not subject to frost). Coordination with the United States Department of Agriculture (USDA) and National Resources Conservation Service (NRCS) to meet the requirements of the Farmland Protection Policy Act, is ongoing. When detailed design information that locates each of the plan components is completed, it can then be determined how many acres of unique farmland would be affected by the Project. See **Appendix C.4.12** for more information.

5.2.15 Socioeconomics

5.2.15.1 Population

The CEPP study area population is expected to increase by 18 percent from 2010 to 2030 with Palm Beach and Miami-Dade counties attracting the greatest number of new residents. Monroe County is expected to experience a small reduction in permanent residents over the next 20 years. When aggregated, the total population is projected to increase by 1 million people. This is a slower rate of growth than projected previously in CERP planning efforts. Population projections are not anticipated to differ between FWO, Alt 4R and Alt 4R2 conditions.

There will be no impacts to Lake Okeechobee commercial navigation with this project. Operational changes were incorporated into the hydrologic modeling conducted for Alt 4R2, in an effort to optimize CEPP system-wide performance within the existing flexibility of the 2008 LORS. More specifically, the hydrologic modeling of the CEPP alternatives included proposed revisions to the 2008 LORS decision tree outcome maximum allowable discharges dependant on the following criteria: Lake Okeechobee inflow and climate forecasts (class limits were modified for tributary hydrologic conditions, seasonal climate outlook, and multi-seasonal climate outlook), stage level (regulation zone), and stage trends (receding or ascending). While some refinements were made within the operational flexibility available in the 2008 LORS, consistent with the original modeling intent, the final operational assumptions ultimately extended beyond this flexibility due to adjustments made to the tributary/climatological classifications. Additional information and documentation of these assumptions can be found in **Appendix A**. The authorized C&SF project depths for Lake Okeechobee navigation are based on 12.56 feet NGVD. The number of days below this criteria was 4934 for the ECB/2012EC, 5323 for the FWO, 5327 for the IORBL1, and 4463 for ALT4R2. Comparison between the FWO/IORBL1 and the Alt 4R2 indicate reduced potential navigation impacts with the TSP. Of course, as discussed above, the Lake Okeechobee Regulation Schedule changes which are implicit in the analysis are not included as part of Alt 4R2.

5.2.15.2 Water Supply and Flood Control

A summary of the anticipated long-term effects on water supply and flood control of the FWO, Alt 4R, and Alt 4R2 is presented in **Table 5.2-5**. Alt 4R and Alt 4R2 are compared to the FWO; similarly, the effects of the FWO are described based on comparison to the ECB. The summary of regional performance differences includes quantitative comparisons between the CEPP ECB and the FWO, the FWO and Alt 4R, and the FWO and Alt 4R2 based on the RSM-BN and RSM-GL CEPP modeling representations of these baselines. The period of simulation (1965-2005) used for the CEPP hydrologic modeling encompasses a wide range of historical climatologic and meteorologic conditions that are representative of south Florida hydrology. This analysis period includes several moderate wet and moderate dry periods, as well as less frequent and potentially more impactful periods of both extreme high rainfall and extreme drought conditions. Alts 1 through 4 are separately compared to the FWO in **Section 5.1.15.2**. To address the Savings Clause requirements for CERP, **Annex B** includes a detailed and comprehensive analysis of potential long-term effects of the CEPP recommended plan (Alt 4R2), where applicable, to existing legal sources for water supply and/or the levels of service for flood protection.

Based on the period of simulation analysis for the recommended plan, the C&SF system modifications successfully maintained the pre-project levels of service for flood protection consistent with the requirements of the WRDA 2000 Savings Clause.

Table 5.2-5. Environmental Effects of Alt 4R and Alt4R2 on Water Supply and Flood Control

Geographic Region	Alts	Water Supply and Flood Control
Lake Okeechobee	FWO	Moderate adverse effect. Compared to the ECB, mean annual EAA water supply demands not met are increased from 7% to 8%. LOSA water supply cutback percentage is increased for 3 of the 8 years with the largest water supply cutbacks.
	Alt 4R	Minor improvement. Compared to the FWO, mean annual EAA water supply demands not met are decreased from 8% to 6%. LOSA water supply cutback percentage is increased for 2 of the 8 years with the largest water supply cutbacks.
	Alt 4R2	Minor to moderate improvement. Compared to the FWO, mean annual EAA water supply demands not met are decreased from 8% to 6%. LOSA water supply cutback percentage is increased for 1 of the 8 years with the largest water supply cutbacks.
Greater Everglades	FWO	Major flood control improvement. Compared to the ECB, the frequency of WCA-3A stages within Zone A of the Regulation Schedule is significantly reduced from 32% to 18% of the 1965-2005 period of simulation.
	Alt 4R	Moderate flood control improvement. Compared to the FWO, the frequency of WCA-3A stages within Zone A of the Regulation Schedule is moderately increased from 18% to 22% of the 1965-2005 period of simulation. Stages within the wettest 10% of hydrologic conditions, however, are generally reduced by 0.2-0.3 feet.
	Alt 4R2	Same as Alt 4R.
Lower East Coast Service Area 1 (Palm Beach)	FWO	Moderately adverse effect. 3 additional water years with 3 or more consecutive months with restrictions, which result from lower Lake Okeechobee stages and not local groundwater conditions. Local groundwater stages east of WCA-1 reduced by 0.2-0.5 feet for the driest 10% of hydrologic conditions. Local groundwater stages south of the Site 1 CERP project reduced by 0.2 feet for normal to dry conditions and by up to 1.0 feet during extreme dry conditions.
	Alt 4R	Minor improvement. 2 fewer water years with 3 or more consecutive months with restrictions. No significant changes to local groundwater stages.
	Alt 4R2	Same as Alt 4R.
Lower East Coast Service Area 2 (Broward)	FWO	Minor adverse effect. 1 additional water year with 3 or more consecutive months with restrictions which results from lower Lake Okeechobee stages and not local groundwater conditions. Local groundwater stages slightly reduced for the driest 10% of hydrologic conditions.
	Alt 4R	Minor adverse effect. No change in the number of water years with 3 or more consecutive months with restrictions. No significant changes to local groundwater stages which are prevalent through normal to dry hydrologic conditions. Reduced stages are indicated during the driest 5-10% of hydrologic conditions for some monitoring gages located east of WCA-2A and WCA-2B.
	Alt 4R2	Negligible. No change in the number of water years with 3 or more consecutive months with restrictions. No significant changes to local groundwater stages which are prevalent through normal to dry hydrologic conditions. An increased demand of 12 million gallons per day (MGD) is provided for LECSA 2.

Geographic Region	Alts	Water Supply and Flood Control
Lower East Coast Service Area 3 (Miami-Dade)	FWO	<p>Moderate to major adverse effects.</p> <p>a) 3 additional water years with 3 or more consecutive months with restrictions, which result from lower Lake Okeechobee stages and not local groundwater conditions.</p> <p>b) L-30 canal stages are reduced by 0.2-0.4 feet for normal to extreme dry conditions.</p> <p>c) L-31N canal stages are slightly reduced by 0.1-0.2 feet for extreme dry conditions. Slight increase in flood control stages within the wettest 10% of hydrologic conditions.</p> <p>d) C-111 canal stages between S-176 and S-18C are generally lowered by 0.2-0.5 feet for normal to extreme dry conditions.</p>
	Alt 4R	<p>Moderate improvement for water supply and flood control, with no anticipated adverse effects.</p> <p>a) Decrease of 3 water years with 3 or more consecutive months with restrictions.</p> <p>b) L-30 Canal stages are increased by 0.1-0.6 feet for normal to extreme dry conditions; moderate reduction of 0.1-0.2 feet for flood control stages within the wettest 10% of hydrologic conditions, with no significant change observed for the upper 1% of the stage duration curve.</p> <p>c) L-31N canal stages are increased by 0.1-0.2 during dry conditions; significant reduction to flood control stages within the wettest 5% of hydrologic conditions. Reduced stages are indicated during the driest 5% of hydrologic conditions for areas east of L-31N and south of the 8.5 SMA.</p> <p>d) No significant change to C-111 canal stages between S-176 and S-18C during normal to dry hydrologic conditions, with a 0.1-0.2 ft increase during normal hydrologic conditions; no significant change for flood control stages within the upper 10% of the stage duration curve.</p>
	Alt 4R2	<p>Moderate improvement for water supply and flood control, with no anticipated adverse effects.</p> <p>a) Decrease of 3 water years with 3 or more consecutive months with restrictions.</p> <p>b) L-30 Canal stages: Same as Alt 4R.</p> <p>c) L-31N canal stages: Same as Alt 4R.</p> <p>d) C-111 canal stages between S-176 and S-18C: Same as Alt 4R.</p> <p>e) Minor increase to stages in the wettest 10% of the hydrologic conditions for areas immediately east of Pennsuco, with stage increases of less than 0.20 feet.</p> <p>f) An increased demand of 5 MGD is provided for LECSA 3.</p>

5.2.15.3 Recreation

Effects of Alt 4R and 4R2 on recreation are presented in **Table 5.2-6** with additional details provided in **Appendix C.2.2.15. Table 5.2-7, Table 5.2-8 and Table 5.2-9** provide information as on when the FWC considers closures in the EWMA due to high or low water stages. A closure event for these tables is one or more consecutive days when high or low water criteria are met based on the two gauge average for WCA 3A-2 and WCA 3A-3.

Table 5.2-6. Environmental Effects of Alts 4R and 4R2 on Recreation

Recreation		
Geographic Regions	FWO	Alt 4R and Alt 4R2
Lake Okeechobee	No Effect	No Effect. There is no impact to recreational navigation.
Northern Estuaries	No Effect	Reductions in extremely high flows to the estuaries that currently damage fisheries habitat would provide minor and less than significant beneficial effects by enhancing utilization of the estuaries by fish and subsequently improve related recreational opportunities such as fishing, boating and kayaking.
EAA	Currently no recreation exists on the project site.	The FEB feature will add approximately 14,000 acres of recreational opportunities and recreation features similar to those in the Greater Everglades, providing a minor and less than significant beneficial effect.
Greater Everglades	Recreational hunting and fishing would be affected little if at all. Hiking, Biking and Camping will not be affected directly. Any changes in recreation would be due to degraded quality of wetlands and the aesthetic values could decrease as wildlife viewing and nature study would be degraded.	<p>Improved hydrology will enhance wildlife populations through improved survival and reproduction, subsequently resulting in a minor and less than significant beneficial effect for outdoor recreation opportunities. Proposed facilities will enhance the public's ability to access into and within the Greater Everglades. Increased hydration in the very northern WCA 3A areas that have been drier could have a short-term significant, adverse and unavoidable effect on hunting (deer, hog, and rabbit). Conversely, a long term major significant benefit occurs due to increased fire protection for the peat soils, thus diminishing the potential for loss of this same area. Alts 4R and 4R2 incorporate the least negative effect on Northern WCA 3A mammal hunting opportunities. In these northern dry areas public access is often limited to track vehicles; rehydration will increase public access through improved conditions favorable to airboats.</p> <p>Access for recreational fishing by power boat will have a major and adverse significant effect through backfilling the Miami Canal. This affects 14 of the 33 miles of the Miami Canal in the WCA 3. Fishing opportunities throughout the Greater Everglades will have a major beneficial effect by the improvements in boat access and the addition of access points around proposed structures. The removal of the L-29 levee will create a marsh connection to L-29 canal and enhance fishing in this canal.</p> <p>Improved trail heads for access and designation of blue and greenway trails will be positive. The Blue Shanty Levee will bisect L-67C. Recreational fishing by prop boat to the northern end of L67C canal would continue to be available from a new public boat ramp located in the northern end of L67C at the S151, providing a minor and less than significant beneficial effect. Also at the S151 a new public boat ramp will allow access into the northern 5 miles of the Miami Canal south of S151 not previously served by a public boat ramp. The Blue</p>

Recreation		
Geographic Regions	FWO	Alt 4R and Alt 4R2
		Shanty levee will have an airboat crossing, at full height, so as to not bisect the airboat use within WCA 3B. A boat ramp will be added near S-333 to provide access to the L-29 canal so the L-29 divide structure does not prevent boat access. The L-29 divide structure will also serve as a pedestrian and vehicle access to the remaining L-29. The Blue Shanty Levee will serve as reroute connection for greenways trail users when the L-29 levee is removed to ensure contiguous connection east to west between S333 and S334.
Southern Estuaries	No Effect	Access to the Southern Estuaries would not change based on CEPP, however, increase in flows to Florida Bay would enhance fish populations and subsequently improve related recreational opportunities such as fishing, boating and kayaking, providing a minor beneficial effect.

Table 5.2-7. Closures Over the Period of Record in the EWMA for the ECB, FWO and Alts 4R and 4R2

Alt	High Stage Closures over POR			Fire Closures over POR			Total High Water and Low Water Closures			
	(2 Gauge avg. > 11.6' ft)			(2 gauge avg. <= 9.30' ft)						
	Closure Days	Closure Events	Avg. Closure Duration (Days)	Closure Days	Closure Events	Avg. Closure Duration (Days)	Closure Days	Closure Events	Avg. Closure Duration (Days)	% of POR-Closure
ECB	511	15	34.1	599	19	31.5	1,110	34	32.6	7.4%
FWO	441	12	36.8	677	21	32.2	1,118	33	33.9	7.5%
Alt 4R	605	17	35.6	353	12	29.4	958	29	33.0	6.4%
Alt 4R2	613	18	34.1	355	10	35.5	968	28	34.6	6.5%

Notes:

* 2 Gauge avg. is based on cells WCA 3A-2 and WCA 3A-3.

*3A-2 & 3A-3 average ground surface elevation = 9.66 ft NGVD (closure thresholds are indicated in Table 5.2.7)

Table 5.2-8. High Water Event Changes from the FWO for Alts 4R and 4R2 in the EWMA for each Month of the Year

Month	ECB	FWO	Alt 4R	Alt 4R2	Month
1	0	0	0	0	1
2	1	0	2	2	2
3	0	0	0	0	3
4	0	0	0	0	4
5	0	0	0	0	5
6	0	0	1	3	6
7	2	0	4	3	7
8	0	0	1	1	8
9	0	0	-1	-1	9
10	0	0	-2	-2	10
11	0	0	0	0	11
12	0	0	0	0	12
Total	3	0	5	6	Total

Table 5.2-9. High Water Events for the ECB, FWO, and Alts 4R and 4R2 in the EWMA for each Month of the Year

Month	ECB	FWO	Alt 4R	Alt 4R2	Month
1	0	0	0	0	1
2	1	0	2	2	2
3	1	1	1	1	3
4	0	0	0	0	4
5	0	0	0	0	5
6	2	2	3	5	6
7	3	1	5	4	7
8	0	0	1	1	8
9	2	2	1	1	9
10	5	5	3	3	10
11	1	1	1	1	11
12	0	0	0	0	12
Total	15	12	17	18	Total

5.2.16 Cultural Resources

Alternative 4R and 4R2 effects on cultural resources is presented in **Table 5.2-10**. Criteria used to evaluate the alternatives can be found in **Section 5.1**. A description of full preliminary analysis, background information and descriptions of terms are presented in **Appendix C.2.2.17**.

In conjunction with the National Historic Preservation Act (NHPA), formal consultation was initiated with the Seminole Tribe of Florida's Tribal Historic Preservation Office (THPO); the Miccosukee Tribe of Indians of Florida's NAGPRA Representative; the Florida State Historic Preservation Office (SHPO); Everglades National Park's, Chief of Cultural Resources; and the Florida Bureau of Archaeological Research. During formal consultation, a number of conclusions were drawn (**Appendix C.5**): (1) It was determined that additional surveys were needed to identify cultural resources within specific areas of potential effect. (2) It was decided that as the CEPP project progressed, additional surveys may be needed, specifically during the PED phase, when feature designs were finalized and construction staging areas were determined. (3) Section 106 compliance with the NHPA would be conducted separately from

NEPA and would not be completed during the current feasibility phase of the project, however would be complete prior to construction of each feature.

Under the NEPA process (Section 40CFR1501.2(d) (2)), formal consultation regarding cultural resources has been completed and is final for the CEPP feasibility study. For consideration under the NHPA, determinations of potential effects and mitigation of those effects on cultural resources listed in **Table 5.2-10**, are preliminary and should not be considered final. As required under the NHPA, further Section 106 (36 CFR Part 800) consultation is required and will be completed during the PED phase. The CEPP is currently in compliance with the procedural requirements of the NHPA and will remain in compliance with the NHPA pre and post construction.

Avoidance of adverse effects to cultural resources is the Corps preference, therefore, throughout the planning process for CEPP, the project archaeologist, engineers, and plan formulators have worked closely to determine alternatives and features of alternatives that reduce or eliminate impacts to cultural resources. Pursuant to NHPA implementing regulations, 36 CFR 800.1, where possible, the project design will be modified to avoid impacting significant historic properties and culturally significant sites. Where avoidance is not possible, other mitigation measures will be considered, which could include but are not limited to data recovery excavations. The mitigation measures will be developed in consultation with SHPO, tribal groups and other interested parties as established in implementing regulations for Section 106 of the NHPA.

For this document, the use of the term cultural resources includes historic properties eligible or potentially eligible for NRHP listing and culturally significant sites. For definitions of terms, see **Section 10**.

Table 5.2-10. Environmental Effects of Alt 4R and 4R2 on Cultural Resources

Cultural Resources (Please refer to Cultural Resource in Appendix C.2.2 for further details)		
Geographic Regions	FWO	Alt 4R and Alt 4R2
Lake Okeechobee	No effect on cultural resources.	
Northern Estuaries	No effect on cultural resources.	
EAA, including Associated Canals and Structures	If agricultural practices continue, long-term adverse effect on significant cultural resources sites 8PB16039 and 8PB16040.	Major long-term adverse effect on cultural resources sites 8PB16039 and 8PB16040. Mitigation of effects for historic property 8PB16039 potentially reduced. Mitigation of effects for culturally significant site 8PB16040 is unknown.
L-4 Spreader Feature	The L-4 (8BD5098) is not significant. No effect on cultural resources.	
S-8 Pump Complex	No effect on cultural resources.	Unknown - assessment needed for historic property 8BD5092. If applicable, mitigation could potentially reduce effects.
L-5 Deepening/Widening	The L-5 (8BD5099) is not significant. No effect on cultural resources.	
L-6 Deepening/Widening	No effect on cultural resources.	Unknown – assessment needed for the L-6 levee and associated canal. If applicable, potential mitigation could potentially reduce effects.

Cultural Resources (Please refer to Cultural Resource in Appendix C.2.2 for further details)		
Geographic Regions	FWO	Alt 4R and Alt 4R2
Miami Canal	No effect on cultural resources.	Major long-term adverse effects on historic properties 8PB4840/8BD5097. Mitigation could potentially reduce effect.
L-67A Levee and Canal	No effect on cultural resources.	Potentially major to moderate long-term adverse effect on sites with cultural significance to members of the Miccosukee Tribe of Indians of Florida. If unable to avoid, mitigation unknown. The L-67A (8BD5100) is not significant. No effect on historic properties.
L-67C Levee and Canal	No effect on cultural resources.	
L-29 Levee	No effect on cultural resources.	Major long-term adverse effect on sites culturally significant to the Miccosukee Tribe of Indians of Florida and that are potential historic properties. Potential mitigation could reduce effect.
S-333 Pump Station	No effect on cultural resources.	
New Levee(L-67D) within WCA 3B and Flow Way (Blue Shanty Flow Way)	No effect on cultural resources.	Potentially adverse effect to cultural resources/Unknown - survey needed. Mitigation unknown.
Old Tamiami Trail	No effect on cultural resources.	Major long-term adverse effect. Potential mitigation could reduce effect.
L-67 Ext. Levee	No effect on cultural resources.	
L-31N Levee	No effect on cultural resources.	Potentially major long-term adverse effect to site 8DA2104. Potential mitigation could reduce effect.
S-356 Pump Station	No effect on cultural resources.	
L-28 Levee and Canal	No effect on cultural resources.	Not Applicable
G-211 Operational Refinements	No effect on cultural resources.	
S-334 to S335 Seepage Barrier	No effect on cultural resources.	
Draft Preliminary Operations Plan	Unknown overall effects on cultural resources. Approximately 350 cultural resources sites including five districts, two traditional cultural properties, multiple culturally significant properties and one World Heritage site (ENP) within APE for CEPP. ERTTP investigations are projected to be completed ca. 2016. ¹ Mitigation unknown.	

¹ ERTTP cultural resources investigations specified through the Corps' executed Programmatic Agreement dated August 2012, to identify effect (if any) to subsurface cultural resources material caused by fluctuating water will be completed ca. 2016. This information, including other updated research available at the time, will be utilized in advance of CEPP to determine additional mitigation needs (if any) for effects of fluctuating water on subsurface cultural resources materials above and beyond those already mitigated for ERTTP or as required by other actions.

5.2.17 Invasive Species

Alt 4R has the potential and likelihood for establishment and spread of non-native invasive and native nuisance species (**Table 5.2-11**). Proposed restoration activities may affect ecosystem drivers that

directly or indirectly influence the invasiveness of non-native species. These factors may affect invasive species positively or negatively, depending on the unique characteristics of individual species and the environmental conditions for a given biological invasion (Doren et al. 2009). For example, shortened surface water drawdowns may reduce the recolonization rates of melaleuca in sawgrass marsh while increasing habitat suitability for Old World climbing fern in tree islands. Many of the areas where features are proposed are currently inhabited by non-native invasive and native nuisance species. Construction of the proposed features has the potential to spread the existing non-native invasive and native nuisance species on site as well as introduce new invasive species via contaminated equipment. Disturbed areas resulting from construction are likely to become established with non-native invasive and native nuisance species. New flows created by operations of the proposed features may serve as vectors to spread invasive and native nuisance species into new areas. The large number of existing and potential invasive plant and animal species and the often incomplete knowledge of invasive mechanisms for each species create moderate to high uncertainty in this evaluation. Long-term monitoring in an adaptive management framework is critical to ensure efficient management of the most threatening non-native invasive species in the restoration footprint. A more detailed description of the potential effects of each feature is provided in **Appendix C.2.2.18**.

Table 5.2-11. Environmental Effects of Alts 4R and 4R2 on Invasive Species

Invasive Species		
Feature	FWO	Alt 4R and Alt 4R2
Lake Okeechobee and Northern Estuaries	Negligible effect on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species; Invasion pathway to/from lake and estuaries.	Same as FWO.
A-2 Flow Equalization Basin	Negligible effect on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species; Invasion pathway to/from lake and estuaries. Vegetation management challenges in downstream STA's from continued stormwater pulses.	Moderate to major increase in invasive and nuisance plant and fish species thrive in FEB; Management options limited to mitigating impacts to FEB operations; Potential invasion pathway to WCA's.
Diversion of L-6 Flows and L-5 Improvements	Negligible effect on invasive and nuisance vegetation and non-native fish species, continue to persist at baseline levels.	Negligible to moderate reduction of SAV; Minor to moderate habitat improvement for non-native tropical fish species.
L-4/L-5 Spreader Canal and Levee Degradation	Moderate to major recruitment of existing invasive species in WCA 3A. OMRR&R of canal/levee minimize colonization of certain invasive species.	Minor reduction in recruitment of some invasive and nuisance species; Moderate to major expansion of obligate wetland invasive species in spreader canal and south of spreader canal; Spreader canal is a potential invasion pathway for aquatic species; Portions of remaining levee are habitat for Burmese pythons.

Invasive Species		
Feature	FWO	Alt 4R and Alt 4R2
L-28 Degradation and Backfill	Negligible effect on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species; OMRR&R of canal levee will minimize colonization of certain invasive species.	Negligible effects on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Moderate to major expansion of uncontrolled species; Lack of OMRR&R on remaining levee will promote colonization of certain invasive species.
Increase Capacity of S-333	Negligible effects on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Invasion pathway for aquatic invasive species downstream.	Same as FWO.
L-67A Gated Structures / Spoil Removal and L-67C Degradation	Negligible effect on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species; Invasion pathway for aquatic invasive species downstream.	New invasion pathway for aquatic plant and animal species between WCA 3A and 3B; Moderate to major expansion of cattail downstream of structures; plant and animal habitat reduced by spoil removal. Isolated remnants of L-67C will create invasive plant and animal habitat.
Outflow Structures out of WCA 3B	Invasive and nuisance species persist, negligible effects; barriers for water surface connectivity are present.	New invasion pathway for aquatic plant and animal species between WCA 3B and ENP. Potential for minor to moderate expansion of species.
L-67 Extension Levee Degrade/Backfill	Invasive and nuisance species persist on levee and in canal, negligible effects; continued cattail expansion west of L-67 Extension.	Minor to moderate reduction in habitat for some invasive plants, fish and reptiles by levee removal and canal backfill; Improved habitat for obligate wetland invasive species, minor to moderate expansion of species.
G-211 Operational Modifications / Coastal Canals Conveyance	Negligible effects on actively managed invasive and nuisance species, continue to persist or decrease; Minor expansion of uncontrolled species; Invasion pathway for aquatic invasive species downstream.	Same as FWO.
Increase S-356 Capacity to 1,000 cfs	Negligible effect on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species	Negligible reduction in invasive plant recruitment, minor to moderate improved conditions for obligate wetland invasive species, and potential expansion of cattail in northern ENP.
Miami Backfill S-8 to I-75	Negligible effect on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species	Spoil mound removal/canal backfill reduces habitat for some invasive species, minor to moderate effects; Tree islands vulnerable to invasive plant and animal colonization, minor to moderate effects; Minor to moderate expansion of obligate wetland invasive species in backfill area.
Build North South Levee in WCA 3B	Negligible effect on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species	Moderate to major potential increased invasive species due to levee construction; Increased cattail along levee in WCA 3B.

Invasive Species		
Feature	FWO	Alt 4R and Alt 4R2
L-29 degradation	Invasive and nuisance species persist; Invasion pathway for aquatic invasive species into ENP.	New invasion pathway for aquatic plant and animal species between L-29 and WCA 3B, possible minor to major expansion.
Divide Structure on L-29	Negligible effect on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species	Increased OMRR&R management of aquatic invasive and nuisance plants, minor to moderate effects.
Remove Old Tamiami Trail	Negligible effect on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species	Habitat removal for many established invasive plant and animal species, moderate effects; expansion of obligate wetland invasive species from canal into ENP, potential for minor to moderate effects.
Penetrating Seepage Barrier	Negligible effect on actively managed invasive and nuisance species, continue to persist at baseline levels or decrease; Minor to moderate expansion of uncontrolled species	Moderate reduction in invasive plant recruitment; improved conditions for obligate wetland invasive species.

5.3 EFFECTS ON NATIVE AMERICANS

The Miccosukee Tribe of Indians of Florida and the Seminole Tribe of Florida rely upon the Everglades in its natural state to support their cultural, subsistence, and commercial activities. Portions of the Tribes' Federal Reservation lands are either partially situated or immediately adjacent to WCA 3A (**Figure C.1-18 in Appendix C.1.**). In addition, the Tribes hold easements and leases from the State of Florida over large portions of the WCA 3A. Subsistence activities for members of the Miccosukee Tribe of Indians of Florida and the Seminole Tribe of Florida include gathering of materials, hunting, trapping, frogging, and fishing; while the Miccosukee Tribes of Indians of Florida's commercial activities additionally include frogging, airboat and other guided tours, and providing recreational and tourism facilities within the Everglades.

5.3.1 Miccosukee Tribe of Indians of Florida

General background information on the Miccosukee Tribe is provided in **Section 2.6 Native Americans**. The changes in hydrology from the final array of alternatives for areas of interest to the Miccosukee Tribe are summarized in **Table 5.1-2** and **Table 5.2-1** and described in more detail in **Appendix C.2.1** and **Appendix C.2.2** along with effects on species and other environmental effects.

Representatives for the Miccosukee Tribe of Indians have indicated that restoration of conditions in northwestern WCA 3 towards conditions presently observed in the central portion of WCA 3A, referred to as the South Grass, would be beneficial. Representatives of the Miccosukee Tribe of Indians also requested that CEPP consider levee gapping and backfilling of the L-28 levee and canal to re-connect WCA 3A to the Tribal lands located west of the L-28 Levee south of I-75. Several variable configurations of L-28 levee degrade and canal backfill were modeled during the screening phase of the CEPP and these results were shared with representatives of the Tribe to determine what configuration should be considered in more detail within the final array of alternatives. The Tribe's representatives indicated that application of the objectives and habitat performance metrics of CEPP for the greater Everglades were appropriate for the L-28 Triangle area.

All of the CEPP alternatives show marked improvement in hydroperiod and hydroperiod patterns in northwestern WCA 3A. Resumption of sheetflow and related patterns of hydroperiod extension and increased water depths will significantly help to restore and sustain the micro-topography, directionality, and spatial extent of ridges and sloughs and to improve the health of tree islands in the ridge and slough landscape. Although none of the alternatives would provide the necessary inundation pattern for complete slough vegetation restoration, all action alternatives act to rehydrate northern WCA 3A, promoting peat accretion, reducing the potential for high intensity fires, and promoting transition from upland to wetland vegetation.

All CEPP alternatives result in similar patterns of rehydration within northern WCA 3A and all significantly decrease the amount of time when this region experiences dry out conditions. Gauge 3A-3 in northeastern WCA 3A, used to track droughts, indicates that with the FWO this area will continue to experience water levels below ground 25-30% of the time and that water depths will exceed three feet approximately 1-2% of the time. Tree islands are connected to the surrounding peat marshes via the roots of the trees. Although tree roots are still receiving water from wicking within the peat (unless the tree island is rocky), when the water table drops below these roots, the microclimate of these islands gets too dry and they can burn. All CEPP action alternatives create the hydrology necessary to restore tree islands and reduce the potential for devastating fires. Under all CEPP alternatives, the duration of water above marsh surface increases to 85-90% (10-15% below ground), but at the same time, tree island flooding stress (i.e., ponding depths greater than 3.0 ft) remained extremely rare and slightly reduced compared to the FWO. Rehydration of northern WCA 3A is expected to prevent further tree island degradation and peat fires, and set in motion trends to restore ridge-slough-island patterns. With all CEPP action alternatives, northern WCA 3A will no longer have extremely short hydroperiods. Instead, this area will have more spatially uniform hydroperiods that vary between 120 and 240 days.

Compared to the FWO, Alt 4R and Alt 4R2 stages immediately west of the L-28 Levee are increased by 0.1-0.2 feet under wet to normal hydrologic conditions and increased by 0.2-0.3 feet under normal to dry hydrologic conditions, with no significant change indicated for extreme wet or dry conditions. Stage increases are only observed for the RSM-GL cells located immediately west of the L-28 Levee, which correspond to approximately 1-2 miles west of L-28. Average annual hydroperiods for these cells within the Miccosukee Tribe of Indians of Florida's Alligator Alley Reservation, north of Interstate 75, are increased by 10 to 60 days with Alt 4R and Alt 4R2 (FWO hydroperiods range from 25-150 days), with no significant hydroperiod change indicated for the 2-3 miles south of L-4 (FWO hydroperiods range from 0-15 days).

Alt 1 included gapping of the mid-portion of the L-28 Levee and backfilling of the mid-section of the L-28 canal, south of I-75. By re-establishing a surface water hydrologic connection between WCA 3A and the L-28 Triangle, stages within the Triangle associated with Alt 1 were generally increased by 0.2-0.5 feet during nearly all hydrologic conditions, excluding the driest 25% of hydrologic conditions. However, this component was not brought forward into the recommended plan at the request of the representatives for Miccosukee Tribe of Indians of Florida. Although Alts 2 through 4 do not include modifications to the L-28 Levee or the adjacent canal, stages within the L-28 Triangle are slightly increased by 0.1-0.2 feet during normal to dry conditions, due to groundwater interactions with the down-gradient western WCA 3A marsh. Similarly, although Alt 4R and Alt 4R2 do not include modifications to the L-28 Levee or the adjacent canal, stages within the L-28 Triangle are slightly increased by 0.1-0.2 feet during nearly all hydrologic conditions, with no stage increases indicated during extreme wet hydrologic conditions.

The WCA 3 tributary basins include the C-139, Feeder Canal, L-28 Interceptor, and L-28 Gap (located within the Big Cypress National Preserve) basins, which encompasses approximately 440,000 acres located primarily in eastern Hendry County (**Figure 5-1** and **Figure 5-2**). These basins are collectively called the Western Basins because they are along the western edge of the Everglades. Generally, land within these basins have three classifications: 1) agricultural (vegetable, sugarcane, and citrus), 2) cow-calf operations, and 3) wetlands and native areas. Agricultural land dominates the C-139 and Feeder Canal basins. While the L-28 Interceptor basin land use is split between wetlands and agricultural. The L-28 Gap Basin consists almost entirely (98 percent) of wetlands. Urban land classifications occupy 4 percent of the C-139 Basin. Overall, agricultural land uses and urban lands are projected to remain stable. A portion of the Miccosukee Tribe of Indians of Florida's Alligator Alley Miccosukee Reservation is located within the Western Basins (**Figure 5 - 2**) with water supply needs for its residents, agriculture and wetlands. Both water supply and water quality of stormwater runoff are challenges facing the development of the Western Basins.

Within central WCA 3A (3A-4), stages are generally increased by 0.1-0.2 feet during average to dry conditions, with a slight depth reduction during the wettest 10% of conditions and no significant change during extreme dry conditions for Alts 1 through 4; with Alt 4R and Alt 4R2, stages are generally increased by 0.1-0.2 feet during average to dry conditions, with a slight depth reduction during the wettest 10% of conditions and no significant change during extreme dry conditions.

Southern WCA 3A (3A-28) stages are decreased by 0.1-0.2 feet during the wettest 5% of conditions and slightly decreased during normal to dry conditions for Alts 1 and 4; for Alts 2 and 3, southern WCA 3A stages are decreased by 0.1-0.2 feet during the wettest 5% of conditions and decreased by 0.1-0.2 feet during wet, normal, and dry conditions; and for Alt 4R and Alt 4R2, stages are decreased by 0.1-0.2 feet during the wettest 5% of conditions and slightly decreased during normal to dry conditions. This information has been provided to representatives of the Tribe through PDT meetings and additional individual meetings with representatives of the Tribe.

The WCA 3B hydrologic effects, resultant from the water budget differences, vary significantly between the alternatives. At Site 71 for Alt 1, WCA 3B stages are increased by 0.1-0.2 feet during the wettest 10% of conditions and during normal to dry conditions, compared to the FWO; for Alt 2, stages are significantly increased by 0.3-0.5 feet under all hydrologic conditions; for Alt 3, stages are significantly increased by 0.2-0.3 feet during the wettest 10% of conditions and during normal to dry conditions; for Alt 4, stages are slightly increased during the wettest 10% of conditions and increased by 0.1-0.2 feet during normal to dry conditions; and for Alt 4R and Alt 4R2, stages are increased under all hydrologic conditions, including stage increases of 0.1 feet during the upper 20% of the stage duration curve, stage increases of 0.2-0.3 feet for normal to dry conditions, and a slight stage increase during extreme dry conditions. For Alt 4R2, the peak stage within the Blue Shanty flow-way is 9.70 feet NGVD and stages exceed 8.0 feet NGVD for approximately 45% of the period of simulation.

Two Native American family group settlements are located along the eastern section of the L-29 Canal, the Tigertail Camp and the Osceola Camp. The Tigertail Camp is located north of Tamiami Trail between the L-29 Canal and the L-29 Levee, approximately 0.75 miles east of S-355A and east of the proposed L-29 divide structure. Vehicle access is by means of unimproved roads adjacent to and on top of the L-29 Levee that intersect the Tamiami Trail at canal crossings at each end of the eastern section of the L-29 Canal (near S-333 and S-356). A pedestrian bridge crossing the canal connects a small parking area along the northern side of the highway to the Tigertail Camp. Elevation of the Tiger Tail Camp was

raised as part of the Modified Water Deliveries Project to elevation 12.5 ft-NGVD and is sufficient to protect this area from flooding with implementation of CEPP recommended plan (Alt4R2).

The Osceola Camp is located on the south side of the Tamiami Trail approximately one-half mile east of the S-333 structure, south of the proposed L-29 Levee degrade for the proposed Blue Shanty flow-way. Access is by vehicle directly from the highway. Peak simulated L-29 Canal stages (within the proposed WCA 3B flowway) for Alt 4R2 are 9.59 feet NGVD west of the proposed L-29 divide structure, with stages above 8.0 feet NGVD approximately 35% of the time compared to less than 2% for the FWO condition. East of the proposed L-29 divide structure, the peak simulated L-29 Canal stage is 9.50 feet NGVD, with stages above 8.0 feet NGVD approximately 20% of the time compared to less than 2% in the FWO condition. The current elevation of the Osceola Camp is not sufficient to prevent flooding of this area with implementation of the CEPP recommended plan, which relies upon implementation of the DOI Tamiami Trail Modifications: Next Steps project outlined in the Final Environmental Impact Statement November 2010, with a Record of Decision signed February 11, 2011. Implementation of the chosen alternative (6e) of the Tamiami Trail Modifications: Next Steps would require the Osceola Camp ground to be elevated to 12.5, with non-residential finished floor to 12.83 and residential finished floor to 13.5 feet NGVD. DOI will be responsible as part of the implementation of the Tamiami Trail Modifications: Next Steps to raise the Osceola Camp to the levels above expected flood levels.

Compared to the FWO, stages within northwest ENP (NP-201) which is the gage closest to the Miccosukee Tribe of Indians of Florida's Trail Reservation along Tamiami Trail are generally significantly decreased by 0.1-0.4 feet under all hydrologic conditions for Alt 1; For Alt 2 and Alt 3, NP-201 stages are slightly decreased during wet conditions, slightly increased during normal conditions, and decreased by 0.1-0.3 feet under normal to dry conditions; for Alt 4, NP-201 stages are slightly decreased during extreme wet conditions, increased by 0.1-0.2 feet during normal conditions, and decreased by 0.1-0.2 feet under normal to dry conditions; and for Alt 4R and Alt 4R2, stages within northwest ENP are generally significantly decreased by 0.1-0.3 feet under both wet and dry hydrologic conditions; stages are slightly increased or unchanged from the FWO for normal hydrologic conditions between approximately 35% and 55% on the stage duration curve. To the south and west, the NP-205 monitoring gage indicates a potentially significant stage decrease of 0.1-0.2 feet under all hydrologic conditions for all action alternatives, compared to the FWO.

Regarding the features of the final array of alternatives, the representatives for the Miccosukee Tribe of Indians of Florida has indicated that: 1) the reliance on additional bridging along the Tamiami Trail associated with the DOI Tamiami Trail Next Steps Project is not supported by the Tribe; 2) the additional pumps along the L-29 levee associated with Alt 3 would not be supported by the Tribe; 3) that construction of the Blue Shanty Levee associated with Alt 4, Alt 4R, and Alt 4R2 and the additional spreader canals along northern WCA-3A associated with Alts 2 - 4 seems counter-intuitive to goals of restoration to decompartmentalize the system. Additionally, the Tribe has indicated that none of the alternatives address their concerns regarding the quality of water entering the system at the S-140 pump station from the western basins. Tribal representatives have also reiterated the call for attention to the need for water to be returned to a natural sheetflow over the entire Everglades regions, including western Shark Valley Slough.

5.3.2 Seminole Tribe of Florida

General background information on the Seminole Tribe of Florida is provided in **Section 2.6**. The changes in hydrology from the final array of alternatives for areas of interest to the Seminole Tribe of

Florida are summarized in **Table 5.1-2** and **Table 5.2-1** and described in more detail in **Appendix C.2.1** and **Appendix C.2.2** along with effects on species and other environmental effects.

The Corps submitted a letter to the Chairman of the Seminole Tribe of Florida on December 7, 2011 outlining the scope of the CEPP requesting to meet with the Tribe routinely throughout the planning process and their participation on the Project Delivery Team to ensure any issues or concerns the Tribe may have are identified and to get their input regarding development of the plan (**Appendix C.3.1**). The scope of the planning effort was described and referenced development of the first increment of a subset of CERP project features that provide for storage, treatment and conveyance south of Lake Okeechobee, modifications to canals and levees within WCA 3 to re-distribute water flow, and seepage management features to retain water within the natural system. The components referenced were those CERP components that had been identified to accomplish these objectives, which included the Everglades Agricultural Area Storage Reservoir, Modified Holey Land Wildlife Management Area Operation Plan, Flow to Northwest and Central WCA 3A, Water Conservation Area 3A Decompartmentalization and Sheetflow Enhancement, Dade-Broward Levee/Pennsuko Wetlands, Bird Drive Recharge Area, L-31 N Improvements for Seepage Management and S-356 Structures, and Everglades Rain-Driven Operations. These CERP projects included project features within the EAA, WCA 3 and along L-31 north levee which comprises the eastern border of ENP. The figure included in the scoping letter outlined the area where potential effects would be considered which extended beyond the construction footprint of the CERP project components outlined in the scoping letter. The figure included the northeastern and southerly portions of the western basins which border the EAA and the northwest corner of WCA 3A as areas where potential effects would be considered.

The WCA 3 tributary basins include the C-139, Feeder Canal, L-28 Interceptor, and L-28 Gap (located within the Big Cypress National Preserve) basins, which encompasses approximately 440,000 acres located primarily in eastern Hendry County (**Figure 5-1** and **Figure 5-2**). These basins are collectively called the Western Basins because they are along the western edge of the Everglades. Generally, land within these basins have three classifications: 1) agricultural (vegetable, sugarcane, and citrus), 2) cow-calf operations, and 3) wetlands and native areas. Agricultural land dominates the C-139 and Feeder Canal basins. While the L-28 interceptor basin land use is split between wetlands and agricultural. The L-28 Gap Basin consists almost entirely (98 percent) of wetlands. Urban land classifications occupy 4 percent of the C-139 Basin. Overall, agricultural land uses and urban lands are projected to remain stable. A portion of the Seminole Tribe of Florida's Big Cypress Reservation is located within the Western Basins (**Figure 5 - 2**) with water supply needs for its residents, agriculture and wetlands. Both water supply and water quality of stormwater runoff are challenges facing the development of the Western Basins.

During the scoping phase of the CEPP study, representatives for the Seminole Tribe of Florida participating in the PDT meetings requested that CEPP consider opportunities to re-direct undesirable discharges from Lake Okeechobee to the Northern estuaries to the Western Basins for purposes of restoring natural areas within the Seminole Tribe of Florida's Big Cypress Reservation and the adjacent Big Cypress National Preserve. The Corps subsequently received a letter from the Seminole Tribe of Florida in July 2, 2012 expressing their concerns over reserving water necessary to support healthy ecosystems on the Seminole Tribe of Florida's Big Cypress Reservation and neighboring Big Cypress National Preserve not being included in the developing CEPP plan.

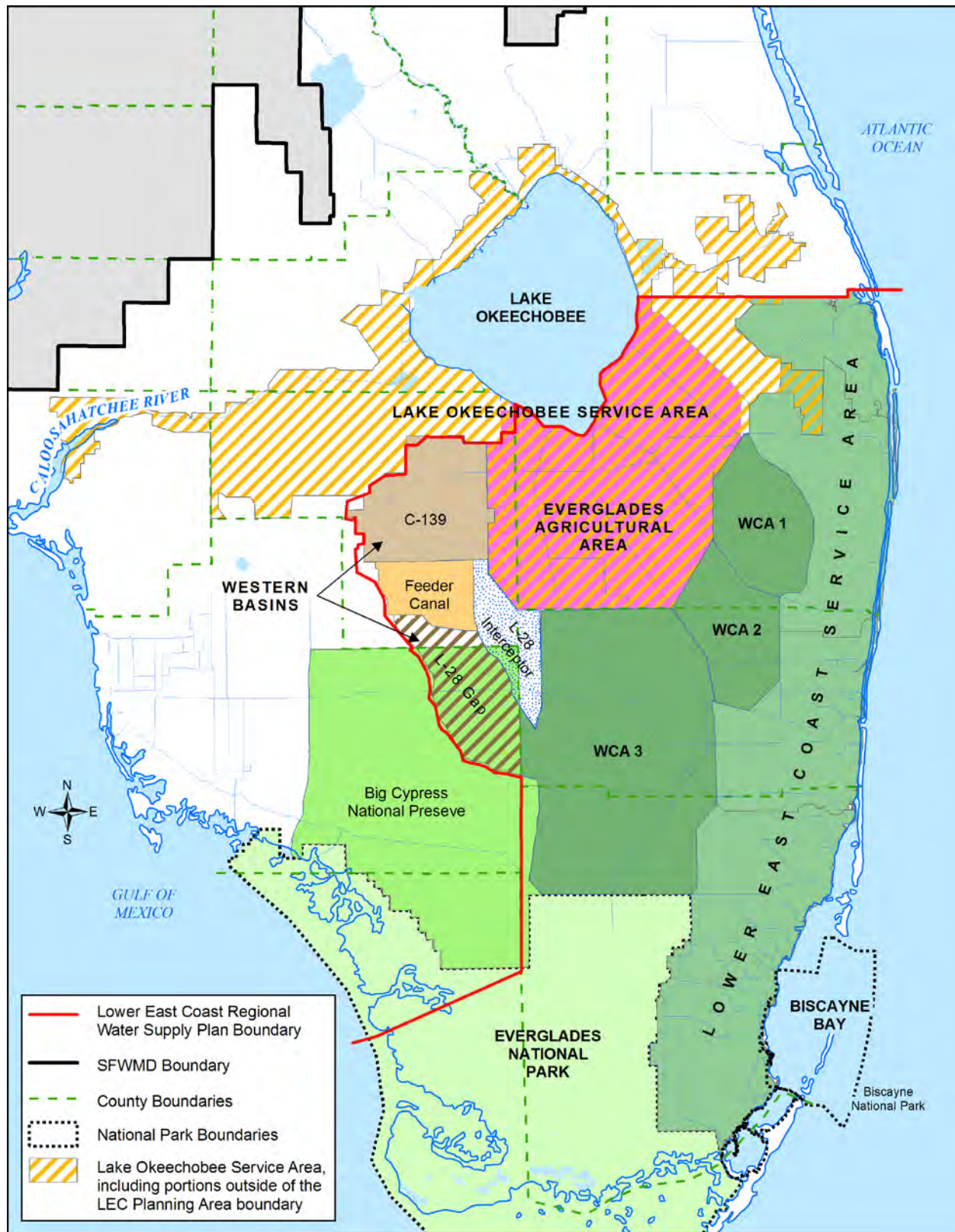


Figure 5-1. Everglades Agricultural Area, Western Basins and Surrounding Basins

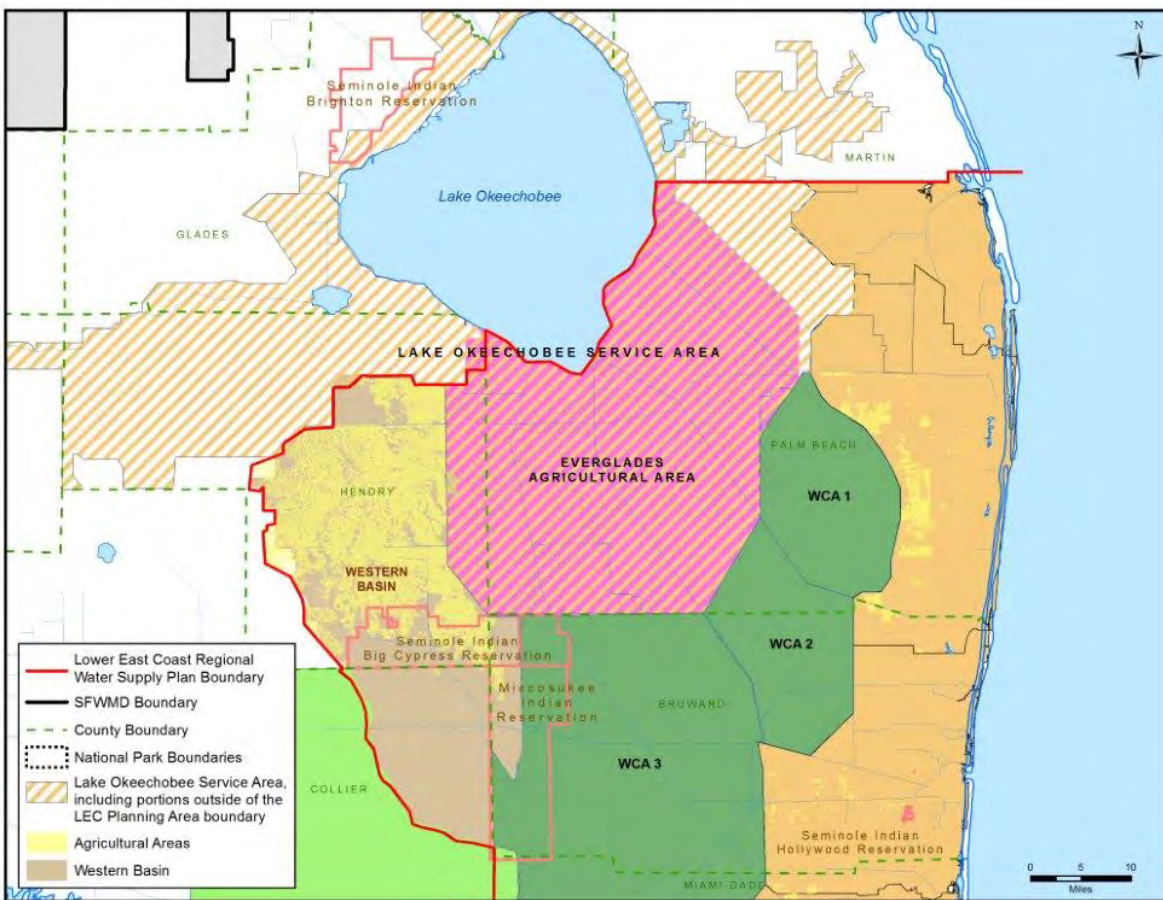


Figure 5-2. Western Basins Map Showing the Seminole Tribe of Florida and Miccosukee Tribe of Indians of Florida Reservations

The Corps remains fully committed to ecosystem restoration and over the past several years has found success in doing so through continued engagement with key partners and stakeholders. The Seminole Tribe of Florida's interest in seeing the CEPP used as a planning vehicle to deliver the long-term hydrologic benefits is understandable. However, within the broader CERP, the current CEPP study cannot specifically address several restoration projects, to include the delivery of water to the Big Cypress Reservation. To support restoration, the CEPP study sought to identify a suite of projects that most effectively capitalized on existing data, knowledge, evaluation tools, previously constructed restoration features, land in Public ownership, and lands currently available. Implementing an incremental approach along with the continued gathering of critical scientific data and knowledge will certainly facilitate future studies and subsequent progress in restoration.

The Seminole Tribe of Florida issued a Minority View for inclusion in the South Florida Ecosystem Restoration Task Force 2012 Strategy and Biennial Report (http://www.sfrestore.org/documents/2012_sbr.pdf.) that represents the culmination of and seeks a response to, the Tribe's long standing concerns for natural systems in the western basins of the Everglades:

- adequate water supply for the environment in the western basins
- the lack of attention by Federal and State resource agencies on western basin conditions

The following is an excerpt from the Seminole Tribe of Florida's Minority View included in the South Florida Ecosystem Restoration Task Force 2012 Strategy and Biennial Report (http://www.sfrestore.org/documents/2012_sbr.pdf):

"In consideration of the 2012 South Florida Ecosystem Restoration Task Force Strategy and Biennial Report, the Seminole Tribe of Florida seeks to amend the report with the following note. As background, over the past six months, the Corps explained that CEPP projects would not be available to contribute to resolving challenging hydrology problems on the Big Cypress Reservation because the western basins have never been appropriately modeled to allow effective planning. The Tribe once again requests that the western basins be monitored and modeled. The Tribe seeks a response in the Task Force's strategy for how to address the western basins in the restoration of the South Florida Ecosystem."

A subset of Task Force member agencies has convened to discuss this issue and specific concerns raised by the Tribe:

- The Big Cypress Reservation Critical Project is not operating as intended;
- Natural areas in the reservation and downstream are experiencing negative ecological impacts, affecting core Tribal values;
- The CEPP does not address problems in the western basins;
- The Tribe's concerns are long standing and have not been addressed.

The Tribe reiterated their concerns with the hydrology and inadequate water supply for the environment in the western basins (C-139, Feeder Canal, L-28, and L-28 Gap) as more recently evidenced by the negative impact of low water levels on the Big Cypress Reservation Critical Project. Further, the Tribe re-emphasized the call for attention to the area as evidenced by the lack of monitoring, data, and models – a situation that prevents the Tribe, and everyone else, from being able to adequately assess the impacts of water resource management decisions on lands in the western basins.

The Tribe has expressed the importance of these concerns as factors affecting the traditional Seminole Tribe of Florida's cultural, and recreational activities, as well as commercial endeavors, which are dependent on a healthy Everglades ecosystem.

A subset of Task Force member agencies has convened to discuss this issue and other specific concerns raised by the Tribe. A mission statement has been drafted in support of the restoration of the Seminole Tribe of Florida's Big Cypress Reservation natural areas and adjacent portions of the Big Cypress National Preserve. Its purpose is to identify and recommend to the SFERTF opportunities to restore ecological and culturally utilized natural areas within the Big Cypress Reservation and adjacent portions of the Big Cypress National Preserve to support the designated uses of water bodies including wetlands

CEPP deliveries to northern WCA-3A will benefit the Tribe's hunting, fishing, trapping and frogging rights (1987 Tribe, SFWMD and State of Florida Settlement Agreement) along the approximate 14,720 acres on the NW corner of the WCA-3A. As a result of reduced freshwater inflow and drainage by the Miami Canal, northern WCA 3A is currently dominated largely by mono-specific sawgrass stands and lacks the diversity of communities found in central and portions of southern WCA 3A. Implementation of any of the CEPP action alternatives is expected to rehydrate much of northern WCA 3A by redistributing treated STA discharges from the L-4 and L-5 Canals north of WCA 3A in a manner that promotes natural

sheetflow and by removing the drainage effects associated with the Miami Canal. Compared to the FWO, Alt 4R and Alt 4R2 stages immediately west of the L-28 Levee are increased by 0.1-0.2 feet under wet to normal hydrologic conditions and increased by 0.2-0.3 feet under normal to dry hydrologic conditions, with no significant change indicated for extreme wet or dry conditions. Stage increases are only observed for the RSM-GL cells located immediately west of the L-28 Levee, which correspond to approximately 1-2 miles west of L-28. Average annual hydroperiods for the southernmost cells within the Seminole Tribe of Florida's Big Cypress Reservation are increased by 10 to 60 days with Alt 4R and Alt 4R2 (FWO hydroperiods range from 25-150 days), with no significant hydroperiod change indicated for the northernmost cells 2-3 miles south of L-4 (FWO hydroperiods range from 0-15 days) .

Resumption of sheetflow and related patterns of hydroperiod extension and increased water depths will significantly help to restore and sustain the micro-topography, directionality, and spatial extent of ridges and sloughs and improve the health of tree islands in the ridge and slough landscape. Although none of the alternatives would provide the necessary inundation pattern for complete slough vegetation restoration, all action alternatives act to rehydrate northern WCA 3A, promoting peat accretion, reducing the potential for high intensity fires and promoting transition from upland to wetland vegetation.

Representatives for the Seminole Tribe of Florida have indicated that none of the CEPP alternatives provide additional water to the Seminole Tribe of Florida's Big Cypress Reservation and therefore do not address the problems they have identified in the western basins.

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6.0 RECOMMENDED PLAN

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The Central Everglades Planning Project (CEPP) will begin to reverse over 100 years of human induced environmental degradation within the central portion of the globally significant Everglades ecosystem. Restored water depth, duration and distribution in Water Conservation Area (WCA) 3A, WCA 3B and Everglades National Park (ENP) will serve to recreate a landscape characteristic of a pre-drained system that will support a healthy mosaic of plant and animal life. The restored hydrology of the Everglades ecosystem will more closely resemble a natural occurring rainfall driven system with wet and dry cycles essential to flora and fauna propagation. Improved water depth and sheet-flowing distribution will begin to re-establish the unique ridge, slough and tree island micro-topography that once provided sustenance to the vast diversity of the species inhabiting the Everglades.

The recommended plan will benefit the Caloosahatchee and St. Lucie Estuaries by decreasing the number and severity of high volume regulatory flood control releases sent from Lake Okeechobee. This will be accomplished by redirecting approximately 210,000 acre-feet average per year of additional water to the historical southerly flow path south through flow equalization basins (FEBs) and existing stormwater treatment areas (STAs). The STAs reduce phosphorus concentrations in the water to meet required water quality standards. Rerouting this treated water south and redistributing it across the degraded L-4 Levee will facilitate hydropattern restoration in WCA 3A. This, in combination with Miami Canal backfilling and other CEPP components, is paramount to re-establishing a 500,000-acre flowing system through the northernmost extent of the remnant Everglades. The treated water will be distributed through WCA 3A to WCA 3B and ENP via new gated control structures and creation of the Blue Shanty flowway. The Blue Shanty flowway will restore continuous sheet-flow and re-connection of a portion of WCA 3B to ENP.

6.1 PLAN DESCRIPTION

6.1.1 Plan Features

The components of the recommended plan, Alternative (Alt) 4R2, are organized into four geographic areas: North of the Redline, South of the Redline, the Green/Blue lines and along the Yellowline.

- I. **Everglades Agricultural Area (EAA)** (North of the Redline) includes construction and operations to divert, store and treat Lake Okeechobee regulatory releases.

Storage and treatment of new water will be possible with the construction of a 14,000 acre FEB and associated distribution features on the A-2 footprint that is operationally integrated with the State-owned and State-constructed A-1 FEB and existing STAs. The A-2 FEB will accept EAA runoff and a portion of the Lake Okeechobee water currently discharged to the estuaries. This Lake Okeechobee water will be diverted to the FEB when FEB/STAs and canals have capacity. The C-44 Reservoir also collects water that would go to the St. Lucie Estuary, and CEPP modifies operations of the reservoir to return a portion of this water back to Lake Okeechobee, from which water can be delivered to the FEB or used to provide water supply deliveries.

CEPP benefits gained from sending new water south from Lake Okeechobee are derived in part from operational refinements that can take place within the existing, inherent flexibility of the 2008 Lake Okeechobee Regulation Schedule (LORS), and in part with refinements that are beyond the schedule's current flexibility. Modifications to 2008 LORS will be required to optimally utilize the added storage capacity of the A-2 FEB to send the full 210,000 acre-feet per year of new water available in CEPP south

to the Everglades, while maintaining compliance with Savings Clause requirements for water supply and flood control performance levels.

The hydrologic modeling conducted for all CEPP alternatives to optimize system-wide performance incorporated the current Regulation Schedule management bands of the 2008 LORS. The hydrologic modeling of the CEPP alternatives included proposed revisions to the 2008 LORS flow chart guidance of maximum allowable discharges, which are dependent on the following criteria:

- Class limits for Lake Okeechobee inflow and climate forecasts, including tributary hydrologic conditions, seasonal climate outlook, and multi-seasonal climate outlook
- Stage level, as delineated by the Regulation Schedule management bands
- Stage trends (whether water levels are receding or ascending)

Most of the 2008 LORS refinements applied in the CEPP modeling lie within the bounds of the operational limits and flexibility available in the current 2008 LORS, with the exception of the adjustments made to the class limits for the Lake Okeechobee inflow and climate forecasts. Under some hydrologic conditions, the class limit adjustments made to the Lake Okeechobee inflow and climate forecasts reduced the magnitude of allowable discharges from the Lake, thereby resulting in storage of additional water in the Lake in order to optimize system-wide performance and ensure compliance with Savings Clause requirements. However, these class limit changes represent a change in the flow chart guidance that extends beyond the inherent flexibility in the current 2008 LORS. As detailed in **Section 6.8.2.1**, the recommended plan operations also expand on the 2008 LORS backflow operations to Lake Okeechobee through the following operational changes: (1) backflow to Lake Okeechobee from the C-44 Canal is allowed when S-308 is not open for regulatory discharge and the stage in Lake Okeechobee is below 14.5 feet (ft) National Geodetic Vertical Datum (NGVD) (no seasonal variability); and (2) discharges from the Indian River Lagoon-South Project C-44 Reservoir to the C-44 Canal are made when the stage in Lake Okeechobee is below the baseflow zone of the 2008 LORS schedule to provide an additional source of backflow water to Lake Okeechobee. Additional information and documentation of the recommended plan modeling assumptions for Lake Okeechobee operations are found in the **Appendix A**.

Independent of CEPP implementation, there is an expectation that revisions to the 2008 LORS will be needed following the implementation of other Comprehensive Everglades Restoration Plan (CERP) projects and Herbert Hoover Dike (HHD) infrastructure remediation. The U.S. Army Corps of Engineers (USACE) expects to operate under the 2008 LORS until there is a need for revisions due to the earlier of either of the following actions: (1) system-wide operating plan updates to accommodate CERP “Band 1” projects (“Band 1” projects are defined in **Section 2.5**), as described in **Section 6.1.3.2**, or (2) completion of sufficient HHD remediation for reaches 1, 2 and 3 and associated culvert improvements, as described in **Section 2.5.1**. When HHD remediation is completed and the HHD Dam Safety Action Classification (DSAC) Level 1 rating is lowered, higher maximum lake stages and increased frequency and duration of high lake stages may be possible to provide the additional storage capacity assumed with the recommended plan. The future LORS which may be developed in response to actions (1) and/or (2) is unknown at this time. It is anticipated that the need for modifications to the 2008 LORS will be initially triggered by non-CEPP actions and that these actions will occur earlier than implementation of CEPP. Therefore, the CEPP project implementation report (PIR) will not be the mechanism to propose or conduct the required National Environmental Policy Act (NEPA) evaluation of modifications to the LORS. However, depending on the ultimate outcome of these future LORS revisions, including the level of

inherent operational flexibility provided with these revisions, CEPP implementation may still require further LORS revisions to optimize system-wide performance and ensure compliance with Savings Clause requirements.

- II. **WCA 2A and Northern WCA 3A** (South of the Redline) includes conveyance features to deliver and distribute existing flows and the redirected Lake Okeechobee water through WCA 3A.

Backfilling 13.5 miles of the Miami Canal between I-75 and 1.5 miles south of the S-8 pump station, and converting the L-4 Canal into a spreader canal by removing 2.9 miles of the southern L-4 Levee are the key features needed to ensure spatial distribution and flow directionality of the water entering WCA 3A.

Conveyance features to move water into and through the northwest portion of WCA 3A include: a gated culvert to deliver water from the L-6 Canal to the remnant L-5 Canal, a new gated spillway to deliver water from the remnant L-5 Canal to the western L-5 Canal (during L-6 diversion operations); a new gated spillway to deliver water from STA 3/4 to the S-7 pump station during peak discharge events (eastern flow route is not typically used during normal operations), including L-6 diversion operations; approximately 13.6 miles of conveyance improvements to the L-5 Canal; a new 360 cubic feet per second (cfs) pump station to move water within the L-4 Canal to maintain water supply deliveries to retain the existing functionality of STA-5 and STA-6 and maintain water supply to existing legal users, including the Seminole Tribe of Florida; and new gated culverts and an associated new canal to deliver water from the Miami Canal (downstream of S-8, which pulls water from the L-5 Canal) to the L-4 Canal, along with potential design modifications to the existing S-8 and G-404 pump stations.

The Miami Canal will be backfilled to approximately 1.5 ft below the peat surface of the adjacent marsh. Spoil mounds on the east and west side of the Miami Canal from S-8 to I-75 will be used as a source for Miami Canal backfill material. Refuge for mammals and other upland species will continue to be provided by the retention of 22 of the highest priority Florida Fish and Wildlife Conservation Commission (FWC) enhanced spoil mounds between S-339 (located approximately 10 miles south of S-339) to I-75 and the creation of additional upland landscape (constructed tree islands) approximately every mile along the entire reach of the backfilled Miami canal section (S-8 to I-75) where historic ridges or tree islands once existed. The constructed tree islands will block flow down the backfilled canal due to the tree island having a profile across the landscape that varies, or undulates, in elevation. Miami Canal constructed tree island design details will be determined during CEPP preconstruction, engineering and design (PED) phase. Tree island design, construction and planting will be coordinated with appropriate science team members with expertise in these topics to accomplish the restoration vision and intent of CEPP's canal backfilling and tree island construction. A diverse array of species will be planted, including trees, shrubs, and herbaceous species that are appropriate for these tree islands. Additional details are located in **Appendix A**.

- III. **Southern WCA 3A, WCA 3B, and ENP** (Green/Blue Lines) includes conveyance features to deliver and distribute water from WCA 3A to WCA 3B and ENP.

A new Blue Shanty Levee extending from Tamiami Trail northward to the L-67A Levee will be constructed. This Blue Shanty Levee will divide WCA 3B into two subunits, a large eastern unit (3B-E) and a smaller western unit, the Blue Shanty flowway (3B-W). A new levee is the most efficient means to restore continuous southerly sheetflow through a practicable section of WCA 3B and alleviates concerns over effects on tree islands by maintaining lower water depths and stages in WCA 3B-E. The width of the 3B-W flowway is aligned to the width of the downstream 2.6-Mile Tamiami Trail Next Steps bridge,

optimizing the effectiveness of both the flowway and bridge. In the western unit, construction of two new gated control structures on the L-67A, removal of the L-67C and L-29 Levees within the flowway, and construction of a gated spillway in the L-29 Canal will enable continuous sheetflow of water to be delivered from WCA 3A through WCA 3B-W to ENP. A third gated control structure in the L-67A Levee and associated gap in the L-67C Levee, both outside the flowway, will improve the hydroperiod of the eastern unit of WCA 3B. Spoil mounds along the northwestern side of the L-67A Canal, in the proximity to the three new L-67A structures will also be removed to facilitate sheetflow connectivity with the WCA 3A marsh.

Increased outlet capability at the S-333 structure at the terminus of the L-67A Canal, removal of approximately 5.5 miles of the L-67 Extension Levee, and removal of approximately 6 miles of Old Tamiami Trail between the ENP Tram Road and the L-67 Extension Levee will facilitate additional deliveries of water from WCA 3A directly to ENP. Detailed design and construction of these features will minimize project footprints due to the nature of these environmentally sensitive areas.

IV. **Lower East Coast Protective Levee** (Yellowline) includes features primarily for seepage management, which are required to mitigate for increased seepage resulting from the additional flows into WCA 3B and ENP.

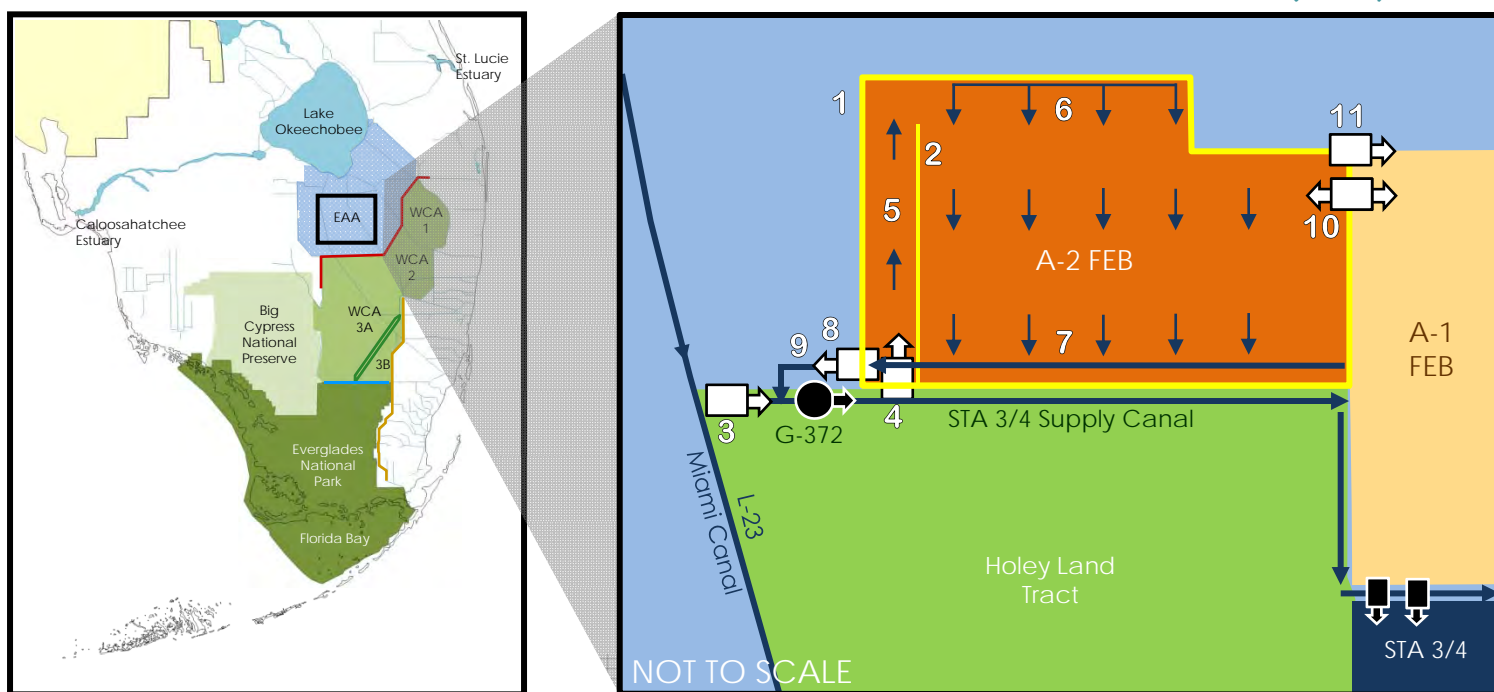
A newly constructed pump station with a combined capacity of 1,000 cfs will replace the existing temporary S-356 pump station, and a 4.2-mile partial depth seepage barrier will be built along the L-31N Levee south of Tamiami Trail.

There is an existing 2-mile seepage cutoff wall in the same vicinity that was constructed by a permittee as mitigation to offset authorized impacts under a Clean Water Act (CWA) Section 404 permit. There is a possibility that the same permittee may construct an additional 5- miles of seepage wall south of the 2-mile seepage wall, if permitted. Since the capability and effectiveness of the existing seepage wall to mitigate seepage losses from ENP remains under investigation, the recommended plan conservatively includes an approximately 4.2 mile long, 35 ft deep tapering seepage barrier in the event construction is necessary. There are remaining uncertainties about the effectiveness of the recommended plan's seepage cutoff wall in maintaining desired stages in marshes of ENP while maintaining flood protection and canal stages to the east without limiting water availability to water users and Biscayne Bay. Therefore, additional analysis of the CEPP seepage cutoff wall will be conducted as an early phase in PED. See **Section 6.10.1.2**, the Engineering Appendix (**Appendix A**), the analyses required by the Water Resources Development Act (WRDA) 2000 (**Annex B**), and the CEPP Adaptive Management Plan (**Annex D Part 1**) for more detail about the remaining uncertainties and suggested analysis to be completed to determine the need for and extent of a CEPP seepage cutoff barrier wall.

The specific feature locations of the recommended plan are shown in **Figure 6-1** through **Figure 6-4**. Also see the foldout **Figure** in the back of this section. Further details of features are available in **Appendix A**.

NORTH OF THE REDLINE

STORAGE AND TREATMENT/FLOW EQUALIZATION BASIN (FEB) – A2



LEGEND: Pump Gated Structure Levee Spreader Canal Existing Structure

#	STRUCTURE	STRUCTURE/FEATURE TYPE	CFS	TECHNICAL NOTES
1	L-624	Levee		Perimeter Levee (~ 20 miles, 11.3 feet high, 14 feet wide, 3:1 side slope)
2	L-625	Levee		Interior levee (~ 4 miles, 11.3 feet high, 12 feet wide, 3:1 side slope)
3	S-623	Gated Spillway	3700	Delivers water from Miami Canal to existing G-372 pump station
4	S-624	Gated Sag Culvert (FEB inflow structure)	1550	Receives water from existing pump station G-372 via STA 3/4 Supply Canal and delivers it to C-624 FEB inflow canal
5	C-624	FEB Inflow Canal	1550	Conveys water from FEB inflow structure S-624 to FEB C-624 E spreader canal (length: ~ 4 miles)
6	C-624E	FEB Spreader Canal		Distributes FEB inflows across northern FEB; sheetflow within FEB is generally north to south (length: ~ 4 miles)
7	C-625E	FEB Collection Canal	400	Existing seepage canal for STA 3/4 Supply Canal, used to supplement FEB sheetflow during normal operating conditions
8	S-625	Gated Culverts (FEB discharge structure)	1550	Delivers water to FEB outflow canal (C-625W)
9	C-625W	FEB Outflow Canal	1550	FEB Outflow Canal is the extended seepage canal for the STA 3/4 Supply Canal; delivers water via existing G-372 pump station to STA 3/4 for water quality treatment
10	S-628	Gated Culvert (FEB intake/discharge structure)	930	Delivers water in both directions between A-2 FEB and A-1 FEB for operational flexibility
11	S-627	Emergency Overflow weir	445	Location to be determined

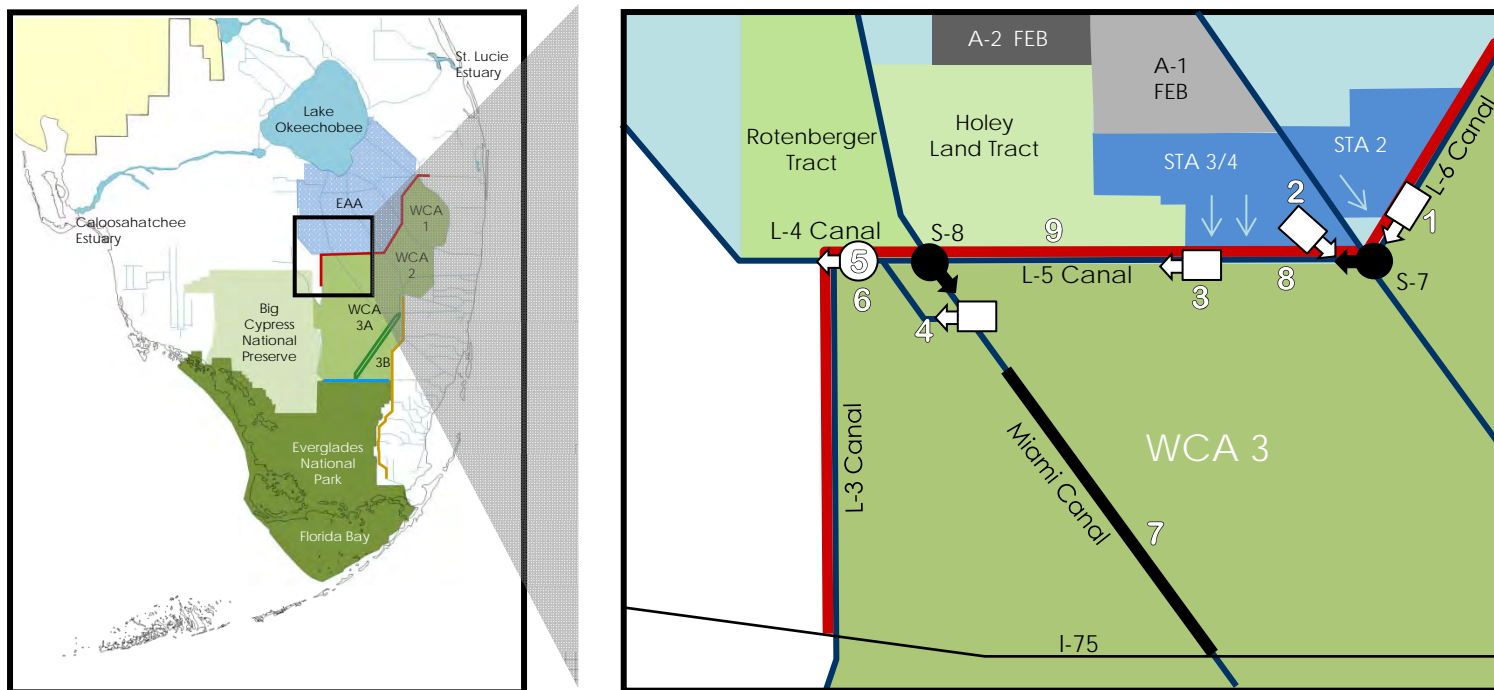
A-2 FEB design also includes an exterior seepage collection system (not illustrated):

	C-626	Seepage Canal	400	~ 11 miles
	S-626	Seepage Pump Station	500	Delivers seepage back into the FEB outflow canal C-625W

Figure 6-1. Recommended Plan Treatment and Storage Features and Location

SOUTH OF THE REDLINE

DISTRIBUTION AND CONVEYANCE



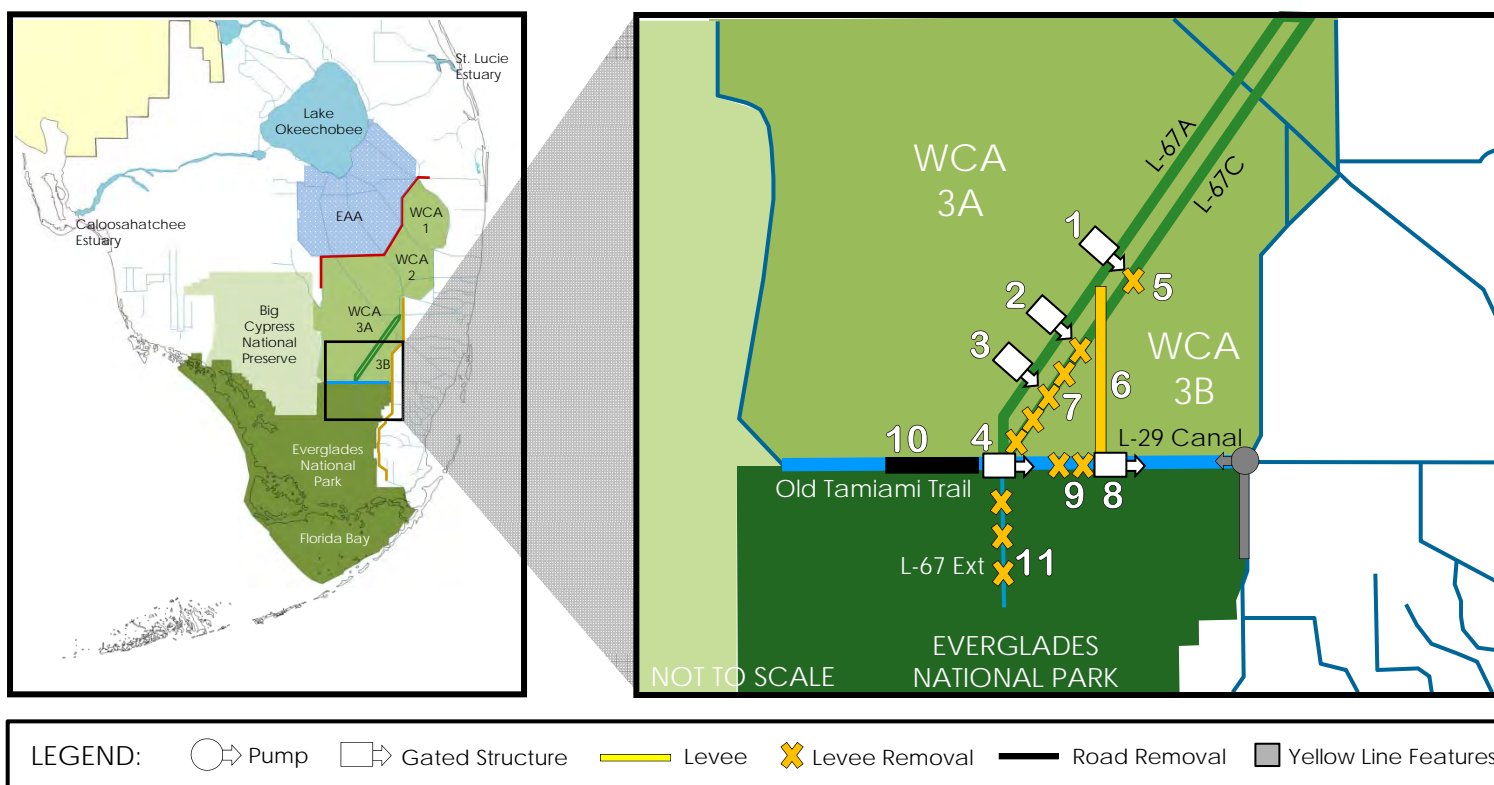
LEGEND:  Pump  Gated Structure  Levee Removal  Existing Structure

#	STRUCTURE	STRUCTURE/FEATURE TYPE	CFS	TECHNICAL NOTES
1	S-620	Gated Culvert	500	Delivers water from L-6 Canal to L-5 Canal
2	S-621	Gated Spillway	2500	Closed to direct STA 3/4 discharges to western L-5 Canal during normal operations; controls water from STA 3 /4 to the existing S-7 pump station during peak events
3	S-622	Gated Spillway	500	Delivers water from east to west in L-5 Canal (replaces existing L-5 canal plug)
4	S-8A	Gated Culverts with Canal	3080 & 1020	Existing S-8 pump station delivers water from L-5 Canal to Miami Canal; S-8A delivers water from Miami Canal to L-4 Canal (3120 cfs) and remaining Miami Canal segment (1040 cfs); potential design modifications to the existing S-8/G-404 complex will be assessed during PED
5	S-630	Pump Station	360	Delivers water from L-4 Canal west to maintain existing water supply deliveries
6		L-4 Levee Removal		Removes ~2.9 miles of south L-4 Levee
7		Miami Canal Backfill with Tree Islands Mounds		Remove ~ 13.5 miles of Miami Canal , from 1.5 miles south of S-8 to I-75; tree island mounds create habitat and promote sheetflow in WCA-3A within the footprint of the former Miami Canal
8		L-5 Remnant Canal	500	Enlarging canal to expand capacity of L-5 Canal (between S-621 & S-622)
9		L-5 Canal	3000	Enlarging canal to expand capacity of L-5 Canal (between S-622 & S-8)

Figure 6-2. Recommended Plan Northern Conveyance and Distribution Features and Location

BLUE AND GREEN LINES

DISTRIBUTION AND CONVEYANCE



#	STRUCTURE	STRUCTURE/FEATURE TYPE	CFS	TECHNICAL NOTES
1	S-631	Gated Culvert	500	Delivers water from WCA 3A to 3B, east of L-67D Levee
2	S-632	Gated Culvert	500	Delivers water from WCA 3A to 3B, west of L-67D Levee
3	S-633	Gated Culvert	500	Delivers water from WCA 3A to 3B, west of L-67D Levee
4	S-333 (N)	Gated Spillway w/new canal	1150	Delivers water from L-67A Canal to L-29 Canal; supplements existing S-333 gated spillway
5		L-67C Levee Removal Gap		Gap, ~ 6000 feet (corresponding to S-631)
6	L-67D	Blue Shanty Levee		Levee, ~ 8.5 miles, connecting from L-67A to L-29 (6 feet high, 14-foot crest width, 3:1 side slopes)
7		L-67C Levee Removal		Complete removal of ~ 8 miles from New Blue Shanty Levee (L-67D)south to intersection of L-67A/L-67C; L-67C canal is not backfilled
8	S-355W	Gated Spillway	1230	Maintains water deliveries to eastern L-29 Canal
9		Levee Removal (L-29)		Removal of ~ 4.3 miles between L-67A and Blue Shanty Levee intersection with L-29 Levee
10		Removal of remnants of Old Tamiami Trail roadway		Removal of ~ 6 miles of roadway west of L-67 Extension
11		L-67 Extension Levee Removal and Canal Backfill)		Complete removal of ~ 5.5 miles of remaining L-67 Extension, including S-346 culvert

Figure 6-3. Recommended Plan Southern Distribution and Conveyance Features and Location

YELLOW LINES SEEPAGE MANAGEMENT

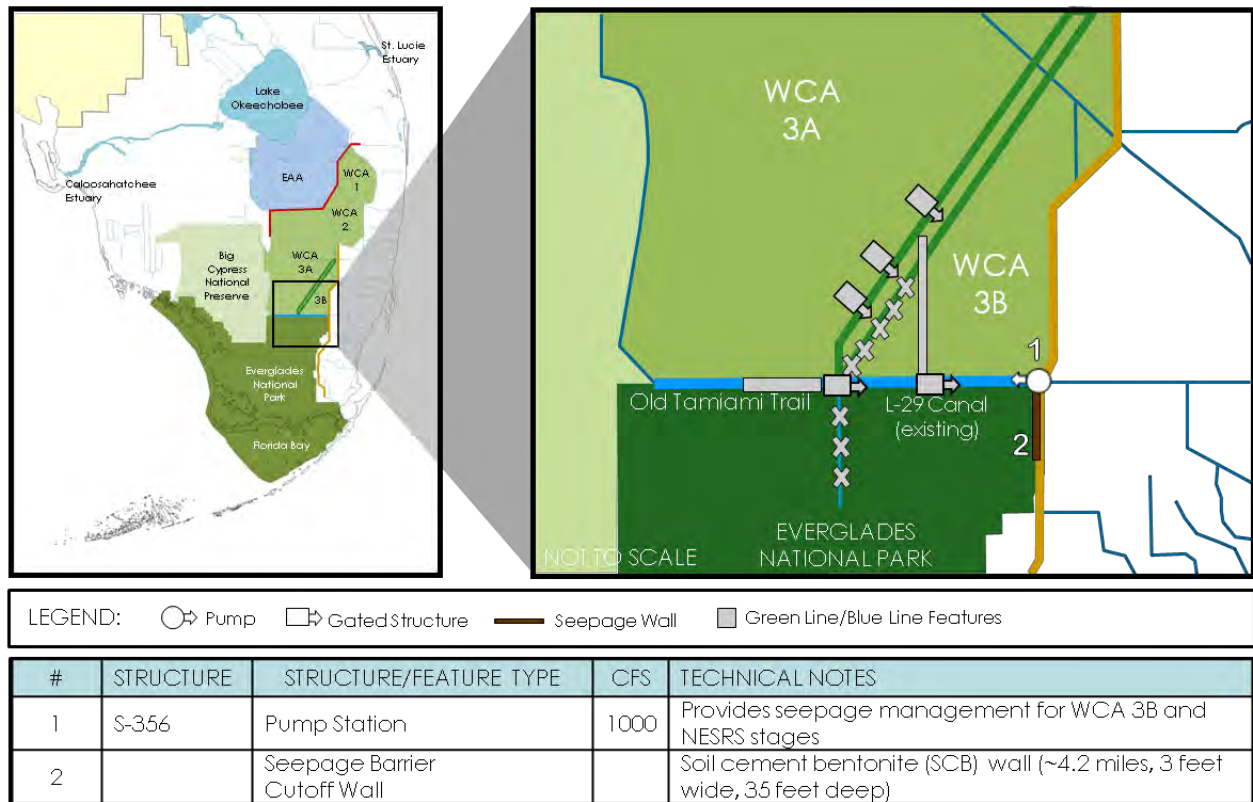


Figure 6-4. Recommended Plan Seepage Management Features and Location

6.1.2 Lands and Interests in Lands

The following real estate interests and lands identified below are needed to ensure the construction and operations, maintenance, repair, replacement, and rehabilitation (OMRR&R) of CEPP is implemented. More details are provided in **Appendix D**.

6.1.2.1 A-2 Flowage Equalization Basin

Fee title will be required for the project footprint of the A-2 FEB. The A-2 FEB requires approximately 13,849 acres in Compartment A, of which approximately 13,839.44 acres were acquired in the Talisman exchange/acquisition. The remaining approximately 9.9 acres in the A-2 FEB were acquired by the South Florida Water Management District (SFWMD) using State funds. In March 1999, the “Talisman Exchange and Purchase and Sale Agreement” effected transactions in which certain landowners in the EAA would sell lands to, or exchange lands, with other landowners and the SFWMD in order for SFWMD to own contiguous parcels of land in the southern portion of the EAA for the purposes of Everglades restoration.

6.1.2.2 Flowage Equalization Basin Discharge Canal

The A-2 FEB Discharge Canal runs from the STA 3/4 supply canal to the southwest corner of the A-2 FEB. There are approximately 91.25 acres required for this canal. The canal runs along the southern portions of Sections 35 and 36, Township 46 South, Range 35 East. Approximately 57.02 acres are owned by the State of Florida and will be acquired by SFWMD, either through direct acquisition from the State (permanent canal easement) or by Supplemental Agreement (fee or permanent canal easement) with the State. The remaining 34.23 acres are owned by SFWMD and were acquired as part of the Talisman Exchange, with both Federal and State funds. Fee title will be the required estate for these lands. These lands are currently leased by either the State of Florida or the SFWMD to agricultural interests.

6.1.2.3 Water Conservation Areas 3A and 3B

SFWMD owns a variety of interests in WCA 3A and WCA 3B. These lands were previously acquired and certified for the Central and Southern Florida (C&SF) Project. The SFWMD owns fee title to approximately 134,280.95 acres, a perpetual flowage easement over approximately 300,343.52 acres (with the fee owned by the State of Florida), a perpetual flowage easement over approximately 70,612 acres (with the fee owned by private parties), canal or levee easement over approximately 11,598.84 acres and a perpetual easement for surface flowage rights over approximately 73,360 acres (with fee title owned by the State). Pursuant to the Seminole Indian Claims Settlement Act of 1987, the Seminole Tribe of Florida transferred property, including what is now referred to as WCA 3A, to the SFWMD while retaining traditional hunting, fishing, trapping, and frogging rights within this property. These subsistence rights are also extended to lands perpetually leased to the Miccosukee Tribe of Indians of Florida also in areas within WCA 3A pursuant a Settlement Agreement between the Miccosukee Tribe of Indians of Florida and the State of Florida, dated 15 March, 1982. The Corps also acknowledges that this area continues to hold cultural significance to both Federally recognized Tribes. All of these lands were provided as an item of local cooperation for the C&SF Project. The rights owned by SFWMD in WCA 3A and WCA 3B have been determined to be sufficient for CEPP project purposes. The SFWMD will recertify these lands to the Federal Government when required for construction or operations at no cost to CEPP.

6.1.2.4 S-356 Structure and L-31N Seepage Barrier

The S-356 structure will be constructed on lands within the right-of-way of existing L-29 Levee, which was previously acquired and provided as an item of local cooperation for the original C&SF Project. The seepage barrier wall will be constructed within the right-of-way of the L-31N Levee, which also was previously acquired and provided as an item of local cooperation for the original C&SF Project. SFWMD

owns sufficient interests (fee or a perpetual easement) in these lands for the construction of these project features. Where SFWMD owns a perpetual easement, either the State of Florida or private parties own the underlying fee title. SFWMD will not receive credit for the provision of these lands unless a greater interest is required and then only for the difference in value between the interest provided for the C&SF project and that required for CEPP. Additional analysis of the CEPP seepage cutoff wall will be conducted as an early phase in PED. See **Section 6.10.1.2**, the Engineering Appendix (**Appendix A**), the analyses required by WRDA 2000 (**Annex B**), and the CEPP Adaptive Management Plan (**Annex D Part 1**) for more detail about the remaining uncertainties and suggested analysis to be completed to determine the need for and extent of a CEPP seepage cutoff barrier wall.

6.1.2.5 Uniform Relocation Assistance Act, PL91-646 as amended

The appropriate relocation benefits were included as part of the Talisman Exchange/acquisition agreement for the land in the A-2 FEB and therefore these costs were not evaluated separately. Under P.L. 91-646, as amended, there are no additional residential relocations and no business relocations associated with the implementation of this Project.

6.1.2.6 Facility/Utility Relocations

Florida Power and Light lines will have to be relocated or abandoned from the area within the A-2 FEB. Florida Power and Light, and Quest Communications lines will have to be relocated where the L-29 is being removed. The removal of Old Tamiami Trail will require relocation of the Florida Power and Light line.

6.1.3 Project Operations

The draft Project Operating Manual (POM) in **Annex C** includes operating criteria based on the Alt 4R2 hydrologic modeling assumptions and generally discusses the transitions to operations during the construction phase, the Operation, Testing & Monitoring Phase (OTMP), and the long-term Operations and Maintenance (O&M) phase. The POM assumes completion of all CEPP components. Modifications and/or revisions to the POM will occur during subsequent implementation phases. Development of the POM is an iterative process that will continue throughout the life of the project. The POM will be updated at periodic intervals during the detailed design, construction and operational testing and monitoring phases of the project. Refinements to the operating criteria in the POM will be made as more project design details, data, operational experience, and general information are gained during these project phases. It is also anticipated that once the POM is completed and the long-term operations and maintenance phase is underway, it may be necessary to revise the POM from time to time based on additional scientific information and implementation of CERP or non-CERP activities.

It is important to understand that the POM will develop over time as the details of the design of CEPP components are developed. The first draft is presented in this document with the recognition that multiple revisions and operational fine-tuning would occur over the life of the project. The operations discussed herein represent the start-up operational strategy, recognizing that constraints in the system may be removed over time due to the completion of many of the CEPP components as well as other CERP and non-CERP Projects. Refinements to the POM may also be needed in response to phased implementation of CEPP components. The draft POM is presented with the recognition that multiple revisions and operational refinements will occur over the life of the project, as described below in **Figure 6-5**. The USACE and SFWMD will share in the responsibilities for conducting water management operations during the OTMP.

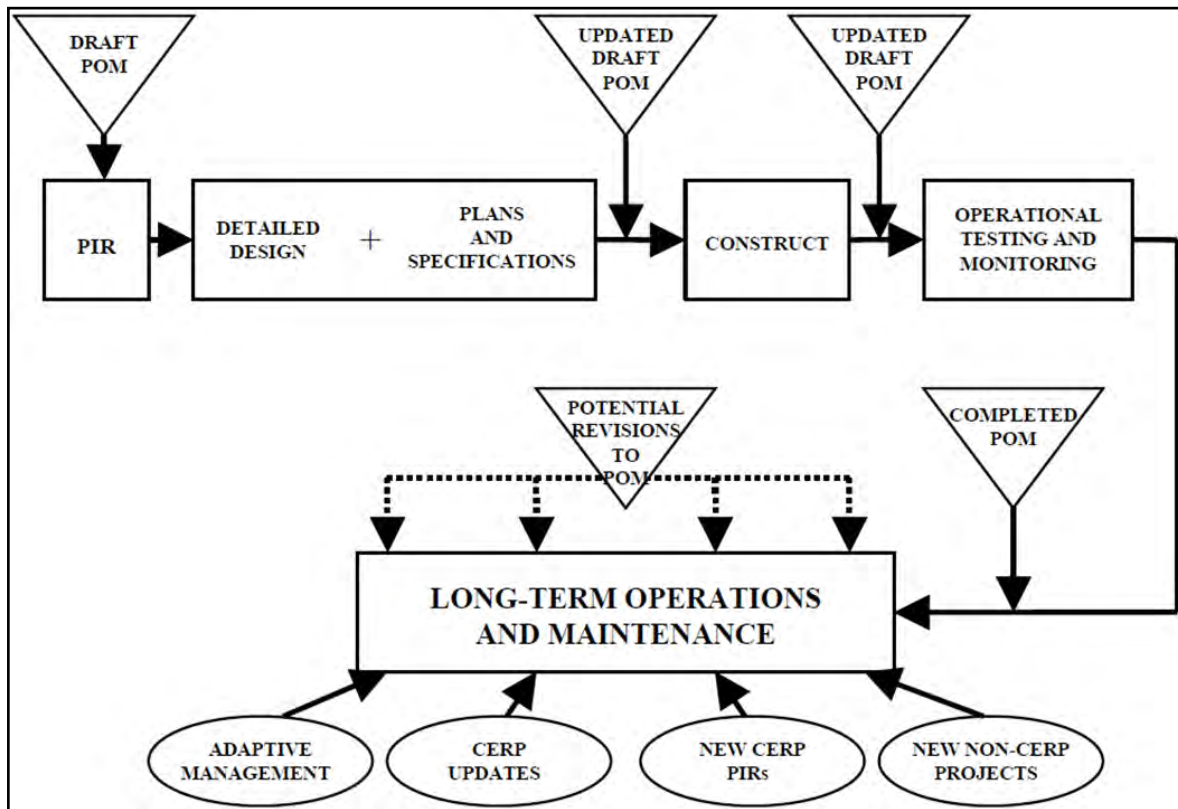


Figure 6-5. Evolution of the Project Operating Manual

6.1.3.1 Rain-Driven Operations

The CEPP proposes changes to the operation of WCA 3 to better mimic a natural delivery of water through the system in response to rainfall. Unlike regulation schedule-based operations, the Rain-Driven Operations (RDO) estimate inflows and outflows in response to weekly rainfall and Potential Evapotranspiration (PET) and target water deliveries so that the weekly stage at ten target locations (3ANW, 3A11, 3ASW, W2, 3A4, 3AS, 3ANE, 3A28, E4, 3A3) approach the corresponding weekly restoration targets. In addition to meeting these targets, the RDO aims at improved recession rates (measured in ft per week) in three range categories: excellent (0.03 to 0.06), acceptable (0 to 0.03 and 0.06 to 0.10) and unacceptable (> 0.10). The recession rate would be calculated as the difference between the current stage and the previous week's stage. The stage would be calculated as the average of three locations: 3A4, 3A28 and 3A3. The RDO employs a mechanism that resists the stage going into Zone A of the WCA 3A Interim Regulation Schedule. As part of a system-wide optimization, the WCA 3A RDO is constrained with the amount and timing of inflows upstream, and the restoration targets and constraints in WCA 3B and the ENP.

It is recognized that transitioning to RDO would likely be a lengthy and complex process for the USACE, but a necessary step to achieve the proposed restoration objectives within WCA 3A and ENP. The process for making this transition has not yet been developed, but it is envisioned for RDO to be phased in gradually as CEPP components become operational. RDO operations may also be considered by the USACE during future operational planning studies prior to CEPP, as appropriate. Initially, system operations would be conducted under the current Rainfall Plan, with modeling and testing of RDO to occur alongside the Rainfall Plan; development and limited testing of RDO modeling tools should be

initiated prior to this operational testing period. When RDO has been developed and approved for use, the USACE will fully implement it.

6.1.3.2 System Operating Manual Updates

Implementation of the CERP plan envisioned the need to create a System Operating Manual (currently the Master Water Control Manual is the primary governing document). This System Operating Manual would ensure that the operations of all projects, both CERP and non-CERP, are integrated within the C&SF system operations in order to achieve the authorized purposes of the C&SF Project and the individual CERP and non-CERP projects. The CEPP plan acknowledges that a revision to the current 2008 LORS, as well as the associated Volume 3 of the Master Water Control Manual – Lake Okeechobee and EAA) will be needed to integrate the features of CEPP as well as the HHD remediation, the Kissimmee River Restoration, and other CERP projects which are connected or adjacent to Lake Okeechobee.

Therefore, it is anticipated that modifications to the 2008 LORS would be triggered by actions other than CEPP implementation and the CEPP PIR will not be the mechanism to propose or conduct the required NEPA evaluation of modifications to the LORS. However, depending on the ultimate outcome of these future LORS revisions, including the level of inherent operational flexibility provided with these revisions, CEPP implementation may still require further LORS revisions to optimize system-wide performance and ensure compliance with Savings Clause requirements.

6.1.4 Adaptive Management and Monitoring

The CEPP Adaptive Management (AM) and Monitoring Plans (**Annex D**) identifies the monitoring information needed to inform CEPP implementation and to document restoration progress to agencies, the public, and Congress. The overall objective of the AM and Monitoring Plan is to focus resources on refinement of CEPP to fine-tune performance due to inevitable uncertainties, based on existing knowledge and knowledge that will be gained through monitoring and assessment.

CERP's interagency science group, the Restoration Coordination and Verification group (RECOVER) provided significant support in the development of CEPP's AM and Monitoring Plan, as did project delivery team (PDT) scientists, engineers, and water operators. Expertise included input from more than 10 agencies and both Tribes of south Florida, consisting collectively of decades if not centuries of scientific and operational knowledge of the Everglades, Lake Okeechobee, the Lower East Coast (LEC), and the estuaries. Using this knowledge, key questions were identified for analysis to inform CEPP design, implementation, and potential adjustments for optimizing project performance.

The CEPP AM and Monitoring Plans contain descriptions of monitoring that should address specific uncertainties identified during CEPP planning, required parameters such as water quality and water levels, and ecological features that track CEPP's progress toward success. The monitoring data will indicate CEPP's progress toward the objectives of CEPP, and CEPP's conformance to applicable legal requirements. The monitoring descriptions are found in detail in **Annex D Part 1 Sections D.1.3 – D.1.4** (pages 13 – 91) and in **Annex D Parts 2, 3, 4**. For each region of south Florida in the CEPP study area, the monitoring parameters, their value to CEPP, timeframe needed to see changes, measurement frequencies, decision criteria for triggering adaptive management options, and suggested adaptive management options are provided in the AM Plan text; the information is also summarized per region in **Tables D.1.3 – D.1.9**. Monitoring durations, which are specified in Annex D, are dependent on the intended use of the monitoring: regulatory monitoring will be continued as long as required by applicable regulations and the adaptive management and ecological success monitoring will continue up to 10 years, per WRDA 2007 Section 2039, in coordination with the phases of CEPP construction. See

Annex D Part 1 Section 1.5, “Implementation of CEPP Adaptive Management” for a description of the rolling implementation of the monitoring and the feedback that the data will provide to inform management decisions. The implementation is summarized in **Annex D Part 1 Section D.1.5**, in **Figures D.1.11 – D.1.17**, and in **Tables D.1.10 – D.1.15**.

Part 1 of the AM and Monitoring Plans (**Annex D**) is the CEPP AM Plan. A fundamental principle of AM is that a project can be adjusted to achieve higher performance toward the project’s goals and objectives and to remain within its constraints. In AM the adjustments are based on a scientifically efficient and sound process of learning from data. These adjustments should be viewed as intelligently fine-tuning the project, the need for which is almost inevitable in large-scale, long-term restoration projects like CERP and CEPP. Given this fundamental principle of AM, the CEPP AM Plan provides suggestions for potential improvements and refinements of aspects of CEPP if necessary, called Adaptive Management Options (AM Options). The suggestions are based on current experience and knowledge and are not required actions, nor are they meant to limit agencies from considering other options. All of the AM Options are considered part of the recommended plan for authorization, although some would require more information about project footprint and performance in order to perform a full NEPA analysis, permitting, and agency coordination before they could be initiated. The AM Options are included in the CEPP cost estimates and described here per WRDA 2007 USACE implementation guidance (August 2009). The AM Options are not automatic; they are informed suggestions provided as part of the recommended plan that capture current knowledge of what may be needed in the future to adjust and maximize performance as CEPP progresses. Additional options that are also considered part of the recommended plan but would not require as extensive additional analysis are listed in the CEPP AM Plan (**Annex D Part 1**) where they are summarized per CEPP region in **Tables D.1.3 – D.1.9**.

AM Option: Dig shallow S-355B Collector Canal Extension near the southern end of WCA 3B, east of the proposed Blue Shanty Levee, to increase flows southward out of this part of WCA 3B.

The shallow canal would connect to remnant agricultural ditches to allow them to act as collector canals in the portion of WCA 3B potentially most sensitive to transition of restoring longer hydroperiods. A different AM Option is proposed below for the western portion of WCA 3B, which is referred to as the Blue Shanty flowway. Environmental Considerations: USACE would need to perform an analysis in accordance with Section 404 (b)(1) guidelines for CEPP to perform this option; potential wetland impacts would need to be considered as well as potential nesting and foraging sites for snail kites in the area.

AM Option: Modify agricultural canals in the WCA 3B flowway, west of the proposed Blue Shanty Levee, to maximize sheetflow and hydroperiod objectives.

Remove spoil mounds and backfill the agricultural ditches (in order of priority) that run east-west and north-south in the portion of WCA 3B west of the Blue Shanty canal, a.k.a the Blue Shanty flowway. Environmental Considerations: USACE would need to perform an analysis in accordance with Section 404 (b)(1) guidelines for CEPP to perform this option; potential impacts to nesting and foraging sites for wading birds and snail kites would need to be considered.

AM Option: Extend Decompartmentalization Physical Model (DPM) Test 4 additional years.

Environmental Considerations: During previous Section 106 consultation on the DECOMP Physical Model (DPM), these features were not described to last over two years. Therefore, Section 106 consultation would need to be re-initiated for this feature as required by 36 CFR 800. Coordination with the Florida Department of Environmental Protection (FDEP) would be required.

AM Option: C-11 Extension gapping with 100-foot gaps north and south of the C-11 canal, created by pushing spoil into canal every 1000 ft.

Environmental Considerations: USACE would need to perform an analysis in accordance with Section 404 (b)(1) guidelines for CEPP if this AM action were to be employed. All necessary analysis and coordination would be completed prior to implementation of the action.

In addition to the AM Plan, **Annex D** contains the **Water Quality Monitoring Plan (Part 2)**, **Hydrometeorological Monitoring Plan (Part 3)**, and the **Ecological Monitoring Plan (Part 4)**. These include regulatory monitoring associated with water quality and the U.S. Fish and Wildlife Service (FWS) Biological Opinion (BO), as well as hydrometeorological monitoring to inform system operations, and ecological success monitoring directly related to project objectives.

6.1.5 Invasive and Nuisance Species Management Plan

This plan has been developed in accordance with Executive Order (E.O.) 13112, entitled Invasive Species, signed 03 February 1999, the USACE Invasive Species Policy and CERP Guidance Memorandum 062.00 (CGM62), Invasive Species. The purpose of the Invasive and Nuisance Species Management Plan (INSMP) is to outline measures for preventing, controlling, reducing and monitoring invasive species within the CEPP footprint in order to achieve restoration benefits. To achieve these goals, the plan proposes to complete both initial and long-term invasive species management. The INSMP is a living document and will be updated throughout design, construction and OMRR&R. The INSMP is located in **Annex G**.

6.1.6 Recreation Plan Features

The proposed recreation facilities will increase access into the Greater Everglades and enhance users' opportunities and access within the marsh. Facilities include sufficient gravel parking with boat ramps and trailheads, dry vault toilets, shelters, primitive camping sites and Americans with Disabilities Act compliant fishing platforms, and are illustrated in **Figure 6-6** below.

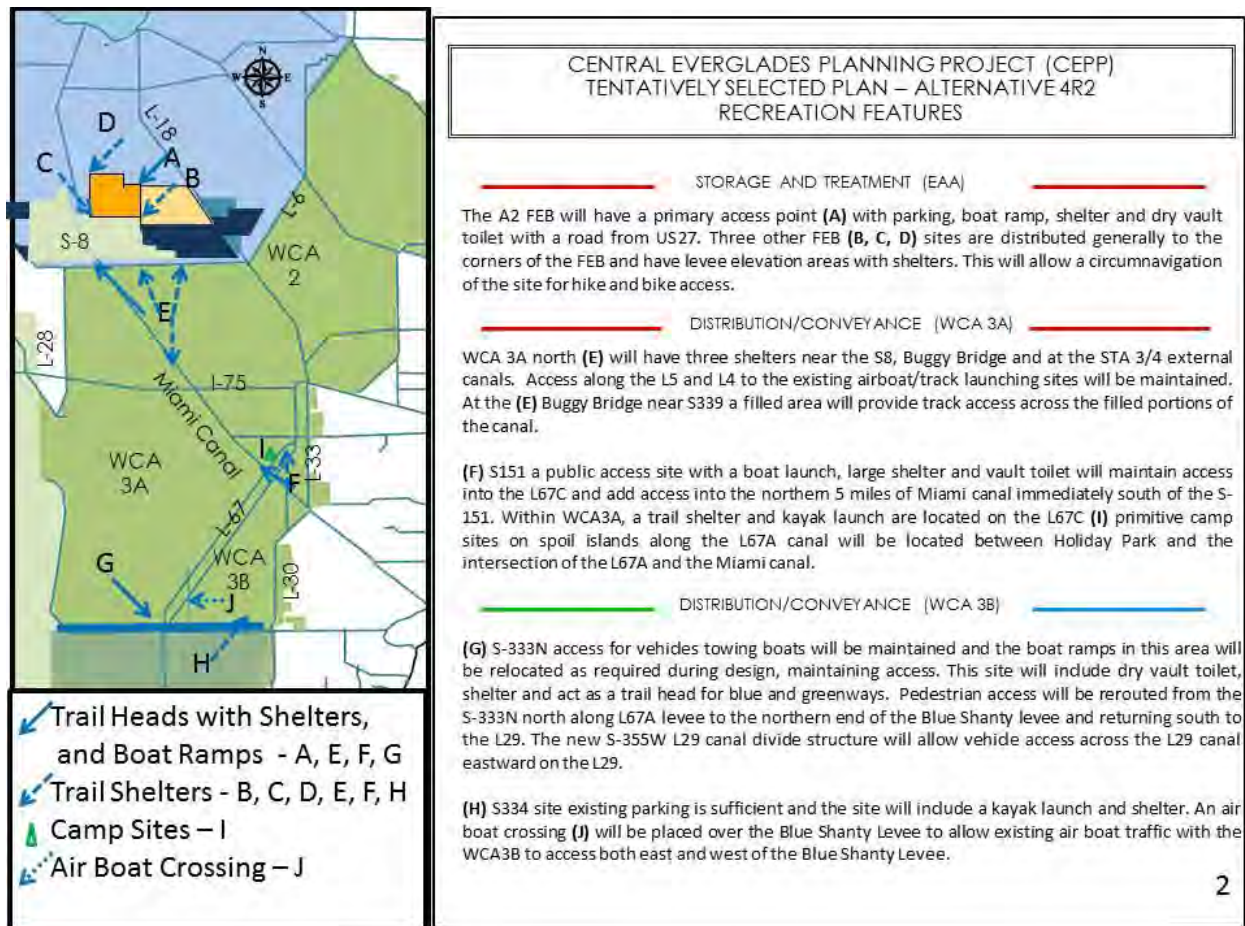


Figure 6-6. CEPP Recommended Plan Recreation Features

6.2 PLAN ACCOMPLISHMENTS

6.2.1 Environmental Benefits

The recommended plan provides significant benefits within the project area; beneficially affecting more than 1.5 million acres in the Caloosahatchee and St. Lucie Estuaries, the Greater Everglades, and Florida Bay. The recommended plan provides an increase of 246,590 average annual habitat units (HU) relative to the future without (FWO) project condition for the period of analysis based on the methodology that was used to quantify ecosystem benefits. The recommended plan would decrease high volume freshwater discharges from Lake Okeechobee that are currently sent to the Northern Estuaries. Additional water from Lake Okeechobee would be sent southward through canals of the EAA to the A-2 FEB. The A-2 FEB would provide storage capacity, attenuation of high flows, and limited pre-treatment prior to delivery of the redirected water to existing STAs, which would reduce phosphorus concentrations in the water to meet required water quality standards. The treated water would be distributed across the northwestern boundary of WCA 3A to flow through and help restore more natural quantity, timing and distribution of water to WCA 3A, WCA 3B, ENP, and Florida Bay. Several existing levees, canals, culverts, and pump stations would be constructed, modified, or removed to improve the flow of water through the system and provide for other water related needs.

The recommended plan addresses the need to restore ecosystem function in the Caloosahatchee and St. Lucie Estuaries by reducing the number and severity of events where undesirable amounts of freshwater

from Lake Okeechobee are discharged into the estuaries (**Figure 6-7** and **Figure 6-8**). Currently, many oyster and seagrass beds are stressed and have been reduced or eliminated from their former areas by extreme salinity fluctuations, increased turbidity and sedimentation, dredging, damage from boats, and nutrient enrichment, which causes algal blooms that in turn restrict light penetration. A reduction in the number of high volume freshwater discharges to the estuaries would help to reduce turbidity, sedimentation, and moderate unnatural changes in salinity that are extremely detrimental to estuarine communities. Reductions in turbidity and sedimentation would allow greater light penetration, promoting the growth of seagrass beds and would help lessen the problem of flushing oyster spat into outer areas of the estuaries that currently experience high salinity levels during the dry season resulting in increased predation and disease in the oyster population. Implementation of the recommended plan provides an increment of the benefits envisioned in CERP and builds upon those achieved in the Northern Estuaries with implementation of other CERP projects (i.e. C-43 West Basin Storage Reservoir and Indian River Lagoon South Project).

In June 2013, the CEPP base condition assumptions established for plan formulation were subsequently revisited and updated to represent the most current information for the analysis of Savings Clause requirements and Project-Specific Assurances (see **Section 6.8** and **Annex B**). The FWO project baseline was updated utilizing new information for the Initial Operating Regime Baseline (IORBL1). In the **Annex B** analysis, the potential effects of CEPP are analyzed through comparison of the with-project condition (recommended plan) to the without project condition (IORBL1). The revised IORBL1 updated the FWO to include the 2.6 mile western Tamiami Trail bridge proposed with the initial increment of the Department of Interior's (DOI) Tamiami Trail Next Steps Project (based on best available phased implementation information from DOI), operational updates to the CERP Indian River Lagoon-South project (based on best available information from the Indian River Lagoon-South project team), and operational refinements to the CERP Broward County Water Preserve Area project (to reduce excess discharges to tide via S-29, including accounting for the effects of the Lake Belt expansion assumed in the CEPP FWO condition). The FWO baseline was used to determine the National Ecosystem Restoration (NER) Plan. The IORBL1 represents the FWO baseline assumption for purposes of completing the CEPP assessments for the Savings Clause and Project Assurances. The IORBL1 updates incorporated the most current information and assumptions at the time of selection of the recommended plan. Compared to the FWO baseline, the updated IORBL1 baseline indicates significant hydrologic differences with respect to the Saint Lucie Estuary, with other portions of the CEPP project area performing similar to the FWO; inclusion of both the FWO and IORBL1 is provided in **Figure 6-8** to highlight performance differences.

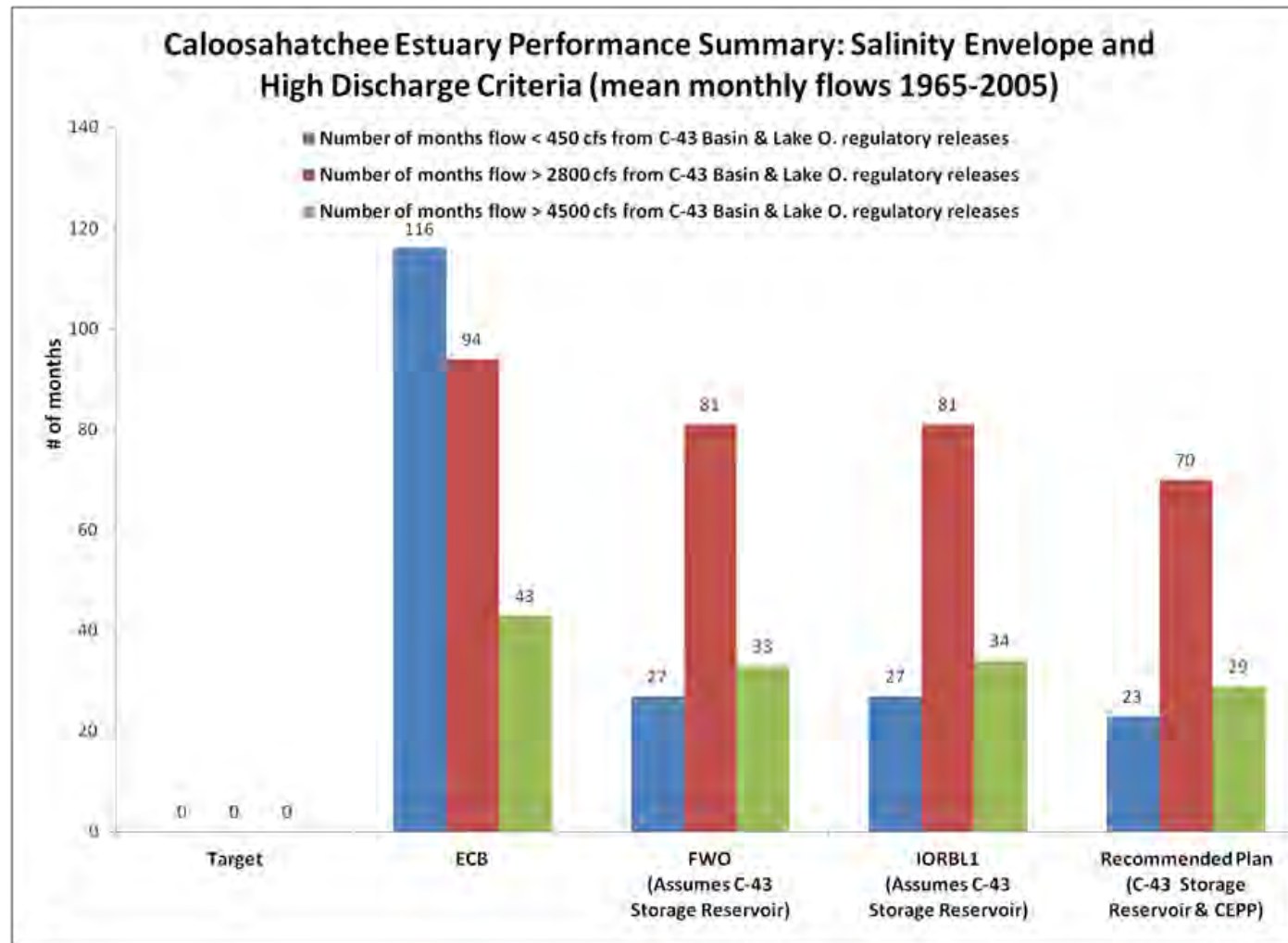


Figure 6-7. Number of Times Salinity Criteria not met for the Caloosahatchee Estuary for the ECB, FWO Project Condition, Initial Operating Regime Baseline (IORBL1) and the Recommended Plan. The salinity envelope target for the Caloosahatchee Estuary is a salinity range of 16 to 28 (PSU) practical salinity units. Meeting target discharges would result in achievement of the salinity envelope. The Caloosahatchee River (C-43) West Basin Storage Reservoir is assumed to be implemented in the FWO Project Condition, IORBL1 and the Recommended Plan.

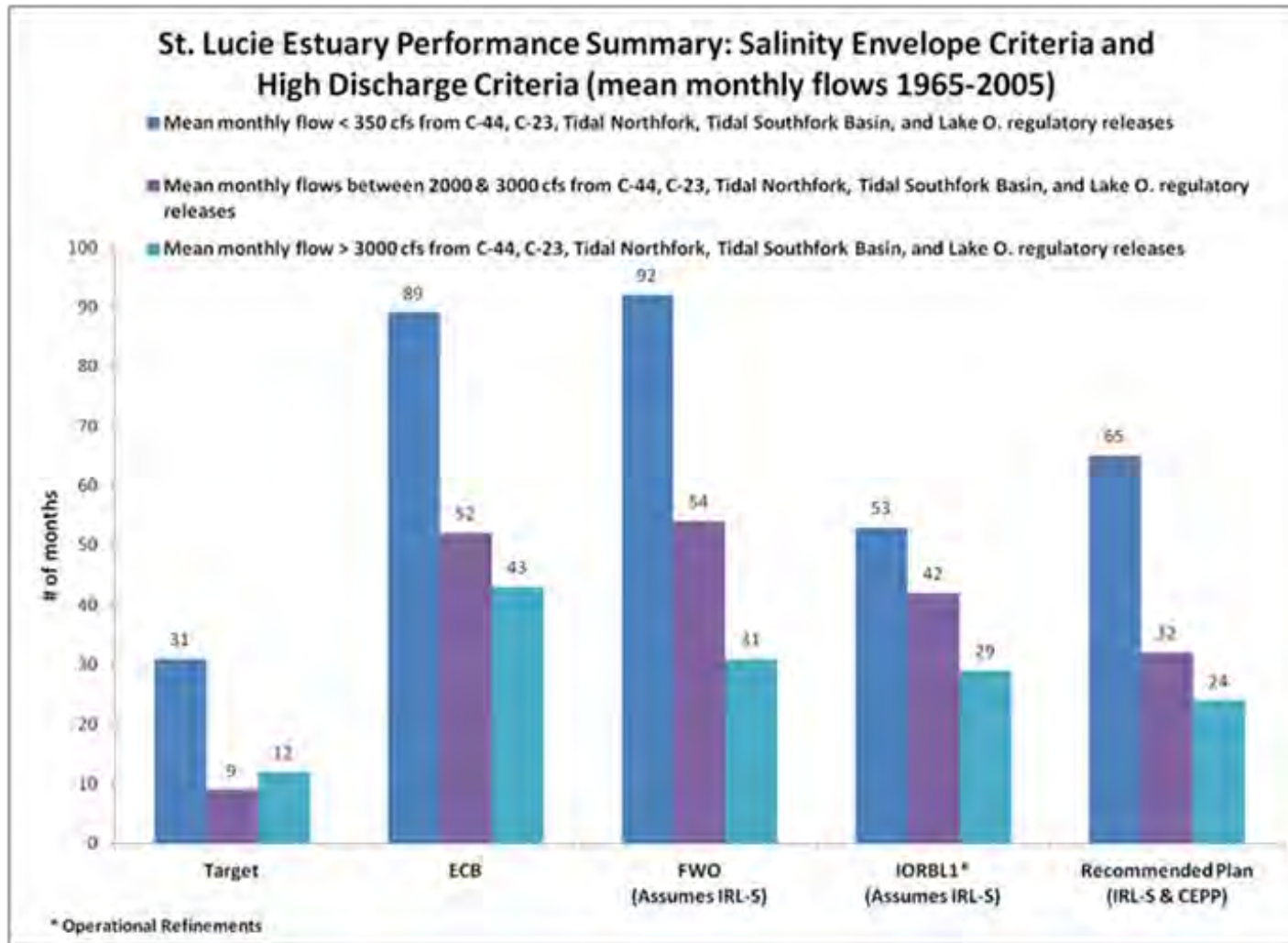


Figure 6-8. Number of Times Salinity Criteria not met for the St. Lucie Estuary for the ECB, FWO Project Condition, IORBL1, and the Recommended Plan. The salinity envelope target for the St. Lucie Estuary is a salinity range of 12 to 20 psu. Meeting target discharges would result in achievement of the salinity envelope. The Indian River Lagoon-South Project is assumed to be implemented in the FWO Project condition, IORBL1, and the Recommended Plan.

The recommended plan provides a significant increase in the quantity of freshwater (approximately 210,000 acre-feet per year, annual average) flowing into the Everglades. This additional freshwater flow to the central Everglades is essential to Everglades Restoration. In the pre-drainage system, the inundation pattern supported an expansive system of freshwater marshes including long hydroperiod sawgrass “ridges” interspersed with open-water “sloughs”, higher elevation marl prairies on either side of Shark River Slough (SRS), and forested wetlands in the Big Cypress Marsh. The original C&SF Project compartmentalized and fragmented the Everglades landscape, reduced flows through the sloughs, and altered hydroperiod and depths. The result has been substantially altered plant community structures, reduced abundance and diversity of animals, and spread of nuisance and exotic vegetation. The recommended plan would provide for resumption of sheetflow and related patterns of hydroperiods and water depth that would significantly help to restore and sustain the microtopography, directionality, and spatial extent of ridges and sloughs, and improve the health of tree islands within the landscape. Additional water flowing into the Everglades would also result in beneficial shifts in habitat for desired wildlife species. Implementation of the recommended plan features and additional flow would provide greater project benefits to those areas located in northern WCA 3A and ENP. **Figure 6-9** through **Figure 6-14** depict the differences in hydroperiods and stage between the recommended plan and the FWO project condition in WCA 3 and ENP as modeled by the Regional Simulation Model for the Glades and Lower East Coast Service Areas (LECSA) (RSM-GL) (version 2.3.2) for the period of simulation (1965-2005). The years 1989 and 1995 are depicted which are representative of a dry and wet year, respectively, in the 41 year period of simulation. Average annual hydroperiod and stage differences across the period of simulation are also illustrated.

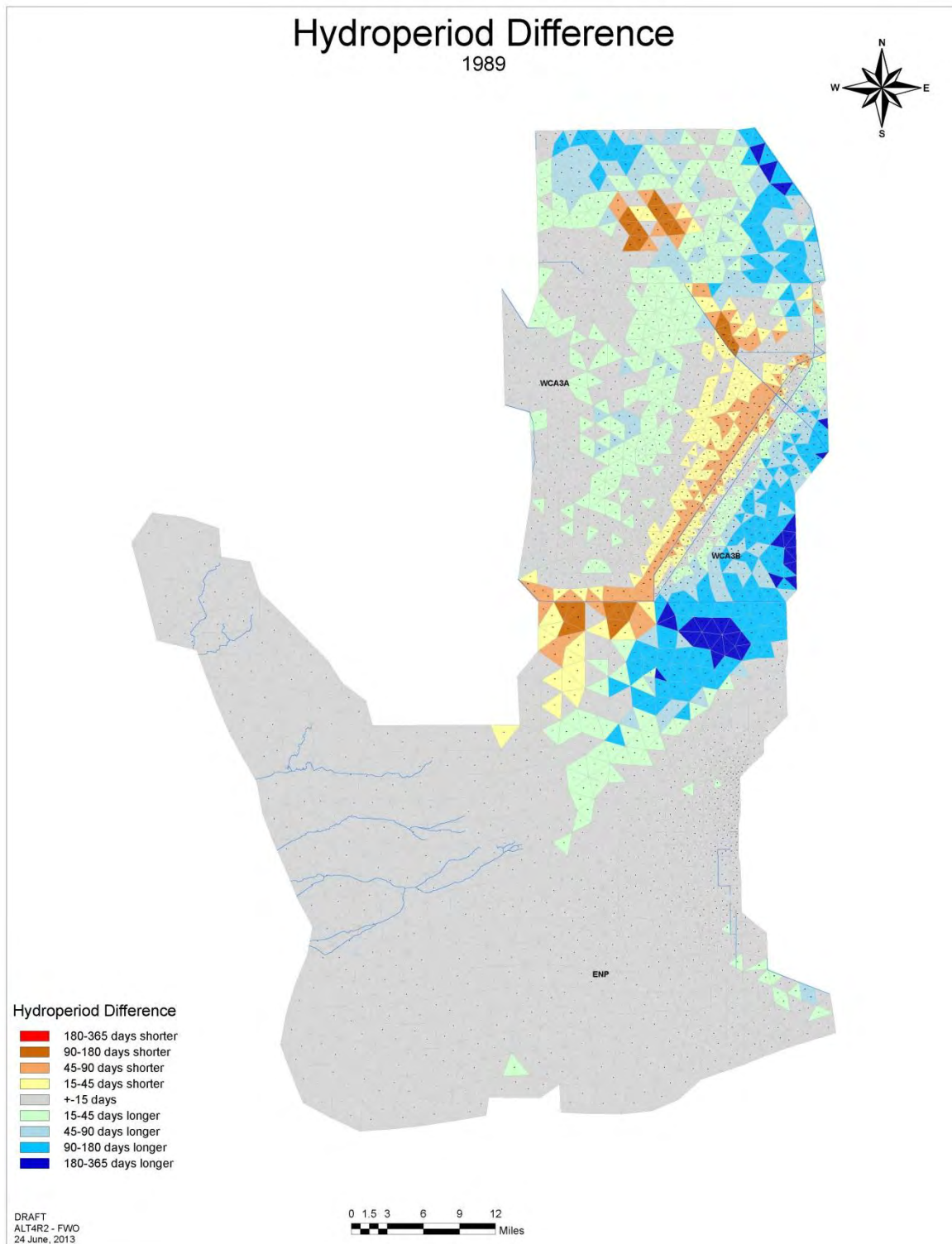


Figure 6-9. Differences in Hydroperiod Distribution within WCA 3 and ENP between the FWO Project Condition and the Recommended Plan for a Representative Dry Year (1989) in the Period of Record (1965-2005). Figure depicts hydroperiods resulting from implementation of the Recommended Plan that are shorter or longer than the FWO.

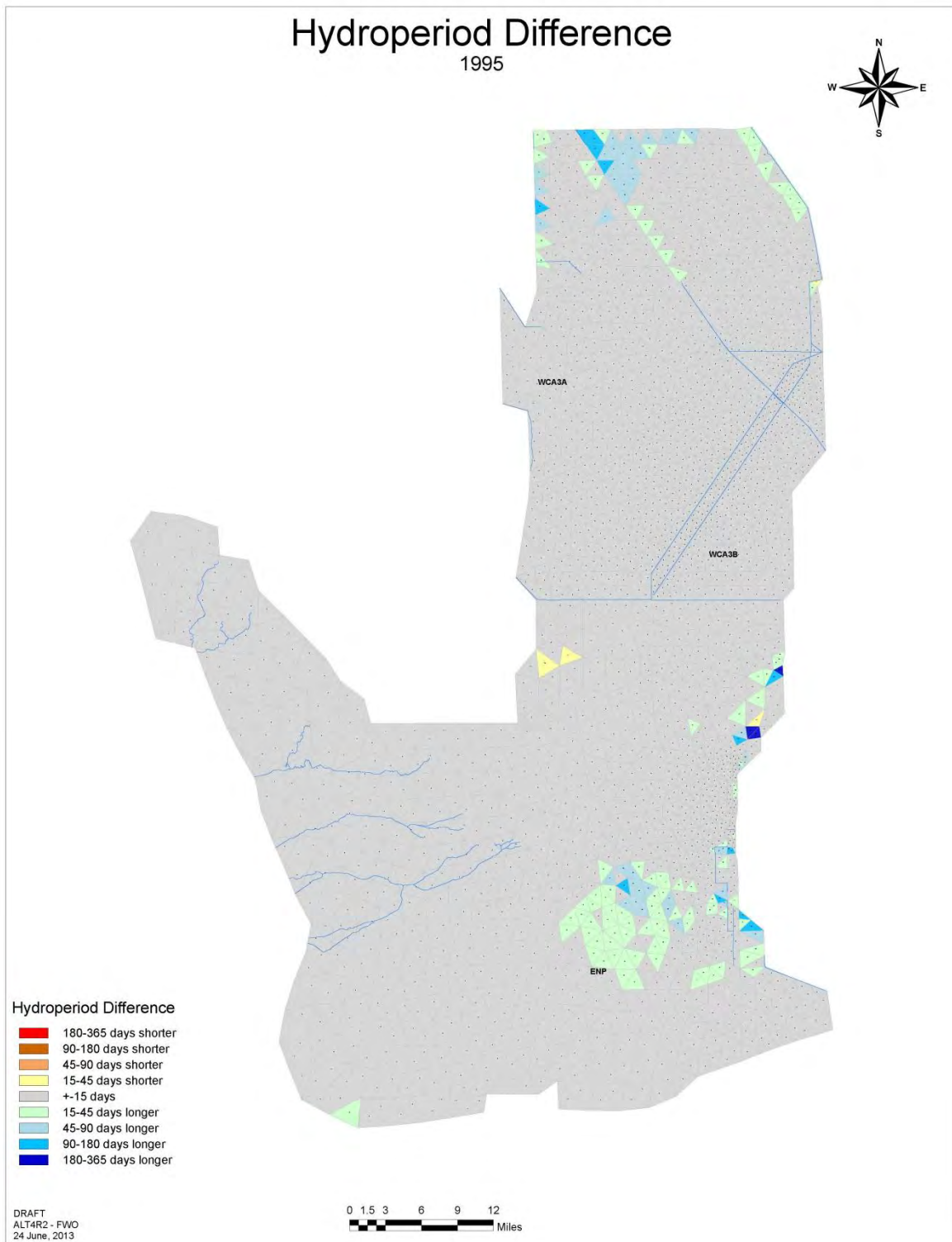


Figure 6-10. Differences in Hydroperiod within WCA 3 and ENP between the FWO Project Condition and the Recommended Plan for a Representative Wet Year (1995) in the Period of Record (1965-2005). Figure depicts hydroperiods resulting from implementation of the Recommended Plan that are shorter or longer than the FWO.

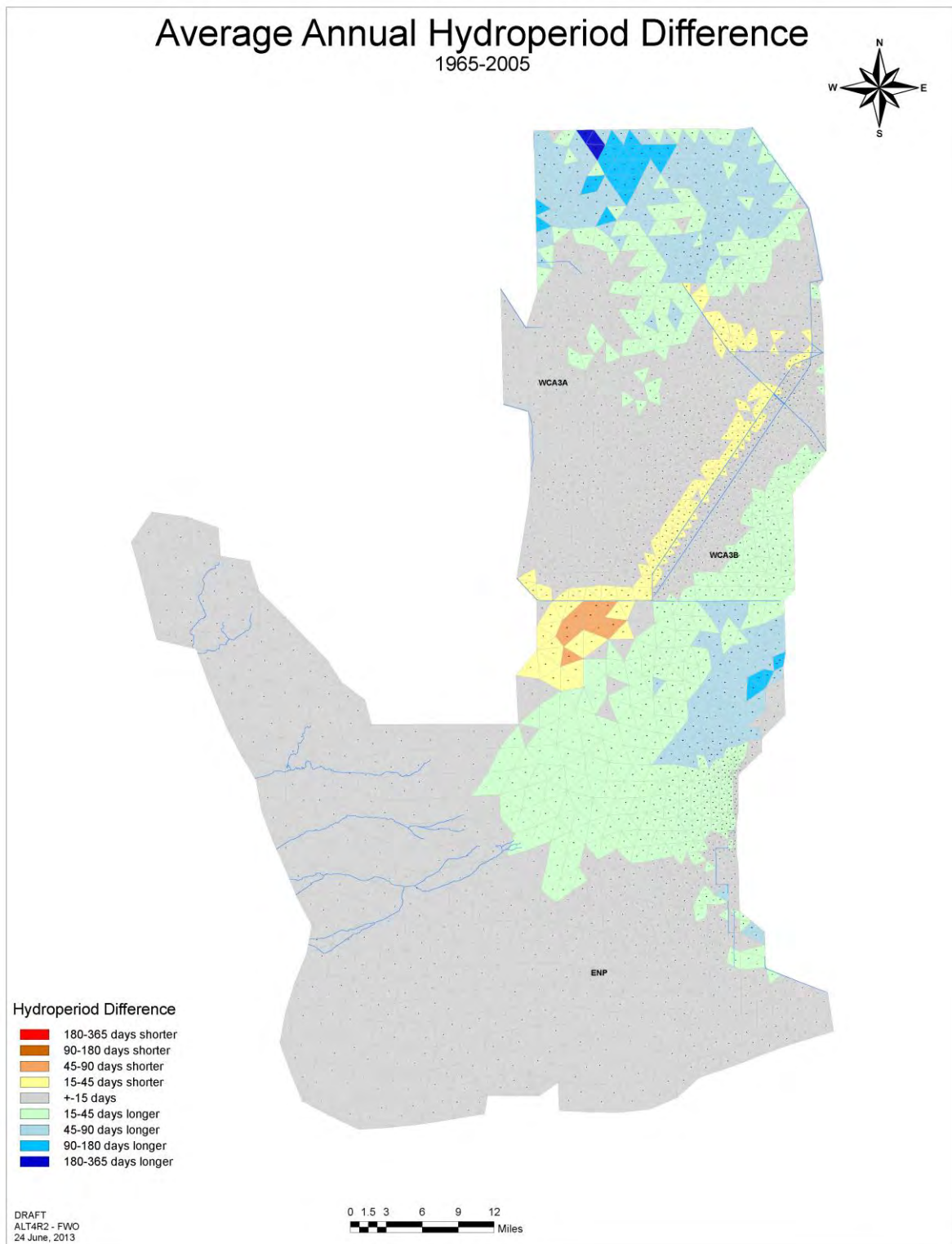


Figure 6-11. Differences in Average Annual Hydroperiod within WCA 3 and ENP between the FWO Project Condition and the Recommended Plan for the Period of Record (1965-2005). Figure depicts hydroperiods resulting from implementation of the Recommended Plan that are shorter or longer than the FWO

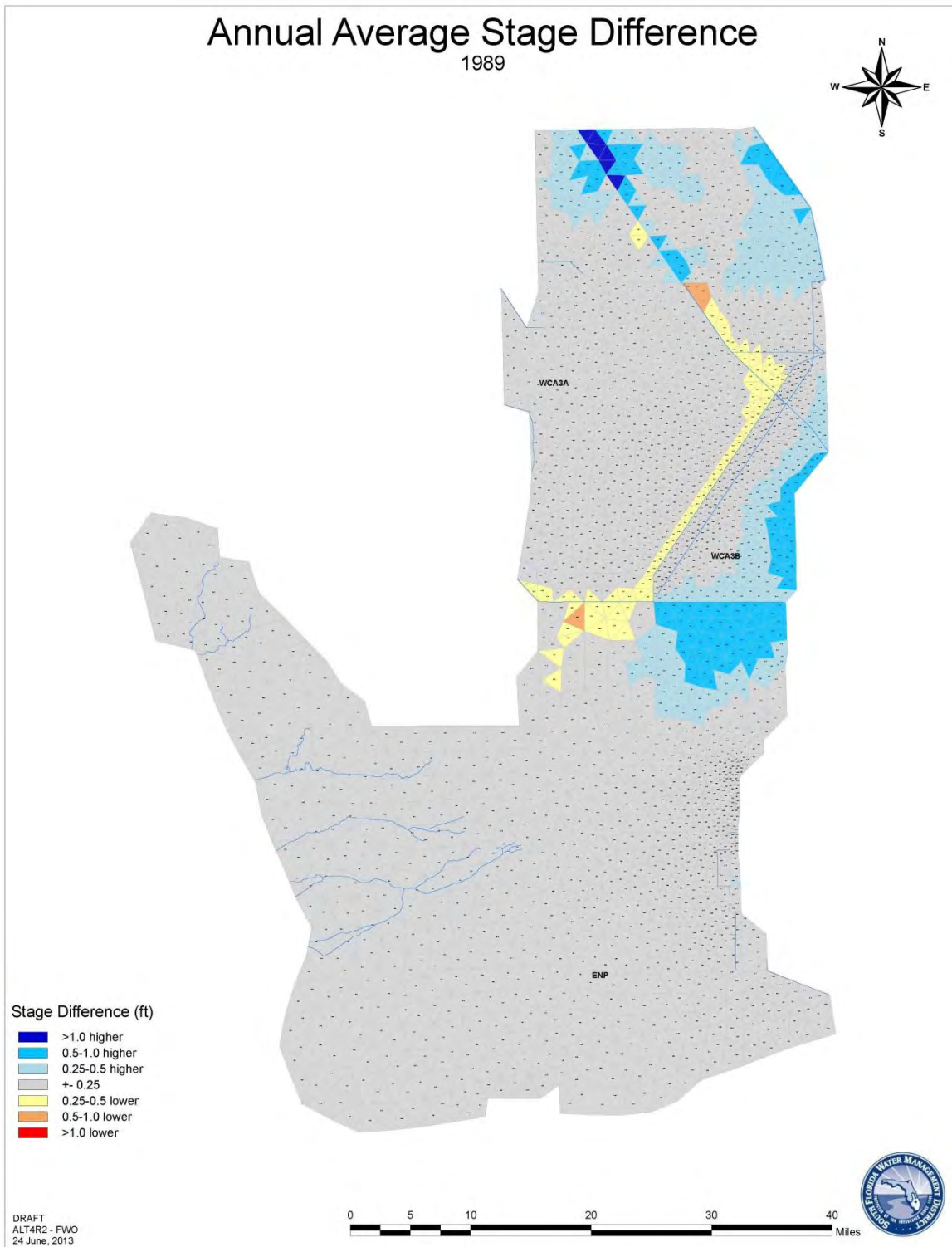


Figure 6-12. Differences in Stage within WCA 3 and ENP between the FWO Project Condition and the Recommended Plan for a Representative Dry Year (1989) in the Period of Record (1965-2005). Figure depicts stages resulting from implementation of the Recommended Plan that are higher or lower than the FWO.

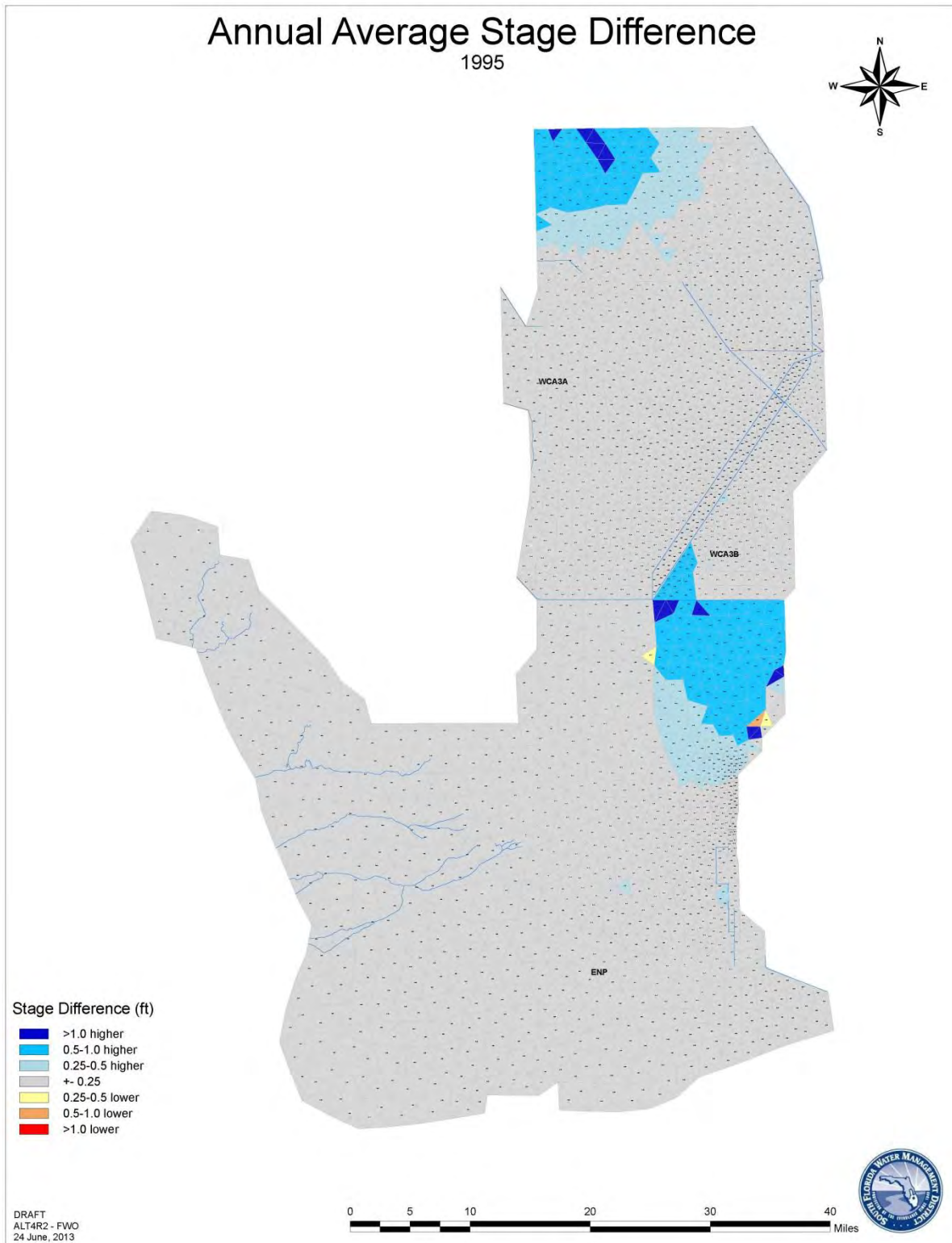


Figure 6-13. Differences in Stage within WCA 3 and ENP between the FWO Project Condition and the Recommended Plan for a Representative Wet Year (1995) in the Period of Record (1965-2005). Figure depicts stages resulting from implementation of the Recommend Plan that are higher or lower than that of the FWO.

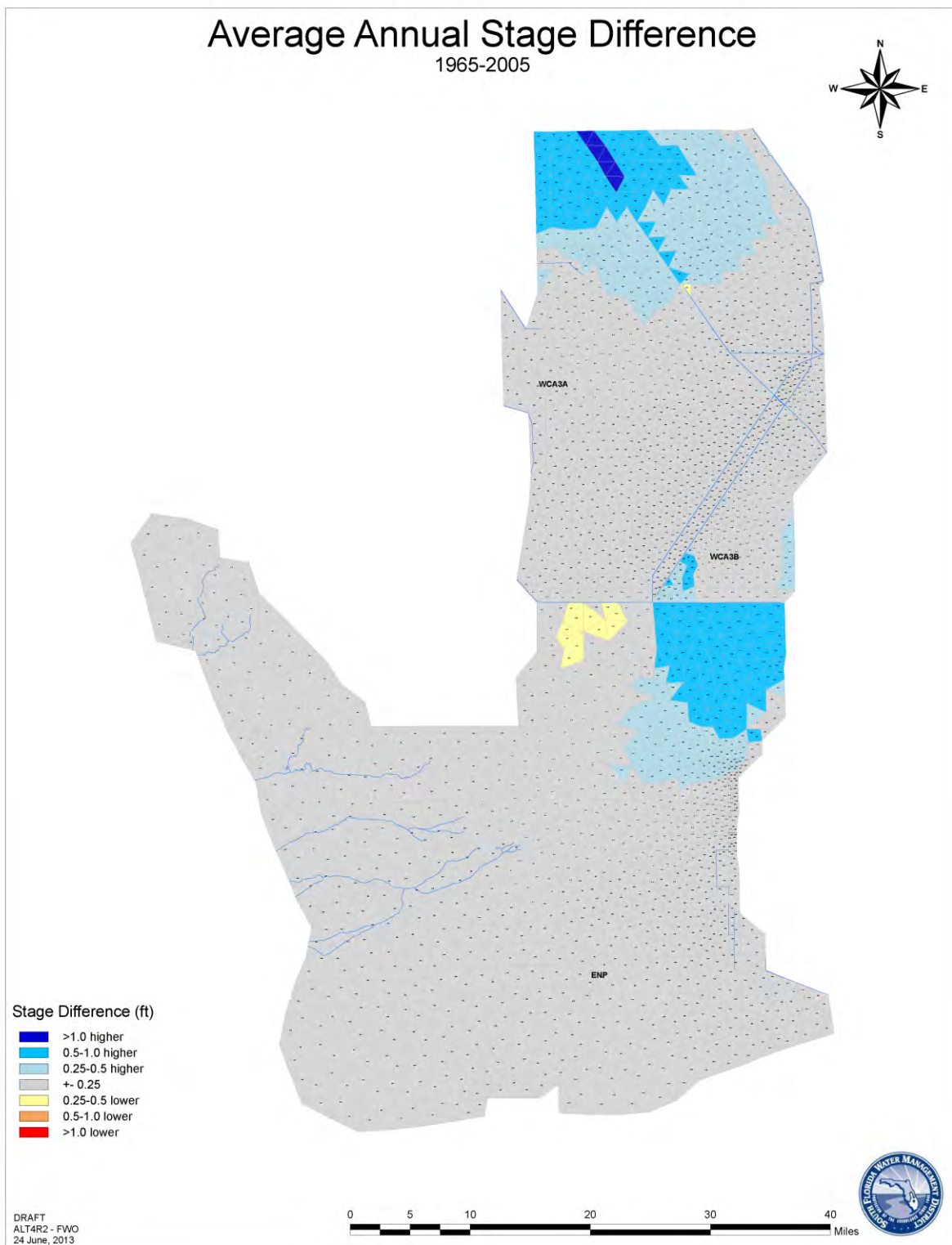


Figure 6-14. Differences in the Average Annual Stage Difference within WCA 3 and ENP between the FWO Project Condition and the Recommended Plan for the Period of Record (1965-2000). Figure depicts stages resulting from implementation of the Recommend Plan that are higher or lower than that of the FWO.

In northern WCA 3A, the Miami Canal functions as a major, unnatural drainage for WCA 3A. In combination with the northern levees of WCA 3A (L-4 and L-5), the Miami Canal has substantially impacted historical sheetflow and natural wetland hydroperiods. As a result, the natural capability of northern WCA 3A to store water is lost and the Miami Canal effectively over-drains the area. These hydrologic changes have increased the frequency of severe peat fires and have also resulted in the loss of ridge and slough topography that was once characteristic of the area. Most of WCA 3A north of Interstate 75 has experienced some form of fire and in more recent years those fires have moved farther south into the western portion of WCA 3A. Today, northern WCA 3A is largely dominated by sawgrass, cattail and scattered shrubs and lacks the structural diversity of plant communities seen in central and western WCA 3A. The recommended plan is expected to rehydrate much of northern WCA 3A by providing a means for redistributing treated STA discharges from the L-4 and L-5 in a manner that promotes sheetflow and by removing the drainage effects associated with the Miami Canal. This would promote the reversal of soil loss and would help in the restoration of organic soil accretion.

Central WCA 3A is considered to be fairly well conserved ridge and slough habitat. Vegetation and patterning in the central portion of WCA 3A resembles the pre-drainage conditions most closely and represents some of the best examples of Everglades habitat left in south Florida. This region of the Everglades appears to have changed little since the 1950s (which was already post-drainage) and contains a mosaic of tree islands, wet prairies, sawgrass stands, sawgrass ridges, and aquatic sloughs. Increases in depth within central WCA 3A were not as significant as increases in proposed depths in northern WCA 3A; however maintenance of existing conditions within this region of the project area is desirable as ridge and slough habitat is well conserved.

The southern portion of WCA 3A is primarily affected by long durations of high water and a lack of seasonal variability in water depths created by impoundment structures (*i.e.* L-67 and L-29 levees). The increased duration of high water events within southern WCA 3A has negatively impacted tree islands and caused fragmentation of the sawgrass ridges, again resulting in the loss of historic landscape patterning. Southern WCA 3A would remain largely unaffected by the recommended plan. The recommended plan would not result in significant benefits to southern WCA 3A through reduction in high water levels or durations.

Within WCA 3B, the ridge and slough landscape has been severely compromised by the virtual elimination of overland sheetflow since the construction of the L-67A/C Canal and Levee system. WCA 3B has become primarily a rain-fed compartment, experiencing very little overland flow and has largely turned into a sawgrass monoculture where relatively few sloughs or tree islands remain. Loss of sheetflow to WCA 3B has also accelerated soil loss reducing elevations of the remaining tree islands in WCA 3B, making them vulnerable to high water stages. The recommended plan would begin to re-establish hydrologic connectivity of WCA 3A, WCA 3B, and ENP. Increases in stages and hydroperiods would promote wetland vegetation transition, through contraction of sawgrass marshes and expansion of wet prairies and sloughs.

Flows through SRS under current water management practices, including the existing WCA 3A Regulation Schedule and the current limited capacity to redirect Lake Okeechobee water south to the Everglades, are much reduced when compared with pre-drainage conditions. The result has been lower wet season depths and more frequent and severe dry downs in the sloughs and reduction in the extent of the important shallow water “edges”. Dry downs that are too frequent or severe inhibit the productivity and resilience of animal populations, including the prey base (*i.e.* marsh fishes and other aquatic animals) and wading birds that depend upon them. Over-drainage in the peripheral wetlands

along the eastern flank of Northeast Shark River slough (NESRS) has resulted in shifts in community composition, invasion by exotic woody species, and increased susceptibility to fire. The recommended plan is expected to rehydrate much of NESRS by providing a means for redistributing flows from WCA 3A through WCA 3B to ENP. Restoration of flow volumes will significantly improve hydroperiods and water depths while reducing the frequency and severity of dry downs.

Changes in hydrology of the freshwater systems have led to effects on the estuarine and marine environments of Florida Bay. Florida Bay is the main receiving water body of the Greater Everglades system and is heavily influenced by changes in the timing, distribution and quantity of freshwater flows. Alterations in seasonal inflow deliveries to Florida Bay have resulted in extreme salinity fluctuations. Water management actions that result from the recommended plan have the potential to reduce the intensity, frequency, duration and spatial extent of hypersaline events in Florida Bay and establish a persistent and resilient estuarine zone that extends further into the bay than currently exists. CEPP does not reconnect SRS to Taylor Slough or Florida Bay as it was historically, but it does allow additional surface water to flow southeastward around Mahogany Hammock towards West Lake, the Lungs, and Garfield Bight helping to negate the harmful buildup of hypersalinity. This is expected to help restore the bay to more natural conditions and increase biomass and diversity of bay flora and fauna including ecologically and economically important pink shrimp and spotted sea trout, and desired seagrass species. Further information pertaining to the evaluation of the recommended plan is described in **Appendix G**.

6.2.2 Contribution to Achievement of Interim Goals and Interim Targets

Section 601(h)(3)(C)(III) of WRDA 2000 (P.L. 106-541) required that CERP promulgate Programmatic Regulations which would include the “establishment of interim goals to provide a means by which the restoration success of the Plan may be evaluated throughout the implementation process.” Section 385.38 of the Programmatic Regulations (33 CFR Part 385) describes the intent and the underlying principles for establishing interim goals and a process for their development. Recommendations for interim goals and interim targets were developed by Restoration, Coordination and Verification (RECOVER) in 2005. An intergovernmental agreement signed in 2007 among the USACE, DOI and SFWMD established interim goals for CERP. Section 385.39 also established the requirement to develop interim targets to measure progress toward meeting other water-related needs of the south Florida region, and described the intent, underlying principles, and the process for establishing interim targets. An agreement signed in 2007 between the USACE and SFWMD established interim targets.

The Programmatic Regulations also required that each PIR describe how the project contributes to the achievement of interim goals and interim targets (s. 385.26(a)(3)(xv)). Quantitative and qualitative predictions based on results from the RECOVER-approved performance measures, information gained from additional ecological planning tools and best professional judgment was used to evaluate the progress towards the interim goals.

6.2.2.1 Progress Toward Interim Goals

Each of the performance measures for the CEPP planning effort were derived from those approved for use in CERP by RECOVER. Detailed information about the performance measures and the methodology that was used to quantify ecosystem benefits and support plan evaluation and selection of the recommended plan can be found in **Appendix G**. The CEPP Planning Model underwent peer review per Engineering Circular (EC) 1105-2-412 (Assuring Quality of Planning Models) and was recommended for single-use by the National Ecosystem Restoration Planning Center of Expertise (ECO-PCX) and was approved by the USACE HQ Model Certification Panel. See **Section 6.10.1.2**. Further information on

ecological planning tools (i.e., Wood Stork Foraging Potential, Alligator Production Suitability, Everglades Landscape Vegetation Succession [ELVeS], Juvenile Sea Trout and Pink Shrimp) used to evaluate the environmental effects of CEPP alternatives can be found in **Appendix C.2**. Outputs from the regional hydrologic models used in plan formulation (RSM-BN and RSM-GL) were also used to evaluate and help quantify CEPP's progress towards meeting interim goals relevant to CEPP objectives. The RSM-BN and RSM-GL were approved for use through the current USACE Engineering software validation process. See **Section 6.10.1.1**. **Table 6-1** is a summary of the CEPP's effects on the interim goal indicators. Most analyses compare the recommended plan to the FWO project condition. When "acre-feet" are cited, this refers to an analysis of an average-annual water budget over the 41-year period of hydrologic model simulation (1965 – 2005).

Table 6-1. Progress Towards Meeting Interim Goals

Northern Estuaries Indicators	
1.1 American Oysters : Increase areal coverage of American oysters in the Caloosahatchee and St. Lucie estuaries	In the Caloosahatchee Estuary, more oysters were estimated under CEPP relative to the FWO and ECB at Cape Coral, values were similar for CEPP and the FWO at the more downstream and saline Shell Point. Compared to the ECB, CEPP could account for a 7.6% increase in oyster density at Cape Coral and a 4.4% increase at Shell Point. In the St. Lucie Estuary, the predicted seasonal pattern for oysters was similar at Roosevelt (US-1) Bridge, although densities were an order of magnitude lower than in the Caloosahatchee (there are fewer oysters to start with). There were more oysters predicted under CEPP relative to the FWO with a 13.1% improvement.
1.2 Submerged Aquatic Vegetation : Increase the areal coverage and improve the functionality of submerged aquatic vegetation in the northern estuaries	The maximum number of seagrass shoots occurred in August and September in both estuaries with approximately 1.2 million shoots per acre of <i>Halodule wrightii</i> (shoal grass) at Shell Point in the Caloosahatchee and approximately 2.5 million shoots per acre of <i>Syringodium filiforme</i> (manatee grass) at Boy Scout Island near the Saint Lucie Inlet. Overall shoot densities predicted under the CEPP were greater than for either the FWO or the ECB. Compared to the FWO, increases of 8.5% and 6.6% more seagrass shoots were predicted with salinities representative of CEPP in the Caloosahatchee and St. Lucie, respectively. Functionality of existing seagrass beds in the Caloosahatchee and St. Lucie Estuaries are expected to improve with reductions in high flows and accompanying flow velocities.
1.3 Flows: Reduce high and low volume flows to the Caloosahatchee and St. Lucie estuaries	High volume flows (>2,800 cfs) to the Caloosahatchee Estuary were reduced from 81 months in the FWO and IORBL1 to 70 months with CEPP (out of the 492 months in the period of record); incidences of low volume flows (<450 cfs) decreased slightly from 27 months in the FWO and IORBL1 to 23 months with CEPP. In the St. Lucie Estuary, the number of events where the 14-day moving average flow exceeded 2,000 cfs occurred 151 times in the FWO, 133 times in the IORBL1 and 86 times with CEPP; the number of months where average monthly flows <350 cfs occurred was 92 months in the FWO, 53 months with IORBL1, and 65 months with CEPP.
Greater Everglades Indicators	
3.1 Water Volume: Distribute water across the ecosystem in a manner that reflects natural conditions while providing for other water-related needs of the region	Although not always quantitative, the predictions for 3.2 <i>Sheetflow</i> , 3.3 <i>Hydropattern</i> , 3.13 <i>Flows to northern boundaries of the water conservation areas</i> and 3.14 <i>Flows to Everglades National Park</i> , below help to tell this hydrologic story.
3.2 Sheetflow in Natural Areas: Establish more historic magnitudes and directions of sheetflow in the natural areas of the Everglades	Qualitatively, there is a greater magnitude of water flowing through WCA 3A, WCA 3B and ENP with CEPP. The distribution of flow relative to target indicates a 26% and 4% improvement for WCA 3A and ENP, respectively. Distribution decreases by 12% in WCA 3B.

3.3 Hydropattern: Restore the natural timing and pattern of inundation throughout the ecological communities of South Florida, including sawgrass plains, ridge and slough and marl marshes

With CEPP, the timing and inundation duration (length of time water was above ground) in WCA 3A improved 26% towards target. WCA 3B showed a 16% improvement. In ENP, these conditions moved 48% towards target.

3.4 System-Wide Spatial Extent of Habitat: Increase spatial extent of natural habitat

Fourteen thousand acres of public land currently leased for agricultural use will be shifted to higher quality wetland with construction of the A-2 FEB. CEPP will improve the functionality and habitat value of more than 1.5 million acres of Everglades fresh and saltwater marshes and estuaries.

3.6 Periphyton Mat Cover, Structure, and Composition: Restore periphyton mat cover, structure and composition that were characteristic of the spatially distinct hydroperiods (short and long hydroperiods) and low nutrient conditions in the greater Everglades wetland communities

Periphyton monitoring has shown that the continued input of above-ambient phosphorous concentrations will both increase severity of enrichment effects near canals and cause these effects to continue to cascade downstream. Increased input of water through restorative projects such as CEPP may increase periphyton development in areas formerly over-drained.

3.7 Ridge and Slough Pattern: Restore the historical ridge and slough landscape directionality and pattern

Restoration of the ridge slough pattern with CEPP may be highly geographically variable. Focusing flows to northwest WCA 3A could be advantageous from the perspective of local flow velocities. In WCA 3B, only in the area within the Blue Shanty flowway do restored flow lines track historical flow lines. One of the most restorable areas of the ridge-slough landscape is in southern WCA 3A, where the landscape retains high elevation variance, even though the bimodal nature of that distribution has been lost. As such, the inability to meaningfully change the hydrology in this impounded area remains problematic.

3.8 Everglades Tree Islands: Improve tree island health and maintain healthy tree islands

CEPP is protective of existing islands in northeast WCA 3A, and is highly protective of tree islands in Shark River Slough (SRS). Northwest WCA 3A and SRS are the most probable locations for the creation of new tree islands. CEPP provides improved hydrologic conditions for tree islands over the FWO in northern WCA 3A, WCA 3B, and SRS.

3.9 Aquatic Fauna Regional Populations in Greater Everglades Wetlands: Increase the abundance of fish to levels that approximate those predicted for pre-drainage conditions

Small fishes (up to ~8 cm) are expected to increase in abundance over the FWO in most of WCA 3 and ENP. Predictions in WCA 3A are slightly over 7% increase; WCA 3B ~4%; Shark Slough almost 14%; and Taylor Slough almost 7%. This predicted increase in fish biomass has the potential to greatly increase wading bird food availability. Larger fishes (≥ 8 cm) such as largemouth bass are also important components of the Everglades ecosystem. A catch-per-unit-effort abundance index indicates that largemouth bass will increase over the FWO by ~11% in WCA 3A and ~18% in Shark Slough.

3.10 American Alligator: Restore more natural numbers and distribution patterns for alligators across South Florida's major freshwater and estuarine landscapes

Alligator production potential increases over the FWO from ~5-7 years (out of a 41-year period of hydrologic record) in northern WCA 3A and around the backfilled Miami Canal. Gains in other areas (i.e., WCA 3B and ENP), while positive, are fairly negligible.

3.11 System-Wide Wading bird nesting patterns: Increase the total number of nesting pairs, the percentage of wading bird pairs nesting in estuarine locations and the frequency of super colony events and establish conditions that encourage wood storks to initiate nesting earlier in winter

Wood stork foraging suitability notably improves with CEPP in northern WCA 3A and within southern ENP relative to the FWO. Less substantial benefits occur within northwest WCA 3A and WCA 3B, and southeast ENP. Benefits generally result from the increased water deliveries to these regions which result in more suitable water depths for wood stork foraging as compared to existing conditions or future conditions without CEPP. While substantial declines in stork foraging suitability occur within northern ENP, it is predicted that southern ENP may become more suitable foraging habitat for wood storks, making it possible they would start nesting in this location once again. The general transitioning of wood stork foraging habitat from Shark River Slough, which historically was a deep water white-water lily-dominated habitat, back into southern ENP, is considered a progressive step toward ecosystem restoration.

<p>3.12 Snail Kite: Increase the areal extent of suitable foraging for snail kites</p> <p>The apple snail is used as a proxy for snail kites, due to its being virtually the exclusive food source for the kite. CEPP provides better conditions for apple snail populations as well as an increase in suitable apple snail habitat in most of WCA 3A and in WCA 3B and Shark Slough in ENP.</p>
<p>3.13 Flows to Northern Boundaries of the WCAs: Provide more natural surface water flows to the northern boundaries of the water conservation areas</p> <p>CEPP reduces point source surface water discharge from S-8 by 219,000 acre-feet per year and spreads the water out to provide sheetflow through the western hydropattern restoration feature.</p>
<p>3.14 Flows to ENP: Provide more natural surface water flows to Everglades National Park</p> <p>Overland flows are introduced into NESRS from WCA 3B, estimated at 238,000 acre-feet per year, there was no overland flow here in the FWO.</p>
<p>Southern Estuaries Indicators</p>
<p>4.1 Salinity Patterns: Reduce the intensity, duration, frequency and spatial extent of high salinity events, reestablish low salinity conditions in mainland nearshore areas, and reduce the frequency of a rapidity of salinity fluctuations resulting from pulse releases of fresh water from canals</p> <p>Alt 4R2 will move Florida Bay, as a whole, 12% closer to the full restoration target (i.e. from 0.16 to 0.28 towards 1.0). Because of the generally poor current conditions, this 12% lift translates to about a 76% improvement relative to the FWO. Spatially, conditions are better in the east central, central, south, and west during the wet season and do improve in the east central, south, and west during the dry season.</p>
<p>4.2 Submerged Aquatic Vegetation: Reestablish a diverse seagrass community with moderate plant densities and more natural seasonality, and increase the percentage of Florida Bay having suitable habitat for seagrass growth</p> <p>Improved salinity regimes in the North Bay result in a stable mixed <i>Thalassia-Halodule-Ruppia</i> SAV community with a decrease in <i>Thalassia</i> and an increase in <i>Ruppia</i> densities over the FWO.</p>
<p>4.3 Juvenile Shrimp Densities: Increase densities of juvenile shrimp within the various basins of Florida Bay and Biscayne Bay</p> <p>Improved salinity regimes in the Central and Western Florida Bay result in less than 1% increase (0.68% and 0.35%, respectively) in potential pink shrimp annual harvest over the FWO.</p>
<p>4.4 American Crocodiles: Increase the frequency of salinities less than 20 parts per thousand in Florida Bay to foster optimal growth and survival of juvenile crocodiles</p> <p>Improved salinity regimes in north and central Florida Bay result in an increase in the crocodile growth and survival index overall of up to 7% and 14% respectively, and up to 4% and 28% respectively, during dry year conditions compared to the FWO.</p>
<p>4.6 Freshwater Flows to Florida Bay: Increase freshwater flows to Florida Bay</p> <p>Tidal outflows increase with CEPP by an average of 144,000 acre-feet per year.</p>
<p>System-Wide Water Volume</p>
<p>5.1 Quantity of Freshwater Lost to Tide: Reduce the quantity of freshwater lost to tide</p> <p>CEPP captures an estimated 79,000 acre-feet of water from being lost to the Gulf of Mexico in the Caloosahatchee (18% increase relative to the FWO) and 60,000 acre-feet from being lost to the Atlantic Ocean in the St. Lucie on average annually (32% increase relative to FWO).</p>

6.2.2.2 Progress Toward Interim Targets

Each of the performance measures for the CEPP planning effort were derived from those approved for use in CERP by RECOVER and are applied for interim targets. Output from the regional hydrologic models used in plan formulation (RSM-BN and RSM-GL) was also used to evaluate and help quantify CEPP's progress towards meeting interim targets. **Table 6-2** is a summary of the CEPP's effects on the interim target indicators. Most analyses compare the recommended plan to the FWO. The interim targets analyzed in this section are based upon the objectives of CEPP.

Table 6-2. CEPP Progress Towards Meeting Interim Targets

Indicators	Interim Target	Summary of Project Effects
1. Water Volume	Distribute water across the ecosystem in a manner that reflects natural conditions while providing for other water-related needs of the region.	In general, increased water supplies and improved spatial distribution to the natural systems enables increased availability of water for other water related needs in some of the SFWMD water supply Service Areas.
2. Water Supply to Lower East Coast Service Area	Increase water supplies available for meeting existing and future water supply needs including the water supply rights of the Seminole Tribe of Florida, State of Florida, and the SFWMD.	The improved timing and inundation duration in WCA 3 enabled meeting existing permitted demands. An additional 12 million gallons per day (MGD) and 5 MGD of future water supply demands can also be met in LECSA 2 and 3, respectively.
3. Water Supply to Lake Okeechobee Service Area (LOSA)	Increase water supplies available for meeting existing and future needs including the water supply rights of the Seminole Tribe of Florida, State of Florida, and the SFWMD.	Timing and distribution of water from Lake Okeechobee provides the ability to maintain the existing level of water supply performance.

6.2.3 Ecosystem Services

Ecosystem services can be defined as the benefits human beings receive from resources and processes supplied by ecosystems (Murray et al. 2013). Some ecosystem services are material resources that can be used by people, such as food, timber, water, and medicine. Other ecosystem services come from ecological processes, such as carbon sequestration that results from the formation of peat soils. Describing ecosystem services helps capture a fundamental value of ecosystems - that they support human life on Earth.

CEPP would improve the ecological condition of the Everglades and associated estuaries and therefore should boost several ecosystem services. The services expected to improve include aesthetics; biodiversity and species composition; atmospheric carbon sequestration; commercial fishing; frogging; mangrove coastal stabilization and storm protection in Everglades National Park; recreation in the forms of biking, hiking, estuary fishing, some kinds of hunting (although deer hunting accessibility may decrease during some years), and non-motor boating; ecological connectivity of landscapes; educational opportunities; water quality in terms of reduction in phosphorous and sediment loads to estuaries; water quality in estuaries due to increased filtration by oysters; water supply to the LEC and for irrigation; wildfire management; and wildlife-associated activities such as wildlife photography, tours, and viewing.

6.3 ENVIRONMENTAL CONSIDERATIONS

6.3.1 Water Quality for Lake Okeechobee, the Northern Estuaries, and Water Conservation Area 3A

The recommended plan is not expected to significantly affect Lake Okeechobee water quality; however, increased backflow into the lake at the S-308 structure will result in a relatively small increase in lake phosphorus load. This additional load will be addressed through the Basin Management Action Plan process (Section 403.067, Florida Statutes). The Northern Estuaries should see slight improvements to water quality that result from reduced high flow events associated with Lake Okeechobee operations. The construction and operation of the A-2 FEB will slightly decrease EAA basin phosphorus loads to WCA 3.

Backfilling of northern portion of Miami Canal and re-direction of water into the northern marsh areas will result in greater uptake of nutrients and sulfate in northern WCA 3A. Increased flows and new flow patterns may result in an increase in water column phosphorus concentrations at one or more total phosphorous (TP) rule stations within WCA 3A and WCA 3B; however, this should have minimal impact on TP rule compliance. Reduced incidence of dry out of the northern marsh should limit peat oxidation and nutrient re-mobilization. Lower phosphorus and sulfate concentrations should occur in southern WCA 3A. The re-location of methylmercury “hotspots” within the northern Everglades will have limited practical impact on recreational fisheries since the area is already subject to a fish consumption advisory due to high levels of mercury in fish. The shifting of the methylmercury hotspots due to CEPP could impact wildlife; however, factors such as foraging patterns and atmospheric contributions of mercury are likely to play a greater role in regulating wildlife exposure to methylmercury than the hydrologic changes resulting from CEPP implementation.

6.3.2 Water Quality for Everglades National Park and the Southern Estuaries

Water entering ENP at the northern end of Shark River Slough (SRS) from WCA 3 is likely to have lower concentrations of TP as compared with the FWO condition due to the backfilling of the Miami Canal which will result in more water passing through the marsh areas and less water flowing directly from upstream canal sources. It is uncertain how changes in flow distributions proposed under CEPP will impact compliance with Appendix A of the 1991 Settlement Agreement. ALT 4R2 is expected to improve marsh hydroperiods over FWO conditions, which will reduce the risk of downstream TP spikes caused by dry-out and rewetting. Impact to the southern estuaries will be a decrease in average salinity conditions and the addition of nitrogen loading associated with the increase in flow. The effect of the added nitrogen is not expected to be ecologically significant.

Restoration of the Everglades requires projects that address hydrologic restoration as well as water quality improvement. The National Academy of Sciences in its most recent biennial report on restoration progress in the Everglades has recognized this where it noted that near-term progress to address both water quality and water quantity improvements in the central Everglades is needed to prevent further declines of the ecosystem. The significant amount of water resulting from CEPP will significantly improve restoration of the Everglades. Both the Federal and State parties recognize that water quantity and quality restoration should be pursued concurrently and have collaborated to develop and concur on a suite of restoration strategies being implemented by the State to improve water quality (“State Restoration Strategies”), as well as other State and Federal restoration projects, both underway and planned, to best achieve Everglades hydrologic objectives. Specific examples of Federally authorized projects include the Everglades Restoration Transition Plan (ERTP), Modified Water Deliveries to Everglades National Park Project, and the Tamiami Trail Next Steps Project. One of the goals of these projects and their associated operating plans, as well as certain components of the CERP awaiting authorization or that are being planned as part of the CEPP is to improve water quantity and quality in the Everglades through more natural water flow within the remnant Everglades which includes the water conservation areas and ENP. Variations in flows of the C&SF system may result from a variety of reasons. These reasons include natural phenomena (i.e. weather) and updates to the operating manuals to achieve the purposes of the C&SF Project such as flood control and water supply.

One goal of the Consent Decree¹ is to restore and maintain water quality within ENP. The Consent Decree established, among other things, long-term water quality limits for water entering ENP to achieve this goal. The existing limits for ENP are flow dependent and, generally, increased volume of water results in a lower allowable concentration of phosphorus to maintain the overall load of phosphorus entering the ENP. There will be redistribution of flows and increased water volume above existing flows associated with system restoration efforts beyond the current State Restoration Strategies projects. The Corps and its Federal and State partners recognize that to achieve long-term hydrologic improvement, water quality may be impacted, particularly as measured by the current Consent Decree Appendix A² compliance methodology. The Corps and the State partners agree that the monitoring locations/stations for inflows to ENP will require revision. The Technical Oversight Committee (“TOC”) is currently conducting an evaluation of this and other aspects of the compliance methodology.

In an effort to address these potential impacts and determine updates to Appendix A to reflect increased inflows and new discharges into ENP since the Consent Decree was entered, the parties to the Consent Decree have established a process and scope for evaluating and identifying necessary revisions to the Appendix A compliance methodology utilizing the scientific expertise of the TOC. The TOC may consider all relevant data, including the 20 years of data collected since Appendix A was implemented. Ultimately, such evaluations and changes to the Appendix A compliance methodology would be recommended by the Consent Decree’s TOC for potential agreement by all parties. Failure to develop a mutually agreed upon and scientifically supportable revised compliance methodology will impact the State’s ability to implement or approve these projects.

The aforementioned State Restoration Strategies will be implemented under a CWA discharge permit that incorporates and requires implementation of corrective actions required under a State law Consent Order, as well as a Framework Agreement between the U.S. Environmental Protection Agency (USEPA) and the State discharge permitting agency, the FDEP, to ensure compliance with CWA and State water quality requirements for existing flows into the Everglades. The CWA permit for the State facilities, the associated Consent Order (including a detailed schedule for the planning, design, construction, and operation of the new project features), and technical support documents were reviewed by, and addressed all of, the USEPA’s previous objections related to the draft National Pollutant Discharge Elimination System (“NPDES”) permits, prior to issuance.

All parties are committed to implementing the State Restoration Strategies, joint restoration projects, and associated operational plans, in an adaptive manner that is consistent with the objectives of the underlying C&SF Project. The Corps and the State will use all available relevant data and supporting information to inform operational planning and decision making, document decisions made, and evaluate the resulting information from those decisions to avoid adverse impacts to water quality where practicable and consistent with the purposes of the C&SF Project. Based upon current and best available technical information, the Federal parties believe at this time that the State Restoration Strategies, implemented in accordance with the State issued Consent Order and other joint restoration projects, are sufficient and anticipated to achieve water quality requirements for existing flows to the Everglades. If there is an exceedance of the Appendix A compliance limits, which results from a change in operation of a Federal project, and it has been determined that an exceedance cannot be remedied

¹ *United States v. South Florida Water Management District, et al.*, Case No. 88-1886-CIV-Moreno (U.S.D.C., S.D. Fla.).

² Appendix A referenced in this section of chapter 6 refers to the Consent Decree compliance calculation appendix

without additional water quality measures, the Federal and State partners agree to meet to determine the most appropriate course of action, including what joint measures should be undertaken as a matter of shared responsibility. These discussions will include whether it is appropriate to exercise any applicable cost share authority. If additional measures are required and mutually agreed upon, then they shall be implemented in accordance with an approved process, such as a general re-evaluation report (GRR) or limited re-evaluation report (LRR), and if necessary, supported through individual project partnership agreements (PPA's). Failure to develop mutually agreed upon measures and cost share for these measures may impact the State's ability to operate the Federal project features.

6.3.3 Cumulative Impacts

Cumulative environmental effects for the proposed action were assessed in accordance with guidance provided by the President's Council on Environmental Quality (CEQ). The primary goal of cumulative effects analysis is to determine the magnitude and significance of the environmental consequences of the proposed action in the context of the cumulative effects of other past, present, and future actions. **Table 6-3** shows the net cumulative effects of the various resources which are directly or indirectly impacted. CEPP is expected to contribute to a net beneficial cumulative impact on the regional ecosystem. Further information on cumulative effects can be found in **Appendix C.2.2.2**.

Table 6-3. Summary of Cumulative Effects

Hydrology	
Past Actions	Flood and water control projects have greatly altered the natural hydrology.
Present Actions	Federal and State agencies are coordinating on and implementing projects to improve hydrology.
Proposed Action	Reductions in high discharge events from Lake Okeechobee to the Northern Estuaries. Significant beneficial hydrologic effects are anticipated within the Greater Everglades through restoration of sheetflow and rehydration of previously drained areas. Improved hydrologic conditions will result from increasing depths and extending hydroperiods in WCA 3A, WCA 3B, and ENP.
Future Actions	Additional CERP projects propose to restore hydrology to more natural conditions.
Cumulative Effect	Although it is unlikely that natural hydrologic conditions would be fully restored to pre-drainage conditions, improved hydrology would occur. CERP is expected to improve the quantity, quality, timing and distribution of freshwater flow.
Threatened and Endangered Species	
Past Actions	Water management practices and urbanization have resulted in the degradation of existing habitat function and direct habitat loss leading to negative population trends of threatened and endangered species.
Present Actions	Ongoing efforts have been made by Federal and State agencies to implement projects to improve hydrology within the project area. These ongoing efforts include Kissimmee River Restoration, Lake Okeechobee Regulation Schedule, Canal 111 South Dade and other CERP projects. In addition, several water control plans (e.g. Interim Operational Plan for Protection of the Cape Sable Seaside Sparrow, Everglades Restoration Transition Plan) have specifically been implemented to address operations to better protect endangered species including endangered Cape Sable seaside sparrow (CSSS), endangered Everglade snail kite and endangered wood stork. The FWS recovery plan is used as a management tool.
Proposed Action	May affect the Eastern indigo snake, Florida panther, wood stork, Everglade snail kite, Everglade snail kite critical habitat, Florida manatee, Florida manatee critical habitat, crocodile, crocodile critical habitat, CSSS, CSSS critical habitat, green sea turtle, leatherback sea turtle, Hawksbill sea turtle, loggerhead sea turtle, Kemp's ridley sea turtle, small tooth sawfish, and small tooth sawfish critical habitat (See Annex A).

Future Actions	CERP projects under construction, as well as ongoing projects previously mentioned, would assist in maintaining and improving conditions for threatened and endangered species within the project area. ERTTP implementation represents a paradigm shift from single species to multi-species management. ERTTP includes performance measures specifically directed at managing water levels and releases for the protection of multiple species and their habitats within the project area.
Cumulative Effect	Habitat improvement, monitoring and management of threatened and endangered species are anticipated to allow populations to be maintained. Improvement of degraded populations is expected to be facilitated by the restoration and enhancement of suitable habitat through efforts to restore more natural hydrologic conditions within the project area.
Fish and Wildlife Resources	
Past Actions	Water management practices have resulted in aquatic vegetation community changes and a resultant disruption of aquatic productivity and function that has had repercussions through the food web, including effects on wading birds, large predatory fishes, reptiles and mammals.
Present Actions	Ongoing efforts have been made by Federal and State agencies to implement projects to improve hydrology within the project area to restore habitat conditions for fish and wildlife resources.
Proposed Action	Negligible effects to fish and wildlife resources within Lake Okeechobee, and the EAA. Reductions in the number of high discharge events to the Northern Estuaries are anticipated to improve suitable habitat for key indicator species such as oysters. Significant beneficial effects are anticipated within the Greater Everglades. Rehydration within previously dry areas of WCA 3A, 3B, and ENP would increase the spatial extent of suitable habitat for several fish and wildlife resources. Increases in forage prey availability (crayfish, other invertebrates, and fish) would directly benefit amphibian, reptile, small mammal, and wading bird species. Nesting and foraging activities of resident bird species are anticipated to be significantly improved. Although mammals occurring within the action area are adapted to the naturally fluctuating water levels in the Everglades, there is an increased potential that mammals currently utilizing upland habitat may be negatively affected. Increased freshwater flows to Florida Bay would aid in improving suitable habitat for pink shrimp, juvenile spotted sea trout, sea turtles, manatee and crocodiles among other species.
Future Actions	Some level of improvement to fish and wildlife resources is expected to occur as a result of implementation of projects with the capability of improving the timing, quantity, quality and distribution of freshwater flow to the study area. Hydrologic restoration planned as part of CERP would further improve fish and wildlife habitat.
Cumulative Effect	Habitat improvement efforts are anticipated to benefit fish and wildlife resources.
Vegetation and Wetlands	
Past Actions	Drainage of Florida's interior wetlands, conversion of wetlands to agriculture, and urban development has reduced the spatial extent and quality of wetland resources.
Present Actions	Efforts are being taken by State and Federal regulatory agencies to reduce wetland losses.
Proposed Action	Negligible effects to vegetation within Lake Okeechobee and the EAA are anticipated. Reductions in the number of high discharge events to the Northern Estuaries are anticipated to improve conditions for seagrass beds. Significant beneficial effects are anticipated within the Greater Everglades. Improved hydroperiods and sheetflow within WCA 3A, 3B and ENP would result in reduced soil oxidation, promoting peat accretion necessary to rebuild the complex mosaic of habitats across the landscape. Increased freshwater flows to Florida Bay would aid to lower salinity levels, benefiting mangrove communities and seagrass beds.

Future Actions	Some level of improvement to vegetative communities is expected to occur as a result of implementation of projects with the capability of improving the timing, quantity, quality and distribution of freshwater flow to the study area. More natural hydrology as part of the CERP would assist in restoring natural plant communities.
Cumulative Effect	While the spatial extent of natural plant communities would not be restored to historic proportions, the quality of vegetative communities would be improved.
Cultural Resources	
Past Actions	Flood and water control projects, conversion of wetlands into agriculture and urban development have had adverse unmitigated effects to cultural resources either directly or indirectly.
Present Actions	Ongoing efforts have been made by Federal and State agencies to implement projects to improve hydrology within the project area, thereby stabilizing the tree islands which are known to have a high potential for cultural resources.
Proposed Action	While effects of the proposed action have been evaluated, a final determination of effects on cultural resources is not complete. Consultation with stakeholders, including the State Historic Preservation Office, Advisory Council on Historic Preservation, Seminole Tribe of Florida and the Miccosukee Tribe of Indians of Florida is currently ongoing.
Future Actions	Continued improvement to hydroperiods and sheetflow within WCA 3A, 3B and ENP could reduce soil oxidation, which could stabilize the environment, and this in turn could stabilize tree islands containing cultural resources. Investigations mandated in the Programmatic Agreement for ERTTP will be completed ca. 2016 and will determine the effects of fluctuating water on subsurface historic properties.
Cumulative Effect	Cumulative effects to historic properties and culturally significant sites will potentially be long-term adverse effects if not avoided. Mitigation measures for effects to historic properties could potentially reduce the cumulative effect to minor long-term adverse effects. Mitigation measures for culturally significant sites are unknown.
Water Quality	
Past Actions	Water quality has been degraded from urban, suburban, commercial, industrial, recreational and agricultural development.
Present Actions	Efforts to improve water quality from agricultural areas are ongoing. Federal and State projects would temporarily elevate localized levels of suspended solids and turbidity.
Proposed Action	Implementation of the project is not expected to significantly affect the water quality of Lake Okeechobee or the Northern Estuaries. Changes in the quantity, timing, and distribution of flows within WCA 3A and WCA 3B may result in temporary increases in phosphorus concentrations at some TP Rule monitoring stations; however, this should not significantly affect TP Rule compliance. Over the long-term, distributing the flow over the northern WCA 3A marsh, reducing short-circuiting down the canals, adding more flow from the lake that is treated to the water quality based effluent limits (WQBEL), should result in improved water quality within WCA 3 and a reduction in flow weighted mean total phosphorous concentration entering the Park. Southern Estuaries salinity conditions are expected to be improved by the project.
Future Actions	Actions by the State of Florida's Restoration Strategies would decrease nutrient concentration and loadings to the project area. The Broward County WPA Project, (Record of Decision signed in 2012, authorized in WRRDA 2014) would reduce storm runoff deliveries to WCA 3 and improve water quality coming across Tamiami Trail.
Cumulative Effect	While anthropogenic effects on water quality are unlikely to be eliminated, water quality is expected to slowly improve over existing and recent past conditions. During detailed planning and design, the USACE and SFWMD are committed to ensuring that project feature implementation will not result in violations of water quality standards.

Water Supply/Flood Control	
Past Actions	Water supply and flood control for agricultural and urban users has benefited from construction and operation of the C&SF Project.
Present Actions	Availability of water from Lake Okeechobee for agricultural users was recently diminished through implementation of 2008 LORS. Availability of water for urban and agricultural users were recently diminished through implementation of ERTTP. The SFWMD has implemented Restricted Allocation Area Rules to cap users dependent on water supplies from Lake Okeechobee and the regional system (the Everglades).
Proposed Action	Implementation of the project would likely have no effect on water supplies to agricultural users dependent on Lake Okeechobee. Agricultural, municipal, and industrial water supply in LECSA 2 and 3 will increase slightly in the future.
Future Actions	Future supplies would not change in the future unless additional CERP storage or hydrologic improvements to the Everglades are implemented and increase water availability.
Cumulative Effect	While effects on water supplies are unlikely to improve, water supplies available for agricultural and urban users are expected to remain stable until additional storage mechanisms are implemented.

6.3.4 Incomplete or Unavailable Information

The analyses provided in this document are based upon current knowledge of the physical and biological conditions in the action area and on projections of the most probable future conditions, as indicated by hydrologic models. The PDT recognizes that there is uncertainty in the predictions derived from these models that stems from input variability and measurement errors, parameter uncertainty, model structure uncertainty and algorithmic (numerical) uncertainty as outlined in the CERP Model Uncertainty Workshop Report (RECOVER 2002). These uncertainties are also translated into uncertainty as to whether the specific performance indicators and measures used to characterize the overall system performance actually capture that overall performance. The likelihood of capturing all the processes occurring in a system as complex as the Everglades within simulation models is low. Even with a comprehensive model uncertainty analysis for CEPP, there will always be some uncertainty present in predicting environmental benefits associated with any CERP project because of the size and complexity of the Everglades ecosystem as well as the difficulty in fully understanding its physical and biological processes. However, the outputs of the sub-regional hydrologic models used to assess projected hydrologic changes and to quantify ecosystem benefits for CEPP were the best data available to predict the most likely hydrologic changes as a result of the project. Even though uncertainty is recognized, ecological benefits derived from performance measure metrics are useful in making planning level decisions. These values provide a quantitative means for comparing alternatives to identify the best performing alternative.

It is recognized that new technical information or models may be developed as the selected plan is implemented and that the observed results may differ from predicted results. Considering this, it may be necessary to adjust operations to address the new information or observed results to achieve better performance for environmental restoration and protection to ensure the health, safety, and well-being of the general public and affected individuals. Using an AM approach during implementation of CEPP, as documented in **Annex D**, would provide new information to address uncertainties and risks over time, decrease the potential for costly mistakes, and ultimately support fulfillment of the CEPP restoration goals and objectives.

6.3.5 Unavoidable Adverse Environmental Effects

As discussed under each resource in **Section 5.2**, adverse effects associated with implementing the recommended plan are expected to be minimal to moderate. Unavoidable potentially adverse impacts that would result from implementation of the recommended plan include effects to the CSSS and temporary, short term impacts to air quality, the noise environment, and aesthetic resources from operation of construction equipment through lands designated for staging, access and construction. Temporary disturbances to and displacement of fish and wildlife resources to other nearby habitat would occur during construction. Vegetation would be lost during construction that currently exists on levees and spoil mounds that would be degraded and/or in areas where project features would be constructed.

Significant beneficial effects to fish and wildlife resources are anticipated under the recommended plan. Adverse effects to alligators that utilize the Miami Canal would occur due to backfilling of the Miami Canal within northern WCA 3A. These effects are expected to be short-term as alligators would expand into other areas of suitable habitat created as a result of CEPP implementation. Due to increased water flow and changes in water distribution, it is anticipated that overdrained areas in northern WCA 3A will be rehydrated, triggering a vegetation transition from upland to wetland habitat. Although mammals occurring within the action area are adapted to the naturally fluctuating water levels in the Everglades, there is an increased potential that mammals currently utilizing upland habitat may be negatively affected. Refuge for terrestrial mammals and other upland species will continue to be provided by the retention of 22 of the highest priority FWC enhanced spoil mounds between S-339 to I-75 and the creation of additional upland landscape (constructed tree islands) approximately every mile along the entire reach of the Miami canal (S-8 to I-75). Changes in water quality also have the potential to affect prey forage base through altering of vegetation composition or structure. Water quality will continue to be monitored under CEPP.

Non-native and invasive plant infestations in the project area may be exacerbated by soil disturbance during construction and hydrological modification and may require active management. Many non-native and invasive species are flourishing in a variety of habitats and are negatively affecting the ecology throughout the Everglades. Introduction or expansion of non-native fish species due to changes in water distribution and increased connectivity between WCA 3A, WCA 3B and ENP is likely to occur; however, the extent of the impact is uncertain at this time.

Publically owned lands are being utilized for the recommended plan. Portions of the A-2 footprint are currently leased for purposes of agricultural production, including sugar cane. Potential adverse impacts on prime and unique farmland will be assessed during detailed design. Adverse impacts on wetland acreage would occur within WCA 3B with implementation of the recommended plan as a result of the construction of the Blue Shanty Levee (L-67D). This loss would be offset by improved conditions to wetland acreage elsewhere within the region. **Section 5.2.14.1** evaluates increases in wetland acreage directly associated with implementation of the recommended plan. The recommended plan provides a net gain of wetland acreage as a result of the construction of other project features including construction of the A-2 FEB, degradation of the L-4 Levee, backfill of the Miami Canal, construction of gaps in the L-67C Levee, degradation of the L-29 Levee and L-67 Extension Levee, and removal of Old Tamiami Trail.

The recommended plan will potentially have adverse effects to cultural resources, some of which are unavoidable and long term, and/or cannot be assessed until the detailed design phase of the project. Avoidance of adverse effects to cultural resources is the Corps preference, therefore, throughout the

planning process for CEPP, the project archaeologist, engineers, and plan formulators have worked closely to determine alternatives and features of alternatives that reduce or eliminate impacts to cultural resources. Pursuant to 36 CFR 800.1, where possible, the project design will be modified to avoid impacting significant historic properties and culturally significant sites. Where avoidance is not possible, other mitigation measures will be considered. As consulted on throughout CEPP, mitigation measures will be developed during the PED phase in consultation with the State Historic Preservation Office (SHPO), tribal groups and other interested parties as established in implementing regulations for Section 106 of the National Historic Preservation Act (NHPA) (see **Appendix C.5**).

With regards to sites containing human remains, the Corps is currently in consultation with the Seminole Tribe of Florida and the Miccosukee Tribe of Indians of Florida to draft a new policy guidance memorandum to update and expand the 2008 CERP Policy on Human Remains that currently applies to the CEPP study area, to apply to all Civil Works and Regulatory actions within the respective jurisdiction of these Jacksonville District programs in the State of Florida. This document is an internal guidance memorandum designed to consolidate and clarify existing Corps documents regarding the treatment of human remains pursuant to Section 106 of the NHPA and the Jacksonville District's Federal Trust Responsibilities for the State of Florida (see **Appendix C.5** (2008 CERP Policy)).

6.3.6 Irreversible and Irretrievable Commitment of Resources

An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. An irretrievable commitment of resources is one in which, due to decisions to manage the resource for another purpose, opportunities to use or enjoy the resource as they presently exist are lost for a period of time. Construction of the proposed project will include many features considered permanent as well as modifications to existing C&SF Project features, which may be deemed irreversible. This would include project features in the EAA for storage and features in the WCAs and ENP that would change the distribution and conveyance (location, direction, depth, volume, and/or timing) of the available water. The proposed project would also include features necessary to control resulting increased seepage along the eastern boundary of WCA 3B and ENP. Such construction and structural modifications are proposed on such a large scale that these features represent an irreversible and irretrievable commitment of resources. Resources to be committed if the project is approved include expenditure of State and Federal funding, labor, energy and project materials to build, operate and maintain the proposed project.

6.4 COST ESTIMATES OF RESTORATION ELEMENTS

The goal of the cost estimates for the CEPP are to present a Total Project Cost (Construction and Non-Construction costs) for the recommended plan at the current price level to be used for project justification/authorization. In addition, the costing efforts are intended to produce a final product (cost estimate) that is reliable and accurate and that supports the definition of the Government's and the non-Federal sponsor's obligations.

The cost estimate supporting the recommended plan is prepared in MCACES/MII tool. This estimate is supported by the preferred labor, equipment, materials and crew/production breakdown. A risk analysis addresses project uncertainties and sets contingencies for the recommended plan cost items. Guidance for estimating costs, the fully funded (escalated for inflation through project completion) cost estimate and the Total Project Cost Summary, including the risk analysis, is provided in **Appendix B**.

The recommended plan has undergone a higher level of engineering design than did the final array of alternatives. This lessened the risk-based approach of using a high contingency (82%) during plan

formulation to account for uncertainties. While the recommended plan construction cost estimate is slightly higher than Alternative 4R, the lower contingency (44%) has led to a lower overall project cost estimate for the recommended plan.

Table 6-4 includes a breakdown of the estimated costs of CEPP by construction and non-construction costs for ecosystem restoration activities. Lands and Damages generally include LERR (lands, easements, rights-of-way and relocations), Engineering During Construction (EDC), PED and S&A (Supervision and Administration) costs. Costs were estimated at Fiscal Year 2014 price levels and rounded to the nearest \$1,000,000. The Federal discount rate of 3.5% and a 50-year economic period of analysis were used to amortize costs and determine the project investment costs. Based on preliminary engineering and design of the recommended plan, the average annual cost is \$100,000,000 (**Table 6-5**).

Table 6-4. Ecosystem Restoration Cost Estimates (2014 Price Level)^{1, 2}

Construction Phase Items	Cost
06 Fish and Wildlife (monitoring and adaptive management)	\$106,000,000
09 Channels & Canals	\$370,000,000
11 Levees	\$399,000,000
13 Pumping Plant	\$133,000,000
15 Floodway Control and Diversion	\$342,000,000
18 Cultural Resources Preservation	\$26,000,000
32 HTRW Investigations	\$1,000,000
Construction Features Sub-Total	\$1,377,000,000
Preconstruction Engineering and Design (PED), Engineering During Construction (EDC) and Planning	\$345,000,000
Construction Management (S&A)	\$135,000,000
Lands & Damages	\$37,000,000
Total First Cost	\$1,894,000,000

¹ Construction costs in this table include contingencies² Recreation costs are not included in the ecosystem restoration cost estimates (see **Section 6.5**)**Table 6-5. Ecosystem Restoration Investment and Average Annual Costs**

Investment Costs	
Total First Cost	\$1,894,000,000
Interest During Construction: Construction	\$96,000,000
Interest During Construction: Real Estate	\$4,000,000
Total Investment Cost	\$1,994,000,000
Average Annual Costs	
Interest and Amortization of Initial Investment	\$85,000,000
OMRR&R Sub Total	\$11,250,000
New Project Features	\$4,150,000
State Facilities	\$4,000,000
Invasive Species	\$3,100,000
Monitoring Sub-Total	\$3,880,000
Water Quality	\$710,000
Hydrometeorological	\$195,000
Ecological Sub-Total	\$2,145,000
<i>Biological Opinion</i>	<i>\$1,885,000</i>
<i>General Ecological Monitoring</i> ¹	<i>\$260,000</i>
Adaptive Management ¹	\$690,000
Invasive Species ¹	\$140,000
Total Average Annual Costs ²	\$100,000,000

¹ Costs reflect 10-year annual monitoring costs from Tables 6-8 and 6-9 amortized over the period of analysis² Total rounded to the nearest \$1,000,000

6.4.1 Real Estate

Fee title will be required for the project footprint of the A-2 FEB and the FEB Discharge Canal. The estimated real estate cost for the A-2 FEB utilizing the actual acquisition costs are \$31,710,508. For the FEB Discharge Canal comprised of approximately 91.25 acres, SFWMD acquired 34.23 acres with Farm

Bill and State funds acquired at a cost of \$89,047. Approximately \$78,801 will be credited to the Federal Government and \$10,246 will be credited to SFWMD. The approximately 57.02 acres owned by the State of Florida were valued at \$712,750. SFWMD will recertify the lands in WCA 3A/3B to the Federal Government when required for construction or operations at no cost to the CEPP project. Administrative costs were estimated at approximately \$2,494,811. A contingency of 44% was applied on only \$2,986,500. Total estimated real estate costs were \$37,000,000.

6.4.2 Operations, Maintenance, Repair, Replacement and Rehabilitation for Project Features

OMRR&R begins after physical project construction and Operational Testing and Monitoring is complete, and generally includes all operation activities and maintenance needed to keep the project features functioning as intended. OMRR&R for the CEPP project will occur for all new facilities constructed as a result of the project, and as an increase to the OMRR&R for State Facilities that CEPP will use to provide new water to the WCAs and ENP.

6.4.2.1 Average Annual Operations, Maintenance, Repair, Replacement and Rehabilitation for New Project Features

The Operations and Maintenance Costs Methodology Report Database developed by SFWMD was used to calculate OMRR&R costs. This tool is useful in calculating basic operations, maintenance, and repair costs and is based on historical accruals for similar operations, maintenance and repair activities. Rehabilitation and replacement costs include those costs required to keep the pump station operable for the period of analysis. Repair and rehabilitation costs on items such as pumps, drivers, and switchgear are assumed to be rehabilitated or replaced once during the 50-year life cycle. While rehabilitation costs are typically only 35-45 percent of replacement costs; in order to provide a conservative estimate for CEPP features, major equipment replacement is considered in the estimate. Replacement is estimated to occur 30 years after placing the station into operation. The replacement cost includes engineering and structural modification costs as well as the equipment costs. The following table (**Table 6-6**) lists the average annual OMRR&R costs for new CEPP facilities. See **Appendix A** for a list of OMRR&R activities.

Table 6-6. Average Annual OMRR&R costs for New CEPP Facilities

Structure	OMRR&R Costs
A-2 FEB	\$2,090,000
S-620 (CS-1) 500 cfs gated culvert, S-621 (CS-2) 2,500 cfs gated spillway, S-622 (CS-3) 500 cfs gated spillway	\$330,000
Modified S-8 (2 gated culverts)	\$230,000
S-630 (360 cfs Pump Station)	\$240,000
New S-333N - 1,150 cfs	\$160,000
New (S-356) Pump Station at 1,000 cfs	\$600,000
500 cfs gated culverts (S-631, S-632, and S-633)	\$340,000
8.5 mile levee in WCA 3B	\$50,000
S-355W-1,230 cfs gated spillway	\$110,000
TOTAL Average Annual OMRR&R Costs New Facilities	\$4,150,000

6.4.2.2 Average Annual Operations, Maintenance, Repair, Replacement and Rehabilitation for State Facilities used by CEPP

The future OMRR&R costs of operating the State facilities, without CEPP, are based on the Operations and Maintenance Costs Methodology Report Database developed by SFWMD, as described above. The

future OMRR&R costs of operating the system once CEPP is constructed and operational are based on the volume of new water flows through the State facilities as a portion of the overall water flows through the State facilities. In order to calculate the average annual OMRR&R costs attributed to CEPPs usage of State Facilities, a series of steps were taken to determine the new average annual OMRR&R costs of operating the State owned facilities and associated infrastructure, including the structures named in **Table 6-7** and in Appendix A Table A-35 and A-36.

Step 1: Calculation of CEPPs proportion of total flow through State Facilities

The recommended plan is designed to deliver approximately 210,000 acre-feet per year of additional flows from Lake Okeechobee to the central Everglades on an average annual basis. Since the CEPP hydrologic modeling encompasses a 41-year period of record consisting of a wide range of hydrologic conditions, it is recommended that cost sharing for OMRR&R be based upon the average annual treatment capacity water budgets for the “Future Without Project” and “Future With Project” conditions. The total average annual treatment capacity water budget of the State-owned/State-operated features as identified from the SFWMD Restoration Strategies is ~877,000 acre-feet per year. The total average annual treatment capacity water budget of these same features in the CEPP “Future With Project” condition includes ~210,000 acre-feet per year of new water for a total of ~1,087,000 acre-feet per year. The percent of total usage attributed to the new flows under CEPP is estimated as follows:

$$= \left[\frac{\text{New Water Provided by CEPP Ave Annual Water Budget}}{\text{SFWMD Restoration Strategies Water Budget}} \right] \times 100\%$$

$$= \left[\frac{210,000 \text{ ac} - \text{ft/yr}}{1,087,000 \text{ ac} - \text{ft/yr}} \right] \times 100\% = \sim 19\%$$

New water provided by CEPP will comprise ~19% of the total water volume through the State-owned/State-operated facilities.

Step 2: Calculation of total average annual OMRR&R costs for the State facilities used by CEPP:

Average annual OMRR&R costs with CEPP operational are commensurate with the increase in flows associated with the CEPP features. Therefore, since average annual flows are expected to increase approximately 23.5% (i.e., from 877,000 ac-ft to 1,087,000 ac-ft), then the total average annual OMRR&R cost, including CEPP, will be increased by ~23.5% over the without-project condition costs.

Step 3: Apply CEPP flow proportion to total OMRR&R costs of the State facilities used by CEPP:

Applying the 19% flow proportion to the new total average annual OMRR&R costs (\$21,000,000) with CEPP in place will yield the marginal cost of CEPP. The estimated average annual OMRR&R for State facilities that CEPP depends on for operational functionality is projected to increase approximately from \$17,000,000 to \$21,000,000 per year. Nineteen percent of the new average annual OMRR&R costs for the State facilities used by CEPP are \$4,000,000 per year.

Table 6-7. Average Annual OMRR&R Costs of State Facilities used by CEPP

Structure	Without CEPP Per Year Costs	Costs with CEPP in Place
Current G-404 PS costs	\$ 340,000	\$410,000
STA 2 and Associated Infrastructure ¹	\$ 3,010,000	\$3,720,000
STA 3/4 and Associated Infrastructure ¹	\$3,680,000	\$4,550,000
FEB A-1 and Associated Infrastructure	\$1,850,000	\$2,290,000
G-357 Gated Culvert	\$ 110,000	\$140,000
G-370 PS	\$1,480,000	\$1,820,000
G-371 Gated Spillway	\$110,000	\$140,000
G-372 PS	\$1,850,000	\$2,280,000
G-434 PS	\$610,000	\$760,000
G-435 PS	\$300,000	\$ 370,000
S-6 PS	\$1,480,000	\$1,820,000
S-7 PS	\$1,270,000	\$1,570,000
S-8 PS	\$810,000	\$1,000,000
S-150 Gated Culverts	\$100,000	\$130,000
TOTAL Average Annual OMRR&R Costs State Facilities	\$17,000,000	\$21,000,000

¹ See Appendix A Table A-35 and Table A-36 for a list of the STA structures. STA associated infrastructure will be identified prior to executing the Project Partnership Agreement for New Water.

6.4.3 Invasive Species Management

Invasive species management costs accrue during all phases of the project, as shown in **Table 6-8** below. Pre construction management activities, construction phase activities, and Operational Testing and Monitoring Period (OTMP) activities are all construction based activities and are included in the Fish and Wildlife account of the Total Project Cost Summary. As can be seen in **Table 6-8**, some post construction monitoring and management will occur during 10-year cycles and some management activities for invasive species including surveillance, control, etc. will occur throughout the OMRR&R phase.

Table 6-8. Summary of Cost Estimates for Invasive Species Management

Construction Costs ¹	
Pre Construction Management and Monitoring	\$1,220,000
Construction Phase Management	\$5,720,000
Operational Testing and Monitoring Period (OTMP)	
Management	\$4,430,000
Monitoring	\$570,000
Sub Total OTMP	\$5,000,000
Total Invasive Species Management During Construction	\$11,940,000
Post Construction Costs	
Post Construction Monitoring Costs – cost per year for a 10-year cycle	\$400,000
Post Construction Management Costs – average annual cost	\$3,100,000

¹ Construction costs in this table include the project contingency of 44%

6.4.4 Monitoring and Adaptive Management

The methods, locations, timing, and funding requirements for conducting adaptive management and monitoring are included in **Annex D**. The CEPP monitoring plan was designed to provide the monitoring required addressing CEPP-specific needs while being integrated with other Everglades monitoring to take advantage of existing monitoring efforts, knowledge, and information. The CEPP AM and Monitoring Plan leverages several existing programs to avoid redundancies and insure cost-effectiveness. Since CEPP relies on existing physical instrumentation, stations, locations, servicing, and analysis efforts funded by RECOVER, CERP sponsors, and partner agencies, the monitoring requirements described in the CEPP plan are limited to the additional increase in monitoring resources and analysis efforts needed to address CEPP-specific questions. The CEPP monitoring plan assumes these other monitoring efforts will continue into the future at least for the period required by CEPP. Adaptive management and monitoring costs accrue during different phases of the project, as shown in **Table 6-9** below. Construction for adaptive management options, pre construction data investigation, construction phase monitoring, and OTMP are all construction based activities and are included in the Fish and Wildlife line of **Table 6-4**. Post construction monitoring of CEPP's success at meeting ecological objectives and to inform adaptive management will occur during 10-year windows that are staggered to coincide with CEPP's construction schedule (**Annex D**, Part 1, Figure D.1.10). Monitoring such as hydrometeorological monitoring that informs project operations may continue longer than 10 years. Table 6-9 provides a conservative estimate of annual costs for monitoring that may continue as necessary and required during OMRR&R. A conservative estimate for potential water quality monitoring has been included. It is anticipated that the monitoring requirements will be assessed periodically and revised as needed.

The USFWS Programmatic Biological Opinion (BO) states that further consultation will be needed when more specific project details are finalized during PED. While this document does not provide provisions for incidental take of three endangered avian species (CSSS, snail kite, and wood stork), it does describe the anticipated effects based on current information. Upon completing ESA Section 7 consultation for each PPA, USACE will undertake the agreed-to avoidance and minimization measures and implementing terms and conditions (TCs). When USACE is closer to constructing phases of CEPP that will affect listed species, FWS will provide separate consultation document(s) which may authorize incidental take, and provide applicable reasonable and prudent measures (RPMs) and TCs. Although the Programmatic BO does not specify RPMs and TCs for the three avian species, endangered species monitoring costs include a conservative estimate of potential required monitoring based on information provided by USFWS to ensure the costs were captured. Estimated endangered species monitoring costs are \$3,111,200 pre construction, \$35,122,200 during the construction period and the O&M cost will be approximately \$1,885,200 annually. It is anticipated that the monitoring requirements will be assessed periodically and revised as needed.

Table 6-9. Summary of Cost Estimates for Monitoring and Adaptive Management

Construction Costs – Construction General Funding(FY 14)¹	
Adaptive Management Options	\$23,500,000
Pre Construction Data Investigation (PED) - Adaptive Management	\$40,000
Pre Construction USFWS BO Ecological Monitoring	\$3,111,000
Construction Phase Monitoring	
Adaptive Management	\$7,010,000
Water Quality	\$20,000
Ecological	\$1,200,000
USFWS BO Ecological Monitoring	\$35,122,000
Sub-Total Construction Phase Monitoring	\$43,352,000
Operational Testing and Monitoring Period(OTMP)	
Water Quality Monitoring	\$710,000
Hydrometeorological Monitoring	\$2,490,000
USFWS BO Ecological Monitoring	\$1,885,000
Sub-Total OTMP Monitoring	\$5,085,000
Total Monitoring And Adaptive Management First Cost (rounded)	\$75,088,000
Post Construction Costs – Operations and Maintenance Funding	
Post Construction Monitoring Costs – cost per year for a 10 year cycle	
General Ecological Monitoring	\$740,000
Adaptive Management	\$1,950,000
Sub-total Post Construction Monitoring (\$ annually over 10 years)	\$2,690,000
Post Construction Monitoring Costs – average annual cost	
Hydrometeorological	\$195,000
Water Quality	\$710,000
USFWS BO Ecological Monitoring	\$1,885,000
Sub-total Post Construction OMRR&R (\$ average annual)	\$2,790,000

¹ Costs in this table are rounded and include the project contingency of 44%

6.4.5 Operational Testing and Monitoring Period Costs

As defined in the CERP Master Agreement, the term "Operational Testing and Monitoring Period" (OTMP) shall mean a reasonable, limited period of time within the period of construction, after physical construction has been completed, during which the authorized CERP Project or a functional portion of the authorized CERP Project is operated, tested and monitored to verify that the constructed features operate as designed, and to allow for any adjustments to such features as may be necessary so that such features perform as designed.

The OTMP costs for new CEPP project features are included in the PED/EDC construction costs in **Table 6-4** and accrue for interim operation of project features during OTMP. The total amount for operations and testing is equivalent to one year of OMRR&R for new CEPP project features at \$4,150,000.

The invasive species management and monitoring costs during OTMP of approximately \$5,000,000 (**Table 6-8**) and project monitoring during OTMP of approximately \$5,000,000 (**Table 6-9**) are included in the Fish and Wildlife line in **Table 6-4**.

6.4.6 Cultural Resources Preservation Costs

The identification, evaluation and mitigation of cultural resources are included in **Table 6-10**. Data Recovery is 100% Federal responsibility until the cost of Data Recovery reaches 1% of the total project cost. Afterwards, anything above the 1% cap will be cost shared 50/50 between the Government and the non-Federal sponsor. Data Recovery caps are identified in Engineering Regulation (ER) 1105-2-100 Appendix C-4.d(6)(d) and the Archaeological and Historic Preservation Act Section 7. Costs in **Table 6-10** for mitigation are included in the Cultural Resources Preservation line item in **Table 6-4**, the PED costs are included within the PED line item in **Table 6-4**.

Table 6-10. Cultural Resources Cost Breakdown

Item	Total
Mitigation	\$25,740,000
Data Recovery ¹	\$1,750,000
<u>PED</u>	\$3,050,000
Cultural Resources Cost Total²	\$29,000,000³

¹ Data Recovery is 0.1 percent of the total CEPP cost.

² Cultural resources cost total includes contingency

³ Cultural resources costs include PED, **Table 6-4** cultural resources line only includes mitigation; total is rounded

6.5 COST ESTIMATE FOR RECREATION ELEMENTS

Recreation elements of the Recommended Plan include sufficient gravel parking with boat ramps and trailheads, dry vault toilets, shelters, primitive camping sites and American with Disabilities Act compliant fishing platforms as described in Section 6.1.6 and Appendix F. The expenditures attributed to recreation features are justified using a benefit to cost ratio. The tangible economic justification of the proposed project can be determined by comparing the equivalent average annual costs with the estimate of the equivalent average annual benefits realized over the period of analysis. The average annual recreation benefits and costs are summarized in **Table 6-11**. The Federally mandated project evaluation interest rate of 3.5 percent, an economic period of analysis of 50 years and 2014 price levels were used to evaluate economic feasibility. The benefit to cost ratio for the recreation features is 1.6 to 1, with net annual benefits of \$215,000.

Table 6-11. Summary of Recreation Costs and Benefits (FY 14)

Total Recreation Costs	\$6,400,000
Interest During Construction	\$330,000
Total Investment	\$6,730,000
Amortized	\$287,000
OMRR&R	\$68,000
Average Annual Cost	\$355,000
Unit Day Value ¹	\$7.79
Daily Use	200 users
Annual Use (200 users x 365 days)	73,000
Average Annual Benefit	\$570,000
Benefit to Cost	1.6 to 1
Net Annual Benefits	\$215,000

¹ Unit Day Values are derived from EGM 14-03, Unit Day Values for Recreation

6.6 COST SHARING

The total first cost of the restoration features of CEPP, including the value of LERR and PED costs, will be shared between the Federal Government and the non-Federal sponsor under the CERP program as a whole (**Table 6-12**). The non-Federal sponsor will provide cash, perform work-in-kind during planning, engineering and design or manage a portion of construction as necessary to meet its 50 percent share of the total first cost of the project to be balanced according to Section 601 of WRDA 2000.

Table 6-12. Cost Share for the CEPP Recommended Plan

Item	Federal Cost	Non-Federal Cost	Total ¹
<u>Ecosystem Restoration (ER)</u>			
Restoration Construction	\$676,875,000	\$700,125,000	\$1,377,000,000
PED ¹	\$172,500,000	\$172,500,000	\$345,000,000
Construction Management	\$67,500,000	\$67,500,000	\$135,000,000
LER&R	\$31,000,000	\$6,000,000	\$37,000,000
ER Subtotal	\$947,875,000	\$946,125,000	\$1,894,000,000
<u>Recreation (NED)</u>			
Recreation Subtotal	\$3,000,000	\$3,000,000	\$6,000,000
Total Project First Cost²	\$950,875,000	\$949,125,000	\$1,900,000,000
Average Annual Costs			
OMRR&R - CEPP Features	\$2,075,000	\$2,075,000	\$4,150,000
OMRR&R - State Facilities	\$2,000,000	\$2,000,000	\$4,000,000
OMRR&R - Invasive Species	\$1,550,000	\$1,550,000	\$3,100,000
OMRR&R - Monitoring (cost per year over 10- year cycle) ³	\$1,345,000	\$1,345,000	\$2,690,000
OMRR&R - Monitoring (annual cost)	\$1,395,000	\$1,395,000	\$2,790,000
OMRR&R - Recreation		\$65,000	\$65,000

¹Construction costs totals are FY '14 First Costs Rounded to the nearest \$1,000,000 and include a 44% contingency

²Federal costs include cultural resources data recovery of \$1,750,000 represented at 100% federal responsibility

³10-year monitoring costs are included in Table 6-9, and are amortized over the period of analysis in Table 6-5

6.6.1 Cost Sharing of Real Estate

Total estimated real estate costs were \$37,000,000 (rounded), of which approximately \$31,000,000 (rounded) are creditable to the Federal Government and approximately \$6,000,000 (rounded) are creditable to the SFWMD. Federal funds contributed by DOI pursuant to the Farm Bill Section 390 of the Federal Agriculture Improvement and Reform Act of 1996 (Public Law 104-127, 110 Stat. 1022) are credited to the Federal share of the project cost pursuant to Section 601 (e)(3) of the WRDA of 2000. DOI contributed approximately \$30,299,207 toward the purchase of the A-2 FEB and FEB Discharge Canal. SFWMD contributed approximately \$1,376,598 toward the purchase of the A-2 FEB and FEB Discharge Canal. SFWMD's contribution of approximately \$1,500,348 will be credited to SFWMD. For those lands owned by the State of Florida valued at \$712,750, SFWMD will receive credit for the fair market value as of date these lands are provided. More details are provided in **Appendix D**.

6.6.2 Cost Sharing of Operations, Maintenance, Repair, Replacement and Rehabilitation

Section 601(e)(4) of the WRDA 2000 specifies that the (OMRR&R) of authorized projects of the CERP would be cost shared equally by the Federal Government and the non-Federal sponsor. Consistent with the provisions of Section 601(e)(4) of the WRDA of 2000 and given the multi-objective nature of the features in this plan, it is appropriate for the OMRR&R associated with the features of this plan to be shared equally between the Federal Government and the non-Federal sponsor. The Federal and non-Federal sponsor's obligations to provide OMRR&R will continue indefinitely unless the project is deauthorized by Congress. OMRR&R costs associated with recreation features of the plan will be funded 100 percent by the non-Federal sponsor.

The plan recommended by this PIR requires the use of several State facilities constructed and operated pursuant to State permits. The facilities are necessary for the State to meet CWA requirements as approved by the USEPA, and as litigated by the U.S. Department of Justice. Some of these requirements are currently subjected to a Settlement Agreement filed with and overseen by the Federal District Court (United States v. South Florida Water Management District, Case No. 88-1886-CIV-Moreno (S.D. Fla. 1988)).

The Non-Federal Sponsor is responsible for the operation, maintenance, repair, replacement, and rehabilitation of all State features, including the State Restoration Strategies and Everglades Construction Project facilities. Certain of those facilities, as named below and herein after referred to as "State facilities", are to be used by CEPP until such time as CEPP is deauthorized or it is determined use of the State facilities are no longer necessary for the purpose of achieving CEPP project purposes. However, the State's A-1 FEB operations will be integrated with the A-2 FEB project feature and operated pursuant to a mutually agreed upon water control manual. The joint water control plan for the FEBs will integrate the operation of CEPP and the operation of the State facilities used by CEPP. The State facilities will use excess capacity to process "new water" provided by CEPP in addition to the water processed for purposes of achieving the State's water quality requirements.

The State has requested cost sharing OMRR&R of the State facilities to be used by the CEPP as set forth in Section 8.1. Given the State features in question are Everglades Construction Project features, already constructed, or under construction pursuant to State compliance requirements and under permit for that purpose, and/or United States v. So. Fla. Water Management District, Settlement Agreement requirements, they may not be included as Federal project features and no cost sharing for construction would be allowed. There is currently no applicable authority which would allow for cost sharing any expenses associated with such features, including the OMRR&R costs. Thus, because of the current statutory and policy prohibitions against such cost sharing, as the 30 November 2007, *CERP, Water Quality Improvements, Policy Determination* Memorandum indicates new statutory language affording such authority must be adopted as part of the CEPP project authorization in order for the State's request to be effected.

The PIR recommends Congressional authorization of the project with specific statutory language allowing cost share of the OMRR&R for the following State facilities not previously cost shared for construction under the C&SF Project or other Federal authority and the listed C&SF features that are currently cost shared pursuant to executed resolutions: (1) STA 2, (2) STA 3/4, (3) A-1 FEB, (4) G-370 Pump Station, (5) G-371 Gated Spillway, (6) G-372 Pump Station, (7) G-357 Gated Culvert, (8) G-404 Pump Station, (9) G-434 Pump Station, (10) G-435 Pump Station, (11) S-6 Pump Station, (12) S-7 Pump Station, (13) S-8 Pump Station, and (14) S-150 Gated Culverts and their corresponding remote-control facilities. All features required for the State's Restoration Strategies and the Everglades Construction

Project are independent State facilities and are not CEPP components or features. The State facilities will not be incorporated as Federal CEPP project features; however, the operation of State facilities is required to ensure that new water made available by CEPP meets water quality standards and achieves CEPP project benefits

The aforementioned State facilities will use excess capacity to process “new water” provided by CEPP, which has been estimated to comprise approximately 19% of the total water volume that could flow through these facilities. For the purposes of this report, OMRR&R costs are assumed to be linear with flow volumes and will therefore increase the OMRR&R costs for the State facilities that are to be used by CEPP by 19%. Therefore, consistent with the general CERP authorization for cost sharing OMRR&R (WRDA 2000 Section 601(e)(4)), the Corps recommends Congressional authorization of CEPP to contribute 19% of the OMRR&R costs of the aforementioned facilities to the extent that OMRR&R activities are directly related to their use for treating “new water.” The Corps’ pro-rated share for OMRR&R for the aforementioned State facilities used by CEPP is therefore 50% of the 19%, or 9.5% of the total OMRR&R costs. The 19% CEPP cost share will apply to the State facilities and the C&SF features listed above to the extent that OMRR&R activities are directly related to their use for treating “new water.”

After CEPP has operated for an appropriate period of time, an analysis based on monitoring data shall be undertaken to evaluate project performance and verify that CEPP successfully delivers an annual average of approximately 210,000 acre-feet of new water for the natural system, as described in this PIR. If the monitoring data and analyses show CEPP actually produces less than the anticipated 210,000 acre-feet of “new water” on average, then the Federal project is not fully realizing the projected benefits and the State facilities are not being burdened as projected. In such a case, the analysis will be used to inform changes in operations in order to achieve the quantity, timing, or distribution of water as described in this PIR, or recommend changes to the amount of water reserved or allocated to the natural system. Additionally, if the monitoring data and analyses show CEPP actually processes significantly more or less than the anticipated 210,000 acre-feet of “new water” on average, then the analysis may be used to adjust the calculation of OMRR&R cost share upward or downward to reflect the actual average annual use of excess capacity by the Federal project. Any recommended adjustments to the OMRR&R cost share calculation may require additional Congressional approval and legislation. This will be accomplished through consultation with the State and USACE Headquarters and is necessary after operations have begun to capture the true Federal interest and cost share responsibility. Additionally, it must be recognized and the adjustment made given these State facilities are subject to legal requirements outside of the Federal project and will not be operated in such a manner that the Federal project will cause exceedances of the State’s water quality requirements under State NPDES and EFA permits and associated Consent Orders. Such State requirements may limit the anticipated Federal project benefits.

No cost share of the aforementioned State facilities shall commence before the date the CEPP project produces “new water” and the associated Federal project feature is declared construction complete and the state assumes its OMRR&R responsibilities as established in the appropriate PPAs. Similarly, no cost share for State facilities is allowed until the State facilities are shown to be construction complete and the State begins regular operation of such facility.

The proposed Federal cost-share for OMRR&R is intended to include only the State facilities listed above. Modifications to this list of State facilities used by CEPP, including new flow control structures that may be constructed within STA 2, STA 3/4, and the A-1 FEB, must be coordinated with, and

approved for cost-sharing purposes by, the USACE Headquarters and the Office of the Assistant Secretary of the Army for Civil Works (ASA (CW)). For proposed modifications to this list, the State will coordinate any additional State water quality facilities upon which CEPP is dependent and which the State has determined are needed to meet water quality standards and achieve CEPP project purposes, with the Corps' Jacksonville District. Upon receipt of the State's request to modify the list of cost shared facilities, the Corps' Jacksonville District will prepare a recommendation for USACE Headquarters approval. USACE Headquarters will coordinate the Corps' recommendation with the Office of the ASA (CW). Preparation and approval of a Modifications to Completed Projects report, in accordance with ER 1165-2-119 may be required as a prerequisite to Federal cost share.

Similarly, as a condition of the Corps' cost share for replacement and rehabilitation actions for the State facilities listed above, prior to commencing such actions early coordination with, and approval by, the USACE Headquarters and the Office of the ASA (CW) will be required, using the procedures outlined above. Preparation and approval of a Modifications to Completed Projects report, in accordance with ER 1165-2-119, may be required as a prerequisite to Federal cost share. Costs associated with major rehabilitation of the wetland treatment areas (STA 2, STA 3/4, and the A-1 FEB) due to peat soil accretion are excluded from cost sharing. A pro-rata determination of appropriate repair, replacement, and rehabilitation cost share at the time of turnover of the CEPP A-2 FEB project feature, will be conducted based on the remaining life expectancy of the State facilities. USACE Headquarters will approve the established Corps obligation. The State may request, through coordination with Corps' Jacksonville District, that USACE Headquarters approve exemptions for certain replacement and rehabilitation activities that they deem to be minor actions. Additionally, during PED the State and the Corps will coordinate on more specific definitions of activities that are considered as either repair, replacement or rehabilitation. The Corps' Jacksonville District will subsequently coordinate these determinations with USACE Headquarters for approval.

6.6.3 Cost Sharing of Monitoring

CERP post construction project monitoring is cost-shared for a maximum period of 10-years for performance based ecological monitoring, and monitoring required for operations may continue longer. Given that the construction of all project features may require more than 10-years, the duration of cost-shared performance based ecological monitoring will extend past 10-years for the entire project; however, each monitoring activity associated with individual project features will not be cost-shared for more than 10-years post transfer of project component to local sponsor. **Annex D Part 1, AM Plan** provides the explanation of the staggered implementation of 10-year monitoring windows. These efforts will be cost shared during the construction phase of the project in accordance with Section 601(b)(2) of WRDA 2000. After construction, the costs will become part of the project's OMRR&R plan and cost-shared as described in the recommendations section of this report.

System-wide monitoring will be performed as part of the CERP Monitoring Assessment Program implemented by RECOVER. Data collected as part of this monitoring program is critical to the overall success of CERP Projects. Funding for system-wide monitoring is provided by and for RECOVER, and is independent from project-level funding. A draft POM (**Annex C**) has been developed for use in water management. Operational monitoring will be cost shared during the operation and maintenance phase of the Project.

6.6.4 Cost Sharing of Cultural Resources Preservation

Data recovery is 100% Federal responsibility until the cost of Data Recovery reaches 1% of the total project cost. Data recovery caps are identified in ER 1105-2-100 Appendix C-4.d(6)(d) and the Archaeological and Historic Preservation Act Section 7.

6.6.5 Non-Federal Sponsor Work-In-Kind for Construction

Should the non-Federal sponsor construct phases of the CEPP prior to execution of a PPA, then this work must be covered by a Pre-Partnership Credit Agreement (PPCA). The non-Federal sponsor would receive credit for such construction costs at the time the PPA for CEPP is executed. Such credit would be applied toward the non-Federal sponsor's share of the costs associated with the implementation of the CERP as authorized by Section 601(e)(5)(C) of WRDA 2000, shall not include cash reimbursements, and shall be subject to: a) the authorization of the CEPP project by law; b) a determination by the Secretary of the Army that the construction work completed under the PPCA is integral to the authorized CERP restoration project; c) a certification by the District Engineer that the costs are reasonable, allowable, necessary, auditable, and allocable; and d) a certification by the District Engineer that the activities have been implemented in accordance with USACE design and construction standards and applicable Federal and State laws. Also, per Section 601(e)(5)(E) of the Water Resources Development Act of 2000, in-kind credit is subject to audit by the Secretary.

6.7 PLAN IMPLEMENTATION

Implementation of CEPP will occur over many years and include many actions by USACE and SFWMD. This subsection discusses the major implementation phases that are expected to occur after Congressional authorization and appropriation of funding for project construction. Multiple PPAs will be executed prior to construction. Each PPA will cover a separable element that groups inter-related project features to provide hydrologic and ecological benefits. These PPAs include the construction of logical groupings of plan elements, agreed upon by the USACE and SFWMD, that maximize benefits to the extent practicable consistent with project dependencies (**Table 6-13**) and the CEPP AM and Monitoring Plans (see **Annex D**).

A multiple PPA approach incorporates the adaptive management process, per the guidance of the Programmatic Regulations for the CERP (2003) and the WRDA of 2007. Sequencing of the PPAs will allow earlier restoration benefits by initially building project components that take advantage of existing water in the system that meets State water quality standards, while providing assurances of sound financial investments.

6.7.1 Implementation and Construction Sequencing

6.7.1.1 Dependencies and Requirements

Upon identification of a recommended plan for CEPP, the next step is to consider how CEPP features will be implemented (sequencing scenarios) when considering internal and external project dependencies. Development of sequencing for CEPP features considers that a number of CERP and non-CERP projects (**Table 6-13**) must be constructed and operating before implementing most CEPP features to avoid unintended consequences. Additionally, several basic principles considered in development of an implementation plan for CEPP features include the following:

1. All features of the State's Restoration Strategies must be completed and meet State water quality standards prior to initiating construction of most CEPP project features.

2. Construction of CEPP Project features cannot proceed until it is determined that construction and operation of the feature:
 - a. Will not cause or contribute to a violation of State water quality standards; and
 - b. Will not cause or contribute to a violation of any applicable water quality permit discharge limits or specific permit conditions ; and
 - c. Reasonable assurances exist that demonstrate adverse impacts on flora and fauna in the area influenced by the Project features will not occur.
3. Appendix A water quality compliance must be addressed consistent with Section 8.3 for new project water entering ENP.
4. The operation of State facilities is required to ensure that new water made available by CEPP meets water quality standards and to ensure achievement of CEPP project benefits. If after construction and operation of CEPP project features State water quality standards are not being met, the Federal and State partners agree **per paragraph 8.3 of Section 8** of this PIR/EIS to meet to determine the most appropriate course of action in accordance with existing law and policy. In such an event, an evaluation of CEPP benefits, including the possibility of reduced benefits, will be included in the assessment of any suggested resolution. It is recognized that the operation of the State facilities has a primary permitted purpose of achieving water quality compliance for existing flows.
5. Sequencing takes into account the earliest opportunity to realize benefits, including the features that can provide benefits that utilize existing water meeting State water quality standards.
6. Additional outlet capacity from the south end of WCA 3A must be provided before new project water from Lake Okeechobee is released into WCA 2A and WCA 3A.
7. The sources of material needed for Miami Canal backfilling and the Blue Shanty Levee were considered to minimize costs associated with double handling and stockpiling of materials.
8. Where possible sequencing should include steps and timing to test concepts, as described in the CEPP AM Plan (**Annex D**).
9. Recreation features will be constructed in conjunction with corresponding CEPP project plan features.

In the future these CERP and non-CERP features will be built as described in **Table 2-2 of Section 2**, however, the timing of their completion affects CEPP implementation. Specific project features cannot be constructed until other CERP and non-CERP projects are constructed and operational. **Table 6-13** provides a complete list of which CEPP features are dependent on other projects and their operation in order to operate CEPP and obtain the full benefits envisioned, further detailed information is contained in **Section G.6 of Appendix G**.

Table 6-13. Project Dependencies

Project	CEPP Feature Dependencies
A-1 FEB State Restoration Strategies	Required prior to implementation of northern WCA 3A distribution features (L-4 degrade, new pump station, S-8 Modifications, L-5 and L-6 improvements, Miami Canal Backfilling) to ensure adequate water quality treatment of inflows. Construction of the A-1 FEB initiated in 2014 and the FEB is projected to begin start-up operations in 2018. Construction of the remainder of the Restoration Strategy projects is projected to be complete in 2025 and demonstrate compliance with water quality standards in 2029.
8.5 Square Mile Area and	Construction of the C-358 seepage collector canal and structure S-357N within the 8.5

Project	CEPP Feature Dependencies
Existing S-356	SMA must be completed to allow full utilization of the 8.5 SMA features to provide seepage mitigation for increasing flows into Northeast Shark River Slough. Construction of these features is underway and anticipated to be complete in 2015. Operation of the existing S-356 pump station (500 cfs) is required prior to significantly increasing flows to NESRS, to provide seepage management. Construction of the project feature is complete. Operational testing projected to begin in 2015 in support of development of the required final integrated operational plan for the Modified Water Deliveries and C-111 South Dade project expected to be complete in 2018.
C-111 South Dade	Extension of the detention area levees to connect with 8.5 Square Mile Area (SMA) required prior to significantly increasing flows to NESRS to enable operation of S-357 pump station up to full design capacity to provide seepage management to 8.5 SMA. Contracts 8 and 9 construction projected to be complete in 2017. Final integrated operational plan for the Modified Water Deliveries and C-111 South Dade project is expected to be complete in 2018.
MWD 1-Mile Bridge & Road Raising	The MWD bridge and road raising will be complete and operational prior to implementation of WCA 3B inflow structures along the L-67A&C levees or increasing flows through existing S-333 to NESRS to ensure adequate road protection to allow for increased stages in L-29 canal. Construction of the 1-mile bridge and road raising completed in 2014.
BCWPA C-11 Impoundment	Required prior to increasing flow through S-333 or implementation of WCA 3B inflow structures along the L-67A&C levees to ensure adequate water quality of inflows to WCA 3B and NESRS. The Broward Water Preserve Area was authorized in WRRDA 2014. Construction of the C-11 Impoundment projected to be complete in 2021.
Tamiami Trail Next Steps Bridging and Road Raising	Required prior to increasing capacities of S-333 and S-356 and implementation of the two WCA 3B inflow structures along the L-67A levee to the flowway, gaps in L-67C levee and Blue Shanty flowway (L-67C removal, L-29 levee removal). Construction of the 2.7 mile western bridge projected to be complete in 2020.
C-44 Reservoir (IRL-S) and connection to C-23 Canal	Required prior to re-directing the maximum amount of water from Lake Okeechobee south to the FEB to meet environmental performance, to avoid reduction in low flows to the St. Lucie Estuary and to avoid low Lake Okeechobee water levels that effect the LOSA. Construction is underway and projected to be complete in 2021.
Modification of the Lake Okeechobee Regulation Schedule	Anticipated prior to full utilization of the A-2 FEB in order to achieve the complete ecological benefits envisioned through re-directing the full 210,000 acre-feet per year south and to avoid low Lake levels that would affect the LOSA. The modification to the 2008 LORS which may be developed in response to system-wide operating plan updates to accommodate CERP Band 1 projects (Section 2.5, Section 6.1.3.2) and/or sufficient HHD remediation for reaches 1, 2 and 3 and associated culvert improvements is anticipated in 2022, subject to outcome of the Dam Safety Modification Report.

In addition to the project feature dependency considerations listed in **Table 6-13**, other factors influencing implementation include funding availability and maintenance of the cost-share balance between the Federal and non-Federal sponsor. The USACE and the SFWMD will undertake integration of the recommended plan and the other CERP projects awaiting authorization into the CERP programs' Integrated Delivery Schedule (IDS), which contains the Master Implementation Sequencing Plan (MISP), through a robust public process.

6.7.1.2 Multiple Project Partnership Agreements

Project features were grouped into three separate PPAs based upon the spatial distribution of the recommended plan features and the locations within the CEPP study area where separable hydrologic

and environmental benefits would accrue as described below. These groupings include a PPA of project features in northern WCA 3A (PPA North), a PPA of project features in southern WCA 3A, 3B and ENP (PPA South), and a final PPA which provides the new water and required seepage management that benefits the entirety of the study area (PPA New Water).

Table 6-14. Project Features by PPA

PPA North	
Project Features	Construction Contract
• L-6 Diversion	• Contract 1
• S-8 Pump Modifications	• Contract 1
• L-4 Levee Degrade and Pump Station	• Contract 1
• L-5 Canal Improvements	• Contract 2
• Miami Canal Backfill	• Contract 2
PPA South	
Project Features	Construction Contract
• L-67 A Structure North	• Contract 3
• One L-67 C Gap (6,000 ft)	• Contract 3
• Increase S-356 to 1,000 cfs	• Contract 4
• Increase S-333	• Contract 4a
• L-29 Gated Spillway	• Contract 4b
• L-67 A Structures 2 and 3 South	• Contract 5
• L-67 A Spoil Mound Removal	• Contracts 3 & 5
• Remove L-67 C Levee Segment	• Contract 6
• Remove L-67 Extension Levee (No Backfill)	• Contract 6
• 8.5 Mile Blue Shanty Levee	• Contract 6
• Remove L-29 Levee Segment	• Contract 7
• Backfill L-67 Canal Extension	• Contract 7
• Remove Old Tamiami Trail*	• Contract X*
PPA New Water	
Project Features	Construction Contract
• Seepage Barrier L-31 N	• Contract 8
• A-2 FEB	• Contract 9

* Contract X - Old Tamiami Trail can be completed at any time during implementation, but must precede backfilling of L-67 Extension Canal. NOTE: Reference **Figure 6-1** through **6-4** for more detailed description of project features. PPA North contains the features of **Figure 6-2**. PPA South contains the features of **Figure 6-3**. PPA New Water contains the features in **Figure 6-1** and **Figure 6-4**.

The report text, tables, and figures that follow demonstrate that PPA North and PPA South can be executed, regardless of the status of the other two PPAs. While not providing full benefits to the region, each would provide a reasonable level of benefits commensurate with its cost, as demonstrated during the screening of options that made up the complete alternatives. PPA New Water is not cost effective as an independent separable element, and additional outlet capacity from WCA 3A (a PPA South

component) must be provided before new project water from Lake Okeechobee is released into the system. As a construction element following construction of PPA North and PPA South, PPA New Water is a cost effective element.

Two potential implementation sequencing scenarios are possible with the three PPAs identified:

Scenario 1 – PPA North --> PPA South --> PPA New Water

Scenario 2 – PPA South --> PPA North --> PPA New Water

Additional information in **Table G-39** of **Appendix G** shows four sets of cost and benefit information, one for each of the proposed three PPAs as stand-alone elements, and one with the costs and benefits gained from implementation of PPA New Water subsequent to the completion of features included in PPA North and PPA South. The information should not be used to justify the exclusion of individual PPAs from the recommended plan, since only regional benefits will be realized if the connectivity and timing of water deliveries through the system is not restored. A cost effective comparison between PPAs is inappropriate due to aforementioned project dependencies and the difference in ecosystem regions. Instead, each PPA is justified on the significance of the resource being restored, and the cost effectiveness of the features within an individual PPA has been conducted to ensure that features within PPAs are cost effective regardless of the status of the other PPAs.

Additional information in **Table G-39** of **Appendix G** presents multiple estimates of performance associated with implementation of each PPA. Performance expectations for each PPA are described consistent with each of the Conceptual Ecological Models (Northern Estuaries, Greater Everglades Ridge and Slough, and Florida Bay) for the CEPP study area by stressors, ecological effects, and attributes (Barnes 2005, Ogden 2005a, Rudnick et al. 2005, Sime 2005). Project zones (See **Appendix G**) and associated acreages estimated to benefit from implementation of each PPA were identified. Acreages shown do not reflect the magnitude or degree to which each acre is improved. The entire acreage associated with each project zone was assumed to benefit since detailed modeling for each PPA was not conducted. Features of the recommended plan identified in each PPA were not separately modeled using the RSM-GL and RSM-BN regional models; as such, a quantification of habitat units with the CEPP Planning Model was also not performed for individual PPAs. Modeling of each PPA would require development of an optimized operations plan to meet project constraints while providing benefits.

6.7.1.3 Approach Taken to Estimating Phased Benefits

The percentage gained in project performance for each PPA was estimated using two separate approaches. Each approach has inherent uncertainties and relies upon simplifying assumptions and professionals judgments. Using two varying approaches are a means to increase the confidence in the overall conclusions. The first approach, the volume based approach, estimated the percentage gained in average annual overland flow (1000 ac-ft) for each PPA relative to that achieved by the recommended plan based upon modeling efforts for the CEPP final array. This approach was solely based on the potential volume of water produced from implementation of each PPA. The volume based approach is limited because it estimates either minimum or maximums flows but not both, for each spatial region. The volume based approach does not integrate timing and spatial variability of benefits. The second approach is a consensus based interpretation of the results from modeling performed during screening and from analysis of the final array of alternatives. The estimates of the percentage gained in average annual overland flow (first approach) were considered during this second approach. The second approach also accounted for the additional portion of overall benefits that are attributable to improved intra-annual timing of flows and spatial variability across benefit zones. The approach produced a range

of percentages to represent the minimum and maximum potential of benefits gained. Percentages were based on the collective scientific knowledge among project team members about the relative contribution of each PPA to the overall benefits resulting from the implementation of CEPP. Further detailed information for each approach can be found in **Appendix G**.

In order to provide a simple representation of the percent of CEPP benefits achieved for each PPA, the results from the two separate approaches were combined. The midpoint of the ranges from the consensus based approach was averaged with the value from the volume based approach by region, and the regions were summed to obtain a percentage of CEPP benefits achieved for each PPA. While a single estimate is useful to provide a broad perspective, it is important to remember that uncertainty exists within each approach and with the combined estimate.

6.7.1.4 Project Partnership Agreement North Only

PPA North includes the hydropattern restoration features in northern WCA 3A and the backfilling of the Miami Canal. The area within WCA 3A affected by the implementation of PPA North would encompass 272,070 acres (i.e. summation of acreages within Zones 3A-NE, 3A-NW, and 3A-MC). WCA 3A provides approximately 41% of the overall benefits being captured from the recommended plan. Construction of these features that re-distribute inflows into WCA 3A provide the benefits identified in the recommended plan associated with restoration of hydroperiods in northern WCA 3A, associated reduction in the risk of muck fires, and restoration of more natural sheetflow. A limited portion of these benefits could be realized through improvements in the re-distribution and delivery of water currently entering northwest WCA 3A prior to bringing in any additional water from Lake Okeechobee.

Backfilling approximately 13.5 miles of the Miami Canal between I-75 and 1.5 miles south of the S-8 pump station, and converting the L-4 Canal into a spreader canal by removing 2.9 miles of the southern L-4 levee will provide benefits to the areas directly adjacent to the canal. Northeastern WCA 3A is expected to benefit from backfilling the Miami Canal; however this region of the study area would receive even more benefits with the additional water that becomes available from implementation of PPA New Water.

Figure 6-15 illustrates the estimated percent of project performance resulting from implementation of PPA North. Implementation of PPA North achieves approximately 17% of the overall CEPP benefits. See **Section G.6.1 of Appendix G** for further explanation of this calculation.

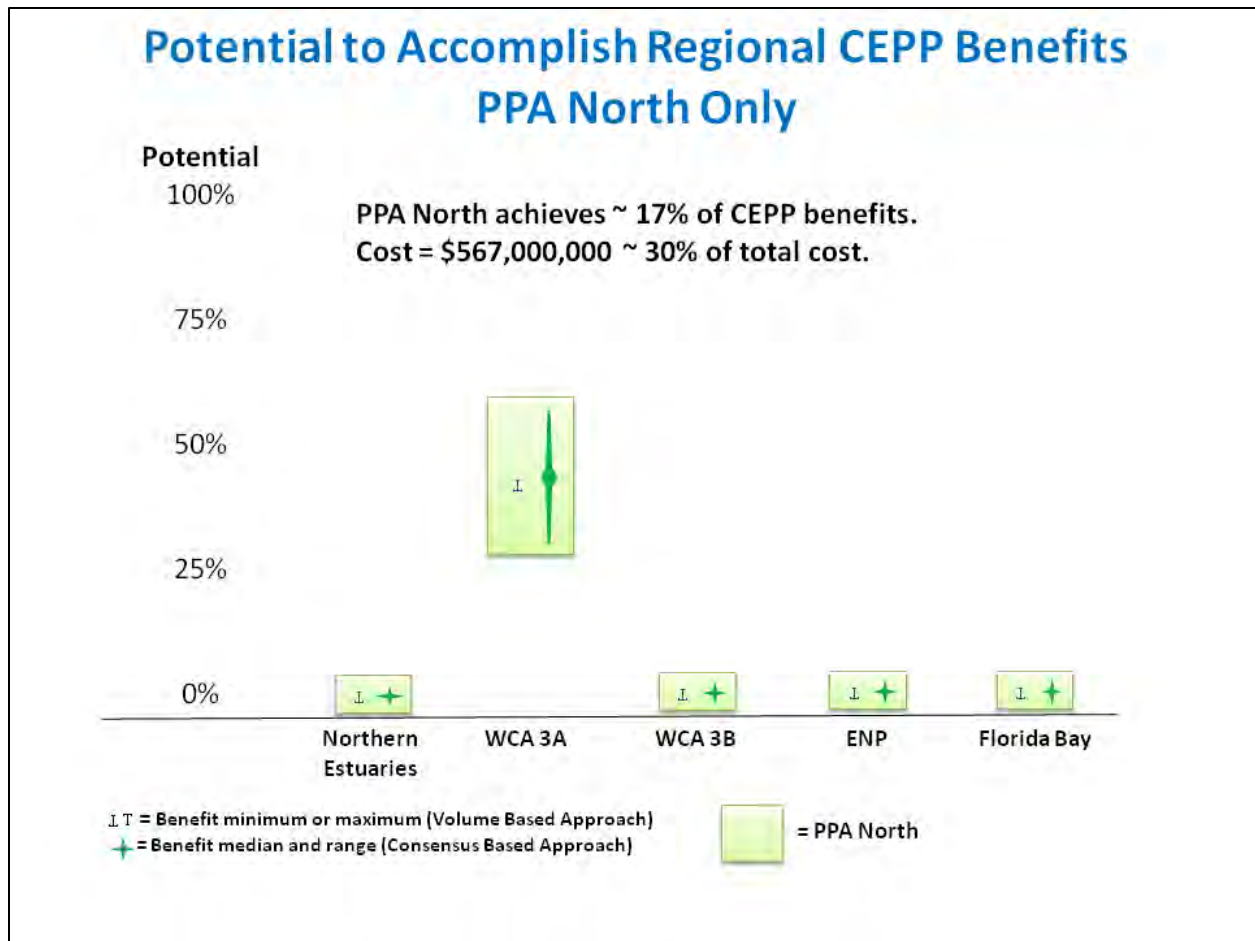


Figure 6-15. Potential Benefits Achieved from Implementation of PPA North by CEPP Planning Region

The PPA North features function together to improve the distribution of available water across northern WCA 3A. The North of the Redline screening consisted of modeled 15 combinations of management measures utilizing existing inflows into WCA 3A of which seven combinations of backfilling and hydropattern restoration features were evaluated in detail (See **Section 3.2.2**). A MCDA analysis combined with parametric cost calculations resulted in four cost effective options out of the seven. The features in these cost effective options were combined with the L-6/WCA 2A diversion component. This provided a dual purpose of delivering water from STA 2 to WCA 3A and a source of backfill material for the Miami Canal, thereby ensuring the features in PPA North are a cost effective means of achieving the standalone ecological and hydrological benefits that are realized from implementation of PPA North.

6.7.1.4.1 Project Partnership Agreement North Construction Sequencing and Adaptive Management

Implementation of this PPA would only occur after the State has completed construction of the State's Restoration Strategy to ensure adequate water quality treatment of existing water. Other non-CEPP project dependences identified in **Table G-39** would also need to be completed. The specific features of the recommended plan to be implemented in PPA North would include the L-4 Levee degrade and pump station, the S-8 pump station modifications, the L-6 Canal improvements, the L-5 Canal improvements, and the backfilling of the Miami Canal. It is important to note that the L-4 Levee degrade and the L-5 Canal improvements generate the primary source of fill for backfilling the Miami

Canal. Grouping these features together for implementation avoids additional costs associated with stockpiling fill and double handling fill material.

6.7.1.5 Project Partnership Agreement South Only

The specific features of the recommended plan to be implemented in PPA South would include conveyance features that function to re-distribute water from WCA 3A to WCA 3B and ENP (**Table 6-14**). WCA 3B and ENP provide approximately 4% and 31% of the overall benefits captured from the recommended plan, respectively. Increasing water flow to NESRS and introducing water flow into WCA 3B could occur once the Broward Water Preserve Area C-11 impoundment is in place to reduce S-9 discharges to the L67-A Canal, which contributes to phosphorus loads into ENP through S-333.

An increase in flows to NESRS could be realized utilizing the existing S-333 and the existing S-356 pump station once the MWD Tamiami Trail Modifications project and the 8.5 SMA is completed, which will allow for the maximum operating stage in the L-29 Canal to be raised from 7.5 ft to 8.5 ft NGVD under conditions where the existing S-356 pump station can effectively manage the increased seepage. Increasing the capacities of the S-356 pump station and the S-333 structure as part of the CEPP PPA South implementation would enable further increases in water flow to NESRS following completion of the DOI Tamiami Trail Next Steps bridging and roadway modifications. Tamiami Trail roadway improvements and the PPA South features will allow for L-29 Canal stages above 7.5 ft NGVD up to the limit imposed by flood control requirements. This limit will be event specific, but it is expected to accommodate increased durations for operational stages approaching, and potentially exceeding, 8.5 ft NGVD in the L-29 Canal. Central and southern WCA 3A are also expected to slightly benefit with the implementation of PPA South.

The southern portion of WCA 3A is primarily affected by long durations of high water and lack of seasonal variability in water depths created by impoundment structures (i.e., L-67 and L-29 Levees) and recommended plan modeling results note a decrease in stages during the wettest 5% of conditions. Removal of the Old Tamiami Trail would slightly alleviate the high water conditions currently experienced in WCA 3A by potentially providing a small increase in the conveyance capacity of the S-12 structures. Benefit from these PPA South facilities could be realized within WCA 3A, WCA 3B, and NESRS from the added outlet capacity. Improved hydrologic conditions in ENP are expected to result in improved salinity conditions in Florida Bay. Florida Bay provides approximately 20% of the overall benefits captured from the recommended plan. The area within WCA 3A, WCA 3B, ENP and Florida Bay to be affected by the implementation of PPA South would encompass 1,316,273 acres.

Implementation of PPA South achieves approximately 21% of the overall CEPP benefits. **Figure 6-16** illustrates the estimated percent of regional gain in project performance because of implementation of PPA South. See **Section G.6.2 of Appendix G** for further explanation of this calculation.

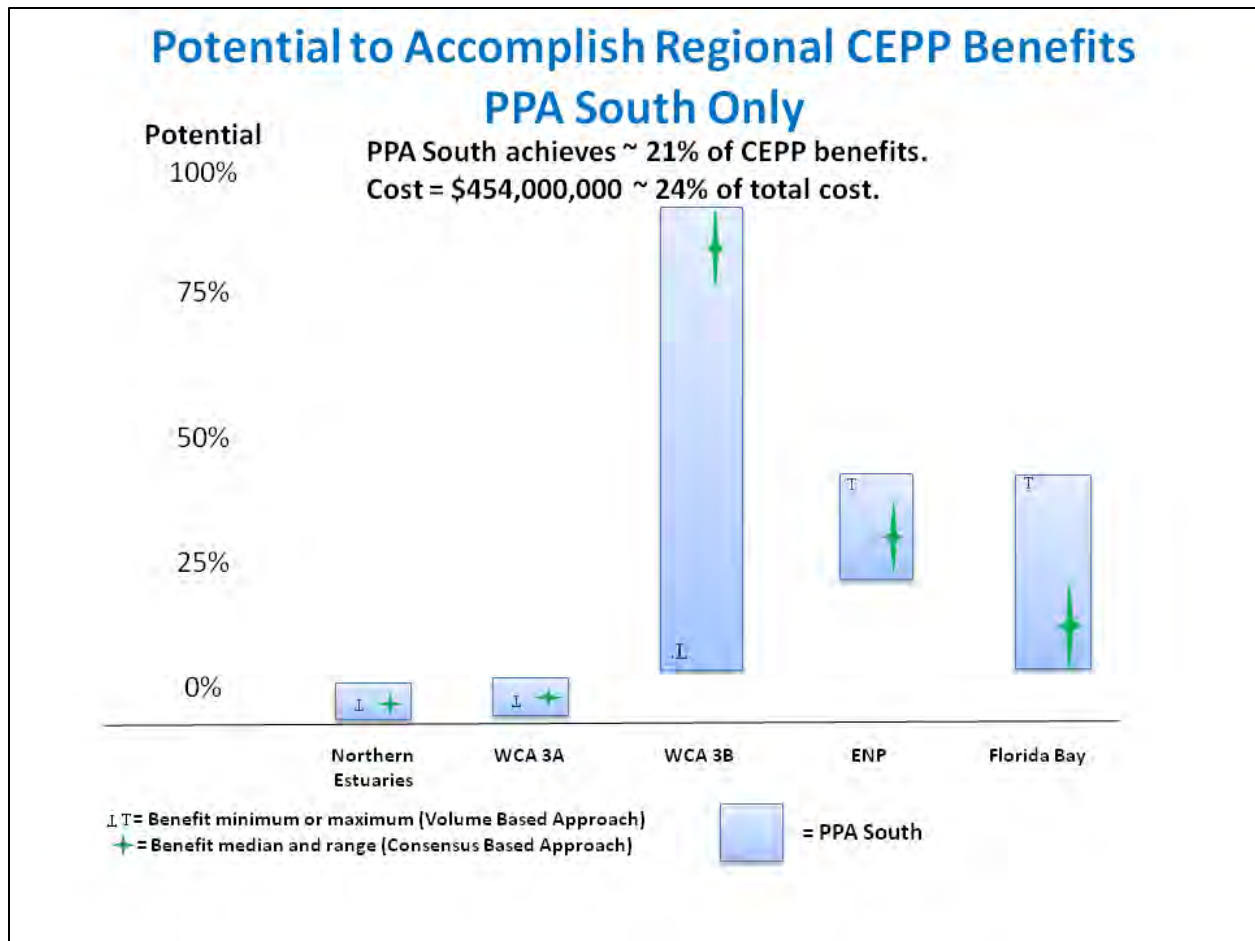


Figure 6-16. Potential Benefits Achieved from Implementation of PPA South by CEPP Planning Region

The screening analysis for the conveyance and distribution measures in southern WCA 3A, WCA 3B and ENP included new water provided by the storage and treatment features in the North. However, the components were sized to handle peak wet seasons flows and stages when the new water is not delivered. In the absence of adding new water to the system, the features would still have to be sized as designed in order to handle the existing water in the system and provide the stand-alone benefits of PPA South.

6.7.1.5.1 Project Partnership Agreement South Construction Sequencing and Adaptive Management

Construction of CEPP features in PPA South will also ready the system for the additional inflows from Lake Okeechobee by providing the necessary additional outlet capacity from WCA 3A. Once the increase in S-356 capacity is on-line to provide requisite seepage management, construction of the Blue Shanty flowway would be undertaken to complete the WCA 3A outlet capacity needed prior to introduction of additional water from Lake Okeechobee.

As described in the Adaptive Management Plan, (**Annex D**, Uncertainty ID#77) construction of the northern most gated-culvert structure on the L-67A Levee and the associated 6,000-ft degrade of the L-67C Levee as the next Phase of implementation would allow for introducing additional inflow to WCA 3B to begin restoration of hydroperiod and reduce continued degradation and soil oxidation in WCA 3B. Implementation of this first structure to provide inflows to WCA 3B will provide the opportunity to: 1)

evaluate water movement within WCA 3B; 2) determine to what extent inflows will move south to the S-355 outlet structures on the L-29 Levee or east where it would move out of WCA 3B via seepage through L-30, and; 3) provide information on seepage out of WCA 3B. Evaluation of results from introducing flows into WCA 3B through this first structure will determine whether an additional inflow structure could be implemented prior to construction of the Blue Shanty Levee (L-67D). Implementation of an additional inflow structure would be dependent on demonstration that the full capacity of the initial structure could be utilized and that any further increase of inflow would not cause adverse or unacceptable effects to resources within WCA 3B or overwhelm the available seepage management facilities capability to prevent flooding of the developed areas to the east. Implementation of these features in L-67A and L-67C will require use of the existing S-356 pump station (500 cfs capacity) to manage additional seepage from WCA 3B and completion of the MWD Tamiami Trail Modifications. This implementation approach is consistent with the adaptive management approach envisioned for CERP in the Programmatic Regulations for the Comprehensive Everglades Restoration (2003) Section 385.31 and described in the Water Resources Development Act of 2007 and its implementation guidance, as well as the incremental adaptive restoration approach identified by the National Academy of Sciences (National Research Council 2007). It incorporates opportunities to learn, reduce uncertainties, provide incremental restoration benefits as early as possible, and minimize the continued degradation of the ecosystems.

6.7.1.6 Project Partnership Agreement New Water Only

Features in PPA New Water include the construction of the A-2 FEB and the seepage barrier along L-31N to ensure adequate seepage management would be in-place prior to moving the additional inflows from Lake Okeechobee provided by the A-2 FEB.

Implementation of PPA New Water would decrease high volume freshwater discharges from Lake Okeechobee that are currently sent to the Northern Estuaries. While water could be moved away from the Northern Estuaries, only a limited amount could be passed south into WCA 3 without the additional outlet capacity provided by PPA South. As a result, the FEB storage capacity would remain largely unavailable following the initial FEB filling each year and the opportunities to divert water away from the Northern Estuaries that the full CEPP plan provides would be extremely limited.

The additional water sent south from the Northern Estuaries to the A-2 FEB would provide some benefit to northern WCA 3A. Additional storage capacity resulting from the construction of the A-2 FEB would help to improve the timing of deliveries to northern WCA 3A; however benefits would be limited. The Miami Canal would continue to function as a source of drainage for WCA 3A. Water would continue to be distributed to northern WCA 3A through a single point source at the S-8 pump station. PPA New Water would provide no benefits to WCA 3B as it does not include conveyance and distribution features located on the L-67 A/C Canals. Limited benefits would be expected in ENP due to construction of the seepage barrier wall, since additional inflows from WCA 3A to NESRS would be limited by water supply and the need to maintain preferred hydrology in WCA 3A with existing inflows (prevent increased dry outs). Florida Bay may benefit, as it is largely influenced by changes in freshwater flows upstream.

Figure 6-17 illustrates the estimated percent gain in project performance as a result of implementation of PPA New Water only. As can be seen in the figure, only negligible benefits are realized with PPA New Water only. The negligible benefits do not support the \$800 million cost, and do not represent a cost effective solution as a standalone increment.

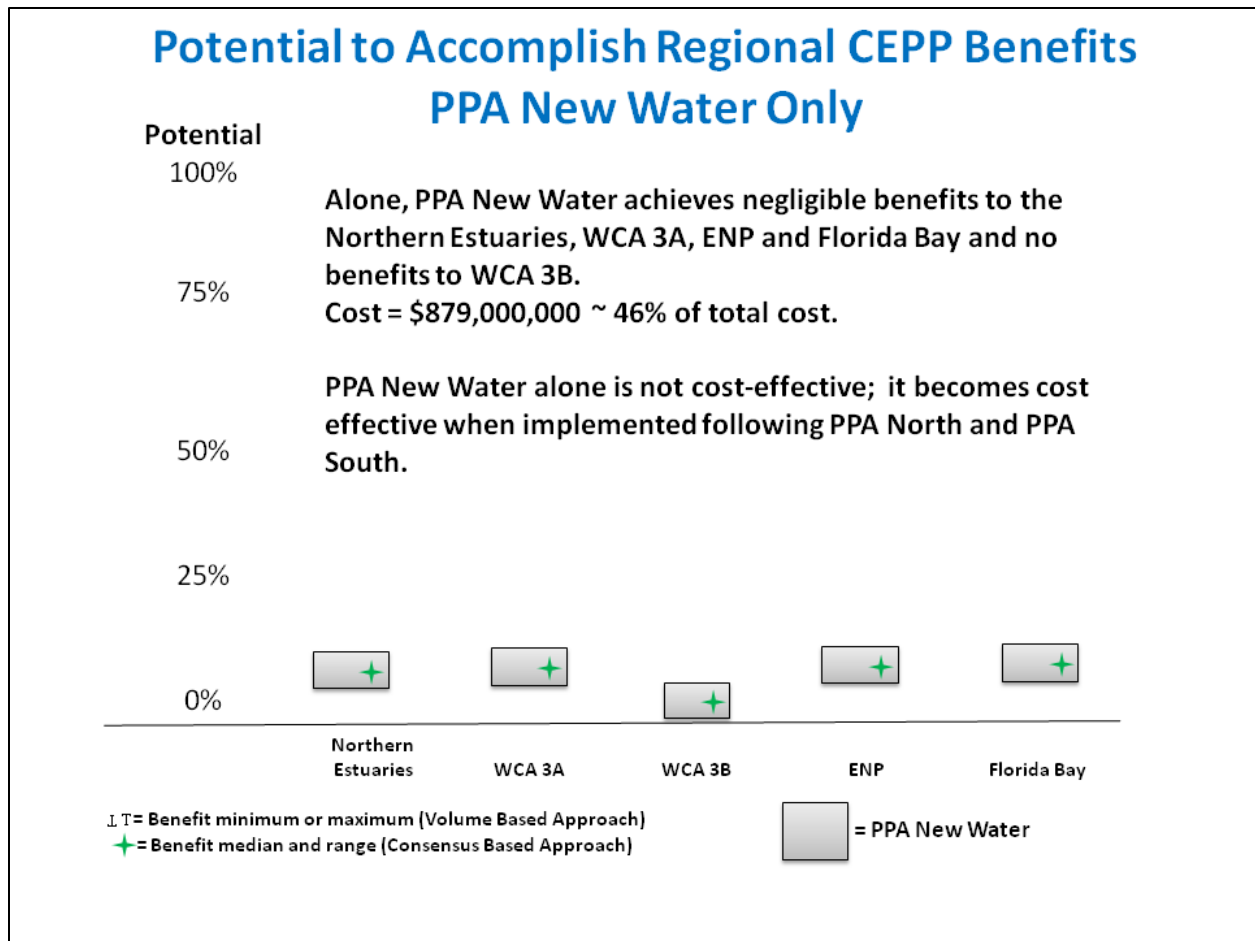


Figure 6-17. Potential Benefits Achieved from Implementation of PPA New Water by CEPP Planning Region

6.7.1.7 Project Partnership Agreement New Water (Assumes North and South Built)

If PPA New Water is implemented subsequent to the construction of PPA North and South (**Figure 6-18**), the area within WCA 3A, WCA 3B, ENP and Florida Bay affected by the implementation of PPA New Water encompasses more than 1.5 million acres and provide 62% of the overall benefits of CEPP. Since PPA New Water is dependent upon PPA North and PPA South features being complete, benefits attributed to PPA New Water were calculated by subtracting the percentage of benefits of PPA North and PPA South from the overall CEPP benefits (100%). The following figure represents the cumulative benefits of constructing PPA North and PPA South by region based on the average of both benefit calculation methods. This figure clearly demonstrates the additional benefits added by PPA New Water as the final construction element to arrive at 100% of CEPP benefits by region. As can be seen in the following figure, PPA New Water is expected to provide approximately 100% of the benefits for the Northern Estuaries, 56% of WCA 3A, 54% of WCA 3B, 60% of ENP and 70% of Florida Bay as a separable increment implemented post construction of PPAs North and South. Implementation of PPA New Water achieves approximately 62% of the overall CEPP benefits post construction of PPAs North and South.

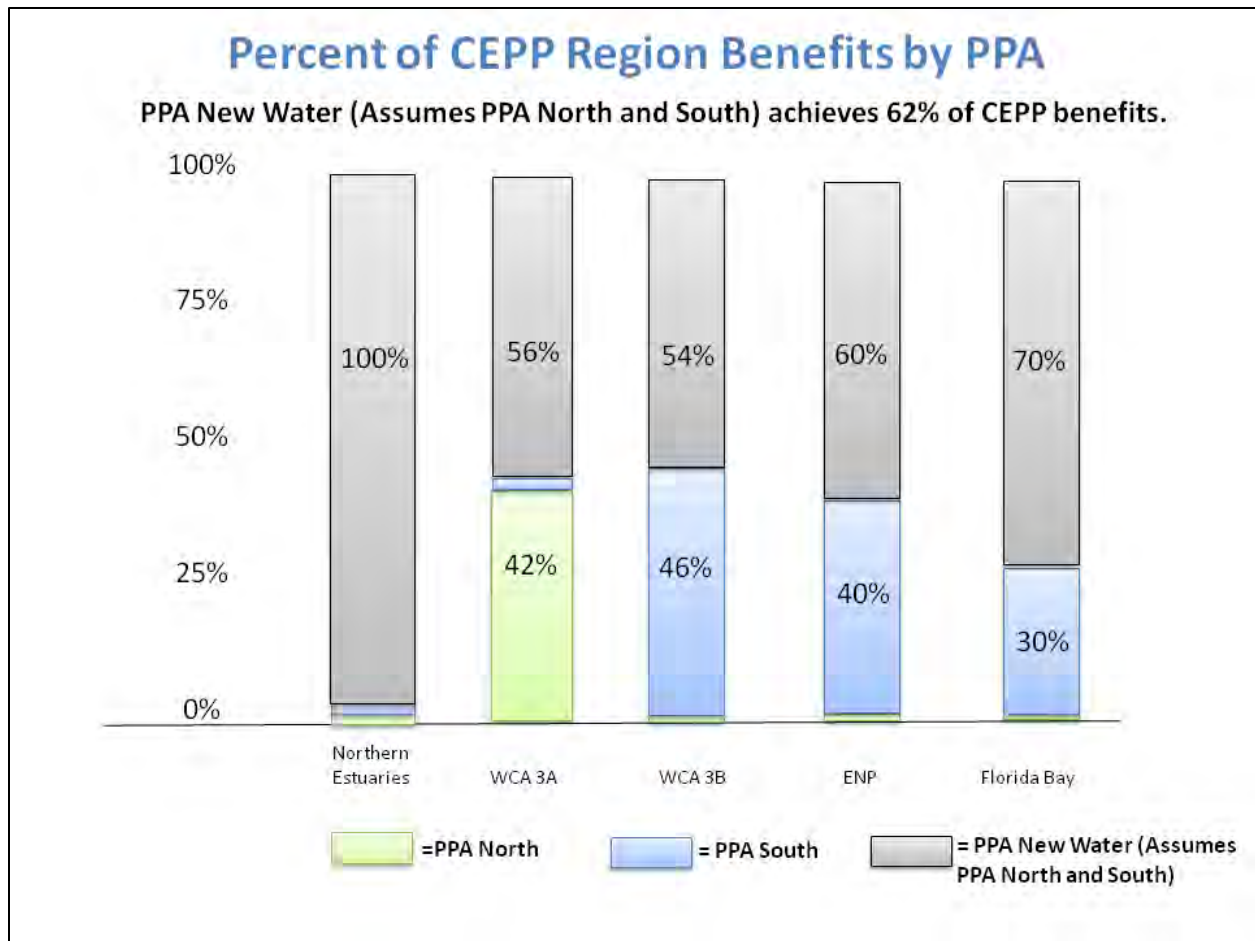


Figure 6-18. Potential Benefits Achieved from Implementation of PPA New Water by CEPP Planning Region. Assumes implementation of PPA North and PPA South.

The configuration of storage and treatment and the required seepage contained within PPA New Water has been determined to be cost effective through the screening process, which utilized both the RESOPS and LOOPS models to identify efficient means of delivering water. Hundreds of options considered during screening (see **Section 3.2.1**) led to the identification of two cost effective solutions for delivering additional water to the Everglades. The FEB configuration was determined to be a cost effective approach to delivering approximately 210,000 ac-ft of additional water on an average annual basis, and a value planning approach (**Section 3.2.4**) was conducted to determine the most efficient manner to implement the seepage management infrastructure required for the new water.

When implemented post construction of PPA North and PPA South, PPA New Water benefits in ENP result from the additional new water and seepage management features that allow for higher L-29 Canal stages and higher inflows during high water periods, and fewer dry downs during dry periods. Tamiami Trail roadway improvements and the PPA South features will allow for L-29 Canal stages above 7.5 ft NGVD up to the limit imposed by flood control requirements. This limit for PPA South will be event specific, but it is expected to accommodate increased durations for operational stages approaching, and potentially exceeding, 8.5 ft NGVD in the L-29 Canal. Full build out of the seepage management components with PPA New Water would allow for L-29 Canal stages up to 9.7 ft NGVD. Peak simulated L-29 Canal stages for the recommended plan were 9.59 ft NGVD within the flowway west of the S-355 W gated spillway and 9.50 ft NGVD east of the flowway and S-355 W gated spillway,

with a percent exceedance of 8.5 ft NGVD approximately 10% and 5% of the time respectively over the period of record (1965-2005); therefore, the incremental increase to high-water stages and high inflow events which PPA New Water provide are relatively infrequent. However, the seepage management components from PPA New Water (i.e., 4.2 miles seepage barrier wall), in addition to the increased capability to use the increased capacity of S-356 from PPA South (through the higher L-29 Canal maximum operating stage) help to maintain stages east of the East Coast Protection Levee and provide additional benefits to WCA 3B, ENP, and consequently Florida Bay. Without PPA New Water, at times there will not be sufficient water to maintain desired water levels in both WCA 3A and ENP, resulting in the need to optimize operations which balance the upstream and downstream needs.

6.7.1.7.1 Project Partnership Agreement New Water Construction Sequencing and Adaptive Management

Construction of PPA New Water last would allow time for consideration of information collected from the recently constructed 2-mile seepage barrier along the L-31N, as well as any additional investigations that may be undertaken to develop detailed design for the seepage barrier feature. There is a possibility that the permittee may construct an additional 5 miles of seepage wall south of the 2-mile seepage wall, if permitted. Since the capability and effectiveness of the existing seepage wall to mitigate seepage losses from ENP remains under investigation, the recommended plan conservatively includes an approximately 4.2 mile long, 35 foot deep tapering seepage barrier wall in the event construction is necessary. This implementation sequence will also allow time for completion of the Indian River Lagoon, South (IRL-S) C-44 reservoir, to ensure there will not be any adverse effects to low flows to the St. Lucie Estuary or the LOSA from re-directing water south to the FEB.

CEPP benefits gained from sending new water south from Lake Okeechobee are derived in part from operational refinements that can take place within the existing, inherent flexibility of the 2008 LORS, and in part with refinements that are beyond the schedule's current flexibility. As summarized in **Section 6.1.1**, modifications to the 2008 LORS will be required to optimally utilize the added storage capacity of the A-2 FEB to send the full 210,000 acre-feet per year of new water available in CEPP south to the Everglades, while maintaining compliance with Savings Clause requirements for water supply and flood control performance levels. Independent of CEPP implementation, there is an expectation that revisions to the 2008 LORS will be needed following the implementation of other CERP projects and HDD infrastructure remediation. It is anticipated that the need for modifications to the 2008 LORS will be initially triggered by non-CEPP actions and that these actions will occur earlier than implementation of CEPP. Therefore, the CEPP PIR will not be the mechanism to propose or conduct the required NEPA evaluation of modifications to the LORS. However, depending on the ultimate outcome of these future LORS revisions, including the level of inherent operational flexibility provided with these revisions, CEPP implementation may still require further LORS revisions to optimize system-wide performance and ensure compliance with Savings Clause requirements.

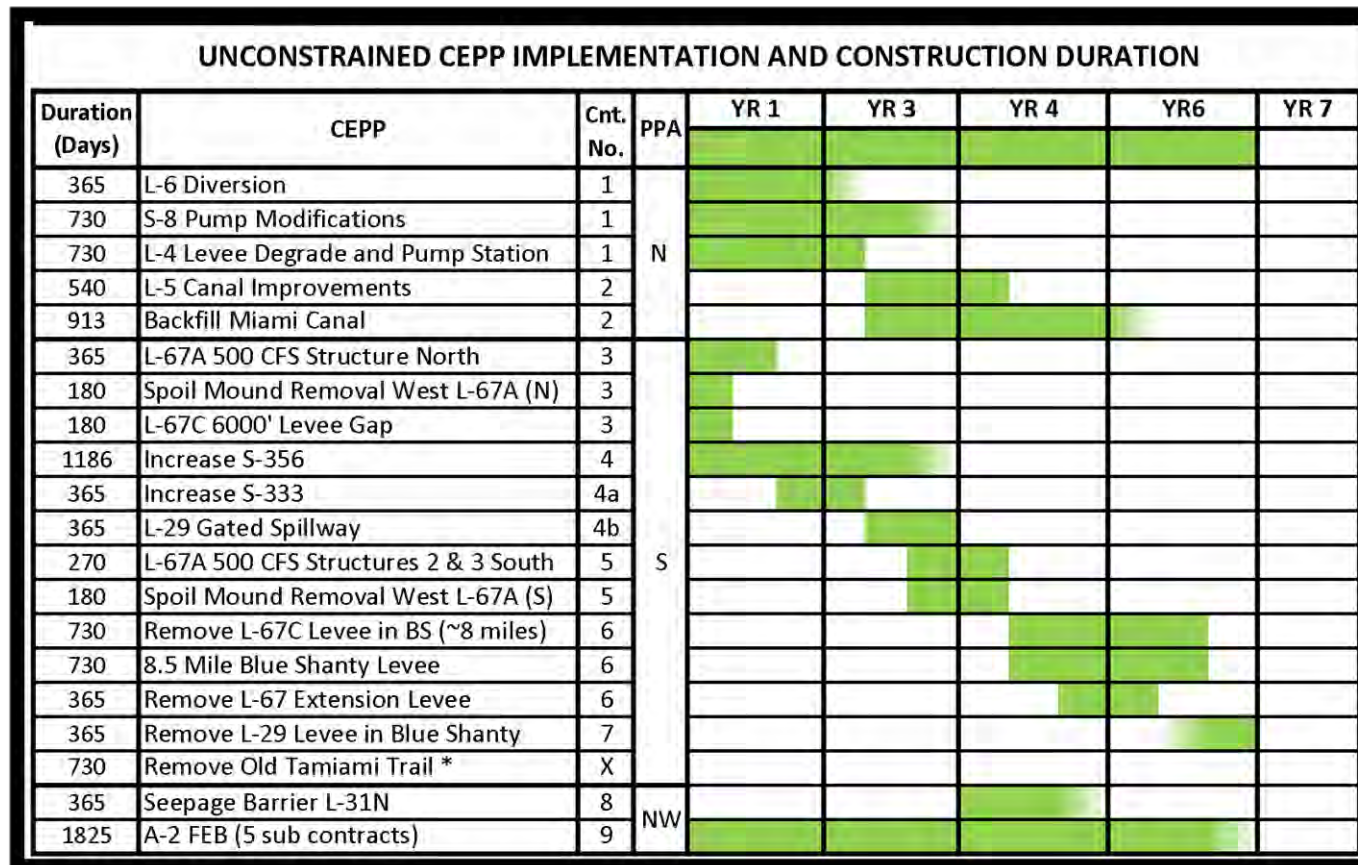
6.7.1.8 Implementation Scenarios

The Everglades lie at the center of the complex south Florida regional water management system in which water distributed to any part of the system affects many others. The current system provides most of the inflows to the project area at the peak of the wet season; however, flow is not spatially distributed as desired due to structural limitations and other project constraints. Providing supplemental flows during the periods outside of the peak wet season is ecologically important to reverse the current adverse effects of marsh dry out during the dry months. Providing storage and treatment will serve to both increase water volume and improve the timing of deliveries to the

Everglades. Additional storage will also reduce the frequency of undesirable high water volume discharges to the Northern Estuaries.

Separable PPAs are useful in informing financial decisions and budgets, and identifying the locations and significance of benefits, but the intent of multiple PPAs is not to compare PPAs against each other for cost-effectiveness. All project features of the recommended plan are needed to beneficially affect the more than 1.5 million acres in the St. Lucie and Caloosahatchee Estuaries, WCA 3, ENP, and Florida Bay. The cost-effectiveness of the features within each PPA has been thoroughly examined during the screening of options that made up the complete alternatives and substantial standalone project benefits have been identified. PPA North and PPA South are expected to achieve only regional benefits by utilizing existing inflows to improve deliveries to WCA 3, ENP, and Florida Bay. The ability to increase flows to the south as envisioned with the recommended plan depends on the construction of the A-2 FEB and seepage wall in PPA New Water, as well as the distribution and conveyance features in PPA North and PPA South. Implementation of all three PPAs are needed to see all of CEPP's improvements associated with the reduction of undesirable high volume discharges to the Northern Estuaries and the restoration of hydroperiods and sheetflow from WCA 3 and ENP to the coastal mangroves of Florida Bay. The total benefits predicted (See **Section 6.2.1**) with implementation of the recommended plan cannot be achieved without the combination of storage and treatment, distribution and conveyance, and seepage management.

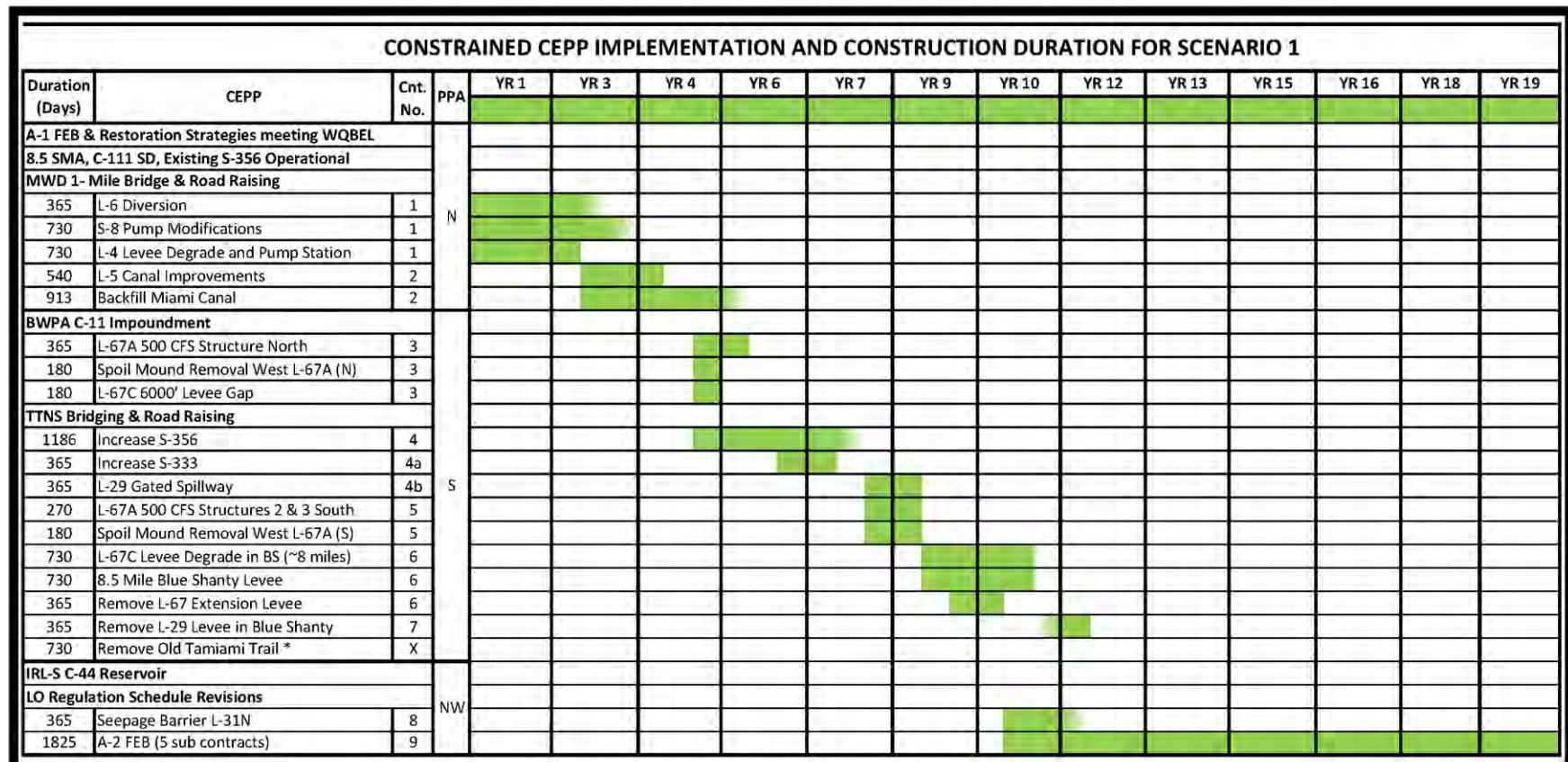
The benefits and construction of PPA North is not dependent on implementation and construction of PPA South and vice versa. The benefits of PPA New Water are dependent on features in PPA North and PPA South. Commencing construction on PPA New Water may occur after an executed agreement between the SFWMD and USACE occurs for both PPA North and PPA South. Construction of PPA New Water may be in parallel with construction of PPA North and PPA South components. **Figure 6-19** includes an implementation scenario with unconstrained resources and funding to demonstrate the duration of construction per PPA, while considering construction dependencies and limitations such as staging and access. This figure illustrates a best-case implementation timeframe for simultaneous execution and construction of all three PPAs, which would achieve realization of the full CEPP benefits within 6 years of project initiation.



* Contract X - Old Tamiami Trail can be completed at any time during implementation, but must precede backfilling of L-67 Extension Canal. NOTE: Reference **Figures 6-1** through **6-4** for more detailed description of project features. PPA North contains the features of **Figure 6-2**. PPA South contains the features of **Figure 6-3**. PPA New Water contains the features in **Figure 6-1** and **Figure 6-4**.

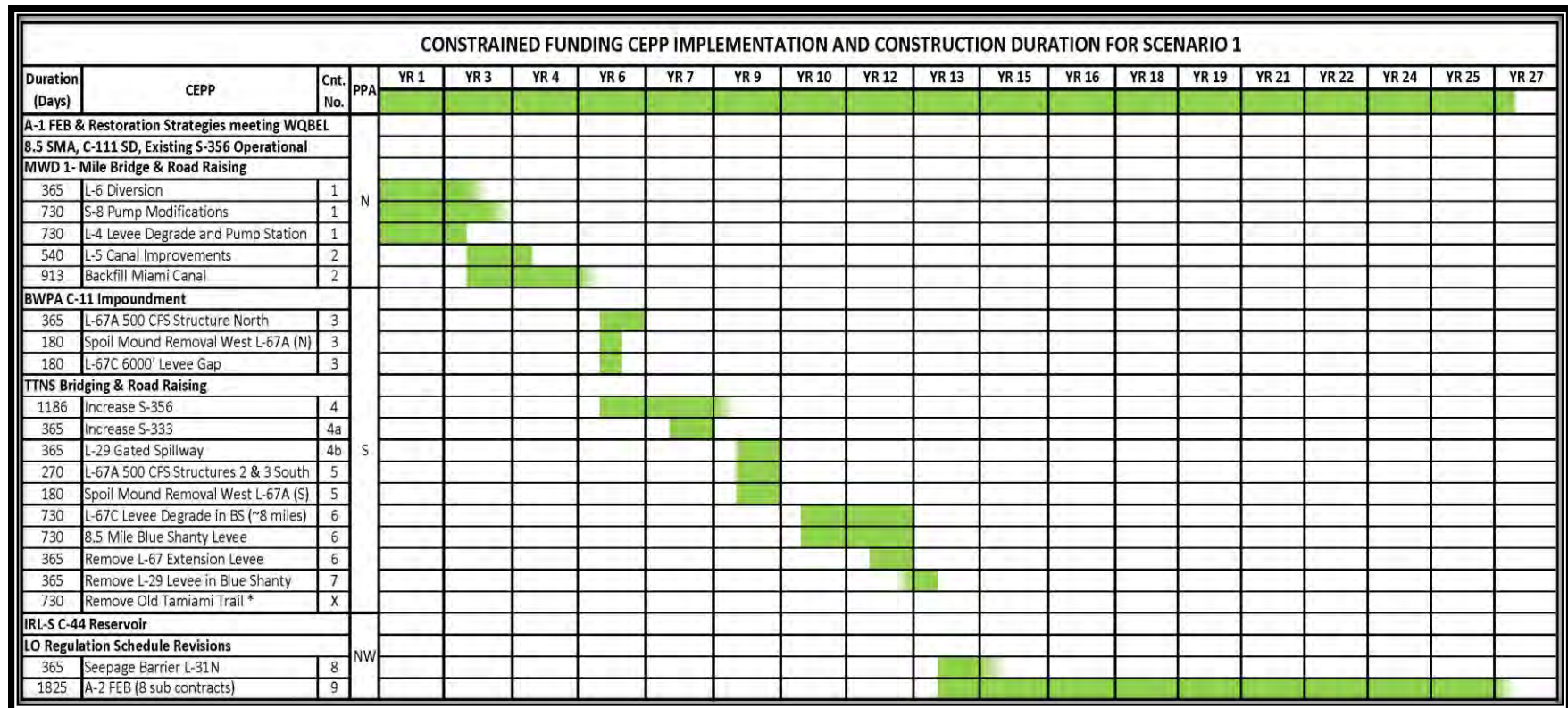
Figure 6-19. Unconstrained CEPP Implementation and Construction Duration.

Uncertainty surrounding the timing of CEPP project dependencies, funding, resources, stakeholder input and potential conflicting priorities will likely lead to a longer implementation period. The implementing agencies are committed to engaging in a public process to integrate CEPP into the IDS (which incorporates the CERP MISP) that defines the order in which CERP projects would be planned, designed, and constructed. **Figure 6-20** illustrates the construction duration associated with implementation Scenario 1 (sequentially constructing PPA North, then PPA South and finally PPA New Water) and assumes constrained project funding of \$100 million per year (\$50 million Federal, and \$50 Million non-Federal sponsor) that escalates through time. **Figure 6-21** also shows construction durations for Scenario 1, but is based on \$100 million per year that does not escalate. These figures illustrate more realistic timelines to realize full project benefits. .



* Contract X - Old Tamiami Trail can be completed at any time during implementation, but must precede backfilling of L-67 Extension Canal. NOTE: Reference **Figures 6-1** through **6-4** for more detailed description of project features. PPA North contains the features of **Figure 6-1** and **6-2**. PPA South contains the features of **Figure 6-3**. PPA New Water contains the features in **Figure 6-1** and **6-4**.

Figure 6-20. Constrained CEPP Implementation and Construction Duration for Scenario 1



* Contract X - Old Tamiami Trail can be completed at any time during implementation, but must precede backfilling of L-67 Extension Canal. NOTE: Reference **Figures 6-1** through **6-4** for more detailed description of project features. PPA North contains the features of **Figure 6-1** and **6-2**. PPA South contains the features of **Figure 6-3**. PPA New Water contains the features in **Figure 6-1** and **6-4**.

Figure 6-21. Constrained CEPP Implementation and Construction Duration for Scenario 1, with non-escalating funding

Other viable options for the implementation of construction phases and subsequent groupings into PPAs may be considered in the future. This flexibility is essential to successful CEPP implementation given the uncertainties associated with the lengthy implementation period and the inevitable improvement in scientific knowledge about the functioning of the greater Everglades that will occur as planned CERP and non-CERP projects are completed. Deviation from the PPAs outlined above (i.e. PPA North, PPA South, and PPA New Water) would require coordination with SFWMD, USACE Headquarters and the Office of the ASA (CW). For example, coordination is required if recommended plan features are reassigned to a different PPA than as originally established and presented in the Final PIR/EIS. Features not included in the recommended plan shall not be added to any of the implementation phases without proper coordination or NEPA analysis if necessary.

Federal laws and regulations applicable to implementing the CERP require PIRs to address certain assurances as part of the project recommendation for approval and subsequent implementation. For the CEPP PIR, the analyses for CEPP associated with Section 601(h)(4) and 601 (h)(5) of WRDA 2000 and the Programmatic Regulations for the CERP (33 CFR Part 385) for Project-Specific Assurances and Savings Clause were conducted for the recommended plan. The recommended plan will be implemented in multiple PPAs. The USACE and the SFWMD will undertake updated project assurances and Savings Clause analyses, if necessary, for the implementation phases that are selected to be included in a Project Partnership Agreement or amendment thereto prior to entering into the PPA or PPA amendment. The USACE District Engineer will ensure that Project-Specific Assurances and Savings Clause requirements are met per PPA, per applicable policies and laws. NEPA documentation will be updated, if applicable, as revisions are made to Water Control Plans and/or Project Operating Manuals associated with each PPA. Compliance with the requirements of the Savings Clause will be maintained throughout the entirety of the CEPP implementation period.

6.7.2 Preconstruction Engineering and Design

Appendix A represents a limited level of design, but includes documentation of all engineering assumptions and conceptual designs. PED for recommended plan features could begin after Congressional authorization and upon SFWMD's concurrence consistent with the implementation phases. USACE will prepare an Engineering Design Report updating the conceptual design and prepare initial, intermediate and final plans and specifications for each phase of construction. All work will be coordinated and reviewed between the USACE and the SFWMD, and approved by the USACE and SFWMD prior to construction, to ensure that the work meets USACE standards and regulations and incorporates SFWMD design guidance, as applicable. PED will include site-specific surveys and geotechnical investigations. During the design phase, detailed analyses, subsurface and site investigations will be conducted to prepare construction documents. During PED, project assurances, Savings Clause analysis and operating manuals will be updated consistent with the implementation phases, if necessary. After completion of 60 percent final plans and specifications for a given project feature, the lead construction agency (USACE or SFWMD) will prepare and submit a CERPRA permit application (Florida Statutes 373.1502) to the FDEP. The FDEP will review the application material to determine if reasonable assurance that the feature will be consistent with State water quality standards in compliance with rules in effect at the time of application. See **Section 6.1** for a list of plan features to be constructed. See **Appendix A** and **Annex C-2 of Appendix A** for limited design details and conceptual design plates.

USACE continues the usage of the NGVD of 1929 (NGVD 29) system for elevation comparisons used with monitoring data, hydrologic modeling and design for Florida. This allows the continuity of years of valuable data to be transitioned during PED to the more accurate North American Vertical datum

(NAVD) of 1988 (NAVD 88). This PIR continues of the usage of NGVD and NAVD where appropriate in hydrologic modeling and preliminary design of CEPP recommended features. In PED, the NGVD 29 elevations will be converted to NAVD 88 for design analyses and completion of construction documents (plans and specifications). In some prior instances, the local sponsor has requested both vertical datums to be referenced during PED. There are appropriate conversions based on spatial relevance to maintain design intent changing from the NGVD 29 datum to the NAVD 88 datum.

6.7.3 Construction

The project will be constructed using conventional means and methods. Multiple contracts will be awarded in a sequenced and phased approach. Construction contracts for project features will not be awarded by the USACE prior to obtaining CERPRA permit authorization or other water quality certification, as applicable. The project features will be sequenced in contracts that maximize opportunities to realize benefits with water that meets State water quality standards, capitalize on use of onsite material, reduce multiple handling scenarios, and maintain flood control operations of existing features. Adaptive Management will help with future development of the implementation and sequencing.

6.7.4 Operational Testing and Monitoring Period

Prior to initiating OTMP, each major operational component will undergo a short period of testing and commissioning. This short period includes functional performance tests on all features to verify all modes of operation and to verify other relevant contract requirements. Following the testing and commissioning, operational testing and monitoring will be conducted for one full wet season (i.e. June 1 to November 30). If the OTMP begins after the start of a wet season, the OTMP should be extended as needed to encompass a full wet season. Contractor services to be provided during the OTMP will include, but will not be limited to, the following: vegetation management including control of exotics, answering questions on equipment operation; contacting the appropriate vendor/manufacture for response or site visits; arranging and officiating supplemental owner training sessions; and assisting in resolution of functionality issues. The operational testing and monitoring period activities of the construction contractor will be separate from and supplemental to the warranty requirements of the contract. The USACE and SFWMD will share in the responsibilities for conducting water management operations during OTMP.

During OTMP the Federal Government and the non-Federal sponsor will work together closely to identify any features that are not operating as designed. Any features that are not operating as designed will be identified in writing to the District Engineer and the non-Federal sponsor. At the conclusion of OTMP, the District Engineer and the non-Federal sponsor will make a determination as to whether the Project is “operational” as defined in the CERP Master Agreement. Once the Project, or a functional portion of the project, is determined to be operational, the feature(s) will be transferred to SFWMD for OMRR&R.

6.7.5 Flood Plain Management and Flood Insurance Programs Compliance

As CEPP is part of the multi-purpose C&SF program, the non-Federal sponsor agrees to participate in and comply with applicable Federal floodplain management and flood insurance programs consistent with its statutory authority. Not less than once each year, the non-Federal sponsor shall inform affected interests of the extent of protection afforded by the authorized CERP project.

The non-Federal sponsor shall publicize flood plain information in the area concerned and shall provide this information to zoning and other regulatory agencies for their use in preventing unwise future

development in the flood plain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the CERP Project.

The non-Federal sponsor shall comply with Section 402 of WRDA 1986, as amended (33 U.S. C. 701b-12), which requires a non-Federal interest to have prepared, within one year after the date of signing a PPA for the authorized CERP Project, a floodplain management plan. The plan shall be designed to reduce the impacts of future flood events in the project area, including but not limited to, addressing those measures to be undertaken by non-Federal interests to preserve the level of flood protection provided by the authorized CERP Project. As required by Section 402, as amended, the non-Federal interest shall implement such plan not later than one year after completion of construction of the authorized CERP project. The non-Federal sponsor shall provide an information copy of the plan to the Government upon its preparation.

The non-Federal sponsor shall prescribe and enforce regulations to prevent obstruction of or encroachment on the authorized CERP project or on the lands, easements, and rights-of-way determined by the Government to be required for the construction, operation, maintenance, repair, replacement, and rehabilitation of the authorized CERP project, that could reduce the level of protection the authorized CERP project affords, hinder operation or maintenance of the authorized CERP project, or interfere with the authorized CERP project's proper function.

6.7.6 Environmental Commitments

The USACE commits to avoiding, minimizing or mitigating for adverse effects during construction activities by including the following commitments in the contract specifications:

1. The contractor would be required to keep construction activities under surveillance, management, and control to avoid pollution of surface, ground waters, and wetlands. The contract specifications would require the contractor to employ best management practices (BMPs) with regard to erosion and turbidity control.
2. The contractor would be required to prevent oil, fuel, or other hazardous substances from entering the air, ground, drainage, local bodies of water, or wetlands. The contract specifications would require that the contractor adopt safe and sanitary measures for the disposal of solid wastes and would require a spill prevention plan. The contractor would also be required to transport and dispose of any construction and demolition debris in accordance with applicable requirements.
3. The contractor would be required to keep construction activities under surveillance and control to minimize damage to the environment by noise and pollution of air resources.
4. The contractor would be required to keep construction activities under surveillance, management, and control to minimize interference with, disturbance to, and damage of fish and wildlife. The contractor would be required to inform the construction team of the potential presence of threatened and endangered species in the work area, the need for construction conservation measures, and any requirements resulting from Endangered Species Act (ESA) Section 7 consultation.
5. The contractor would be required to take appropriate measures to protect historic, archeological and cultural resources within the work area.
6. The contractor would be required to keep construction activities under surveillance, management, and control to prevent the transfer and spread of invasive species due to construction activities. The contract specifications would require the contractor to employ BMPs and measures to prevent the transfer and spread of invasive species.

In addition, as required under WRDA 2000, the CERP Programmatic Regulations, and current USACE policy, the PDT has taken the following actions:

1. The PDT has identified water to be reserved or allocated for the natural system. **Annex B** addresses this requirement.
2. The recommended plan has been evaluated in light of its potential effects on existing legal sources of water and the level of service for flood protection. **Annex B** addresses this requirement.
3. WRDA 2000, the authorizing legislation for CERP, has now made a formal monitoring plan a requirement for all CERP restoration projects. The Selected Plan includes adaptive management, water quality, hydrometeorologic, and ecological monitoring activities to ensure that the intended purposes of the project would be achieved through long term operations. **Annex D** addresses this requirement.
4. In addition to the project level monitoring plan, the PDT has developed a nuisance and exotic vegetation control plan which strives to either prevent or reduce the establishment of invasive and non-native species within the project area. **Annex D** addresses this requirement.
5. USACE guidance interpreting the WRDA of 2007 (Section 2039), requires preparation of an adaptive management plan for all ecosystem restoration projects. Adaptive management is a formal process for continually improving management policies and practices by learning from their outcomes. In the context of CEPP, the adaptive management plan provides an approach for addressing project uncertainties by testing hypotheses, linking science to decision making, and adjusting implementation of the project as necessary, to improve the probability of restoration success. **Annex D** addresses this requirement.
6. The recommended plan has been evaluated in light of its potential effects on fish and wildlife resources, including effects to Federally listed species. Consultation was initiated with USFWS on August 5, 2013 with completion of a Biological Assessment (BA). A Programmatic Biological Opinion (BO) was received on April 9, 2014, which clearly states that further consultation will be needed when more specific project details are finalized during project design and implementation activities. While this document does not authorize incidental take of three endangered avian species (CSSS, snail kite, and wood stork), it does describe the anticipated effects based on current information. Upon completing ESA Section 7 consultation for each PPA, USACE will undertake the agreed-to avoidance and minimization measures and implementing terms and conditions (TCs). When USACE is closer to constructing phases of CEPP that will affect listed species, USFWS will provide separate consultation document(s) which may authorize incidental take, and provide applicable reasonable and prudent measures (RPMs) and TCs. Additional information can be found in **Annex A**.

6.8 PROJECT ASSURANCES AND SAVINGS CLAUSE SUMMARY

WRDA 2000 requires the inclusion of “Project-Specific Assurances” and “Savings Clause” analyses within each CERP PIR. “Project-Specific Assurances” ensure that the water needed for the natural system to achieve CERP restoration goals is identified and subsequently protected from other potentially competing uses. The “Savings Clause” protects existing legal sources of water supply, such as water for municipal and agricultural uses, and ensures that CERP implementation does not reduce the level of service for flood protection. Refer to **Annex B** for complete documentation of the Project Assurances and Savings Clause analysis for the recommended plan, responsive to the requirements of WRDA 2000.

The analyses for Project Assurances and the Savings Clause followed identification of the recommended plan during plan formulation. In June 2013, the CEPP base condition assumptions established for plan formulation were subsequently revisited and updated to represent the most current information for the analysis of Savings Clause requirements and Project-Specific Assurances. Specifically, the ECB was updated to the 2012EC and the FWO baseline was updated utilizing new information for the Initial Operating Regime Baseline (IORBL1). In the **Annex B** analysis, the potential effects of CEPP are analyzed through comparison of the with-project condition (Alt 4R2) to the without project condition (IORBL1). This comparison segregates the effects of the intervening non-CERP and intervening CERP projects. In addition, **Annex B** also additionally compares Alt 4R2 to the two existing baseline conditions (2012EC and ECB) to inform evaluators of the cumulative potential effects of both CEPP and other intervening CERP and non-CERP projects relative to conditions experienced previously.

6.8.1 Project Assurances: Identification of Water Made Available for the Natural System and Water for Other Water-Related Needs

Section 601(h)(4) of WRDA 2000, entitled “Project-Specific Assurances”, requires CERP PIR reports to:

- identify the appropriate quantity, timing, and distribution of water dedicated and managed for the natural system
- identify the amount of water to be reserved or allocated for the natural system necessary to implement, under State law

The 2003 Programmatic Regulations for the CERP, which were developed in response to statutory requirements in WRDA 2000, further established the processes and procedures to guide the Corps in the implementation of the CERP. Section 385.35(b) of the Programmatic Regulations requires that each PIR identify the quantity, timing and distribution of water to be dedicated and managed for the natural system necessary to meet the restoration goals of the CERP. This evaluation considers the availability of the pre-CERP baseline water and previously reserved water, and whether improvements in water quality are necessary. Section 385.35(b) of the Programmatic Regulations also requires that procedures be developed for identifying water generated by the CERP for use in the human environment and specifies that the quantity, timing and distribution of water for other water-related needs be identified in CERP PIRs.

6.8.1.1 Project Assurances: Identifying Water for the Natural System

The identification of water for the natural system captures the quantity, timing, and distribution of water. Hydrologic model data extracted from the RSM-GL simulations was used to develop the volume probability curves at three specified locations in the regional system: inflows to WCA 3 (along the formulation redline), inflows to ENP, and overland flows to Florida Bay. These specified locations represent the inflows to the three basins where ecosystem benefits (habitat units) are expected as a result of implementation of the recommended plan. Specifically, the volumes of water at the 10th, 50th, and 90th percentiles are identified and compared for the pre-project (future without) condition and the recommended plan (future with project) conditions. The pre-project available water (IORBL1), the with-project total water available (Alt4R2), and the water made available by the project (differences between Alt 4R2 and IORBL1, which were computed for each water year within the RSM period of simulation) for the natural system can be found in **Table 6-15** through **Table 6-17**.

The water made available by the project to WCA 3, ENP and Florida Bay is displayed as a volume probability curve in **Figure 6-22**. Compared to the future without project condition, inflows to WCA 3

with the recommended plan are higher during each of the 40 water years analyzed with the CEPP hydrologic modeling. Similarly, inflows to ENP and Florida Bay are higher than or equivalent to the future without project inflows in 37 and 36 years, respectively, of the 40 water years analyzed. The recommended plan provides a significant net increase in inflow volumes to WCA 3, ENP, and Florida Bay when compared to the future without project condition

Table 6-15. Pre-Project Volume of Water (kAF/yr) Available for the Natural System

Pre-project Water Available for the Natural System (IORBL1)			
Location	<i>Water Available equaled or exceeded 10% of Water Years (kAF)</i>	<i>Water Available equaled or exceeded 50% of Water Years (kAF)</i>	<i>Water Available equaled or exceeded 90% of Water Years (kAF)</i>
WCA 3	839	513	286
ENP	1,771	732	212
Florida Bay	1,969	704	218

Table 6-16. Total Volume of Water (kAF/yr) Available for the Natural System

Total Water Available for the Natural System (Alt 4R2)			
Location	<i>Water Available equaled or exceeded 10% of Water Years (kAF)</i>	<i>Water Available equaled or exceeded 50% of Water Years (kAF)</i>	<i>Water Available equaled or exceeded 90% of Water Years (kAF)</i>
WCA 3	1,404	846	420
ENP	2,187	850	419
Florida Bay	2,113	729	287

Table 6-17. Water Made Available by the Project (kAF/yr) for the Natural System

Water Made Available by the Project (difference between Alt 4R2 and IORBL1)			
Location	<i>Water Made Available equaled or exceeded 10% of Water Years (kAF)</i>	<i>Water Made Available equaled or exceeded 50% of Water Years (kAF)</i>	<i>Water Made Available equaled or exceeded 90% of Water Years (kAF)</i>
WCA 3	647	357	97
ENP	534	256	37
Florida Bay	418	137	-13

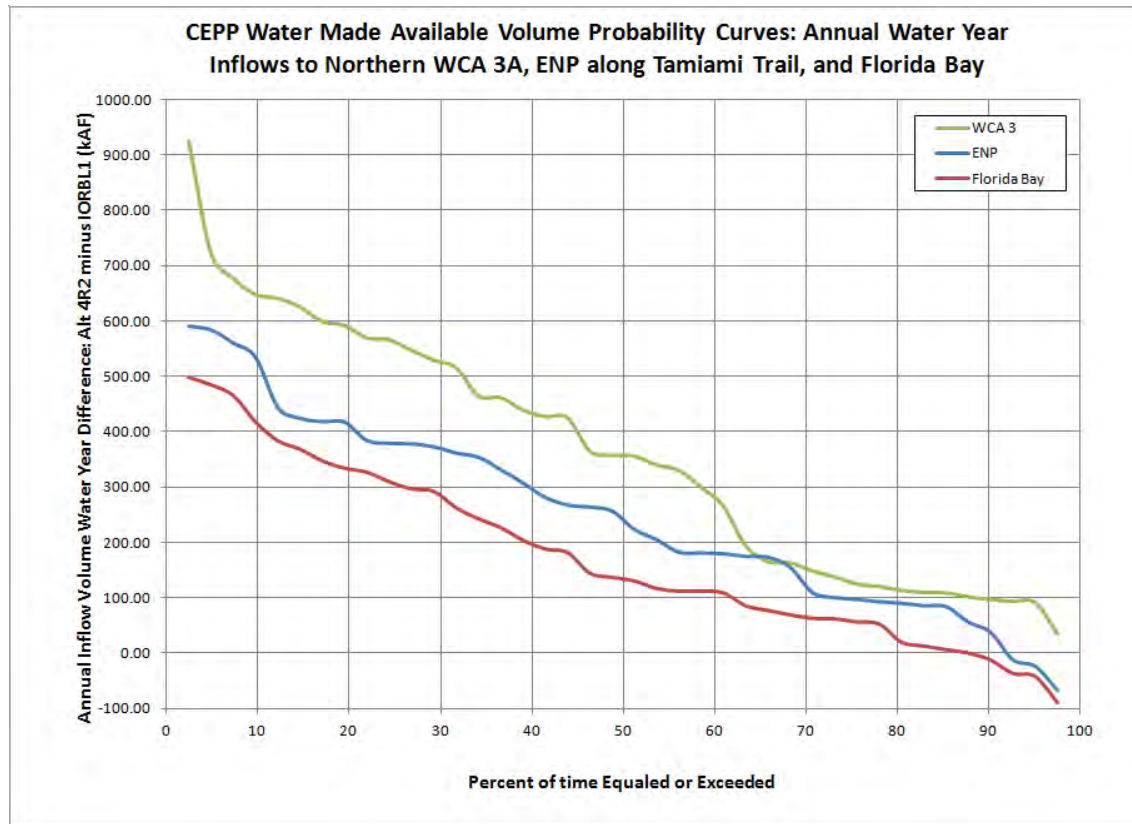


Figure 6-22. CEPP Water Made Available Volume Probability Curves: Annual Water Year Inflows to Northern WCA 3A, ENP along Tamiami Trail, and Florida Bay.

6.8.1.2 Water to be Reserved or Allocated for the Natural System

As required by Section 601(h)(4)(A) of the of the WRDA 2000 and Section 385.35 of the Programmatic Regulations for the Implementation of CERP, the water made available by the project will be protected using the State of Florida's reservation or allocation authority under State law as in represented by **Table 6-17**. The SFWMD has protected the pre-project water for the natural system in the Holey Land and Rotenberger Wildlife Management Areas; WCA 1, WCA 2A, WCA 2B, WCA 3A, and WCA 3B; and ENP through the Restricted Allocation Area Rule for the Everglades and North Palm Beach/Loxahatchee River Watershed water bodies. The combination of protecting the pre-project existing water and the water made available by the CEPP project features is required for the CEPP to achieve its intended benefits.

The SFWMD will protect the water made available by the CEPP project features using its reservation or allocation authority as required by 373.470, Florida Statutes (F.S.). Protection of water made available by CEPP project features is required in order for the SFWMD and the Department of the Army to enter into one or more PPAs to construct the CEPP project features.

6.8.1.3 Project Assurances: Identifying Water Made Available for Other Water Related Needs

The ability of the CEPP project features to provide water to meet other water related needs in the LOSA, LECSA 2, and LECSA 3 was analyzed for the recommended plan. Based on the analysis, the level of service for the LOSA water supply has not improved, nor has it been degraded by CEPP. Therefore, no water was quantified for other water related needs in the LOSA. However, by virtue of additional water being stored in Lake Okeechobee, additional water may reach water users located in the LOSA.

Additional water available for allocation to consumptive use permit applicants is expected to be generated by CEPP in LECSA 2 and LECSA 3. The specific locations, volumes, and/or timing of where this water will be available for withdrawal in LECSA 2 and LECSA 3 will be developed when the following, project-related conditions are met: 1) completion of all CEPP project features and 2) upon a formal determination by the SFWMD's Governing Board that these project features are operational consistent with requirements of the appropriate CEPP PPA. Water will be allocated in accordance with the requirements of the SFWMD's consumptive use permitting rules in effect at that time.

6.8.2 Savings Clause Summary

The Savings Clause analyses, described in Section 601(h)(5) of WRDA 2000, is a means to protect users of legal sources of water supply and flood protection that were in place at the time of enactment of WRDA 2000. Section 385.36 of the Programmatic Regulations requires that CERP PIRs determine if existing legal sources of water will be eliminated or transferred as a result of project implementation. If a project is expected to result in an elimination or transfer of an existing legal source of water, the PIR shall include an implementation plan that ensures a new source of water of comparable quantity and quality is available to replace the source that is being transferred or eliminated. Section 385.36 of the Programmatic Regulations requires that CERP PIRs include analyses to ensure the level of service for flood protection will not be reduced by implementation of the CERP project features.

6.8.2.1 Savings Clause- Water Supply from Existing Legal Sources

Sources of water to meet agricultural and urban demand in the LOSA and LECSAs will continue to be met by their current sources, primarily Lake Okeechobee, the Everglades (including the WCAs), surface water in the regional canal network, and the surficial aquifer system. Sources of water for the Seminole Tribe of Florida and Miccosukee Tribe of Indians of Florida are also influenced by the regional water management system (C&SF Project, including Lake Okeechobee); however these sources will not be affected by the CEPP project. In addition, water supplies to ENP with implementation of the recommended plan exceed FWO project and ECB volumes. Water sources for fish and wildlife located in the Northern Estuaries, WCA 2, WCA 3, Biscayne Bay, and Florida Bay will not be diminished. Therefore, there will be no elimination or transfer as a result of the recommended plan on existing legal sources of water supply for the following:

- Agricultural or urban water supply in the LECSA
- Allocation or entitlement to the Seminole Tribe of Florida under Section 7 of the Seminole Indian Land Claims Settlement Act of 1987 (25 U.S.C. 1772e)
- The Miccosukee Tribe of Indians of Florida
- Water supply for ENP
- Water supply for fish and wildlife

Some of the water utilized by agricultural users in the LOSA from Lake Okeechobee will be transferred to WCA 3 and further south as a result of the implementation of the recommended plan. This transfer is anticipated to occur after the modification of the LORS that will allow full utilization of the A-2 FEB. The recommended plan has identified an additional source of water of comparable quantity and quality that will be available to replace the water sent south. Instead of discharging all water stored in the reservoir to tide via the S-80 or to meet C-44 Basin agricultural water supply demands, as assumed in the future without project IORBL1 baseline condition operations, the recommended plan retains a portion of the water stored in the CERP Indian River Lagoon-South C-44 Reservoir/STA in the regional system for backflow to Lake Okeechobee via the C-44 Canal and raises the Lake Okeechobee stage criteria to allow increased C-44 Canal backflow (**Figure 6-23**). This added operation does not affect existing permitted

allocations within the C-44 Basin. The additional C-44 Canal backflow operations to Lake Okeechobee included in the recommended plan improves the ability to meet existing permitted demands in the LOSA by retaining more water in the regional system and making it available to agricultural users. The operations do not benefit agricultural users in the C-23 Basin. The recommended plan backflow operations capture a portion of releases from the C-44 Reservoir/STA that would otherwise be directed to the Saint Lucie Estuary as excess water.

Specifically, the future without project condition (IORBL1) allows backflow to Lake Okeechobee from the C-44 Canal when S-308 (the Lake Okeechobee discharge structure to the C-44 Canal) is not open for regulatory discharges and when the stage in Lake Okeechobee is 0.25 ft below the base of the 2008 LORS low sub-band (within the baseflow sub-band), which varies between 13.0 and 14.5 ft NGVD seasonally. This operational assumption is consistent with the existing operational protocols of Lake Okeechobee (2008 LORS) and the SFWMD Lake Okeechobee Water Shortage Management (LOWSM) operations. Discharges from the Indian River Lagoon-South project C-44 Reservoir to the C-44 Canal are otherwise limited to environmental deliveries for the St. Lucie Estuary and C-44 Basin agricultural water supply demands during these backflow operations.

The recommended plan operations expand on the IORBL1 backflow to Lake Okeechobee through the following operational changes: (1) backflow to Lake Okeechobee from the C-44 Canal is allowed when S-308 is not open for regulatory discharge and the stage in Lake Okeechobee is below 14.5 ft NGVD (no seasonal variability); and (2) discharges from the Indian River Lagoon-South project C-44 Reservoir to the C-44 Canal are made when the stage in Lake Okeechobee is below the baseflow zone of the 2008 LORS schedule (the bottom of this zone varies seasonally between 12.6 and 13.0 ft NGVD) to provide an additional source of backflow water to Lake Okeechobee. Water captured in the C-44 Reservoir/STA includes excess water conveyed from the C-23 Canal and Basin (approximately 6 kAF on an average annual basis) that is not needed to meet the Indian River Lagoon-South North Fork water reservation target. The recommended plan operational changes result in an average annual increase in C-44 Canal backflow volume to Lake Okeechobee of 57.3 kAF (97.3 kAF in the recommended plan, compared to 40.0 kAF in the IORBL1) and an average annual increase in C-44 Reservoir discharges to the C-44 Canal of 21.3 kAF (37.6 kAF in the recommended plan, compared to 16.3 kAF in the IORBL1).

The transfer of water from Lake Okeechobee to WCA 3 would not be implemented until the CERP C-44 Reservoir/STA, the canal connecting the C-44 Reservoir to both the C-23 Basin and the C-23 Canal, and the CEPP FEB on the EAA A-2 site are operational. If the canal to the C-23 Basin and the C-23 Canal is not operational when the CEPP FEB on the EAA A-2 site is ready to store water, the operations, and ultimately the delivery of water from Lake Okeechobee to the CEPP FEB, may need to be modified to avoid elimination of this portion of the source of water for the LOSA. The water retained in Lake Okeechobee also maintains the level of service for water supply for existing legal users dependent on Lake Okeechobee and its connected conveyance system. Specifically, this includes the agricultural users in the LOSA and the Seminole Tribe of Florida.

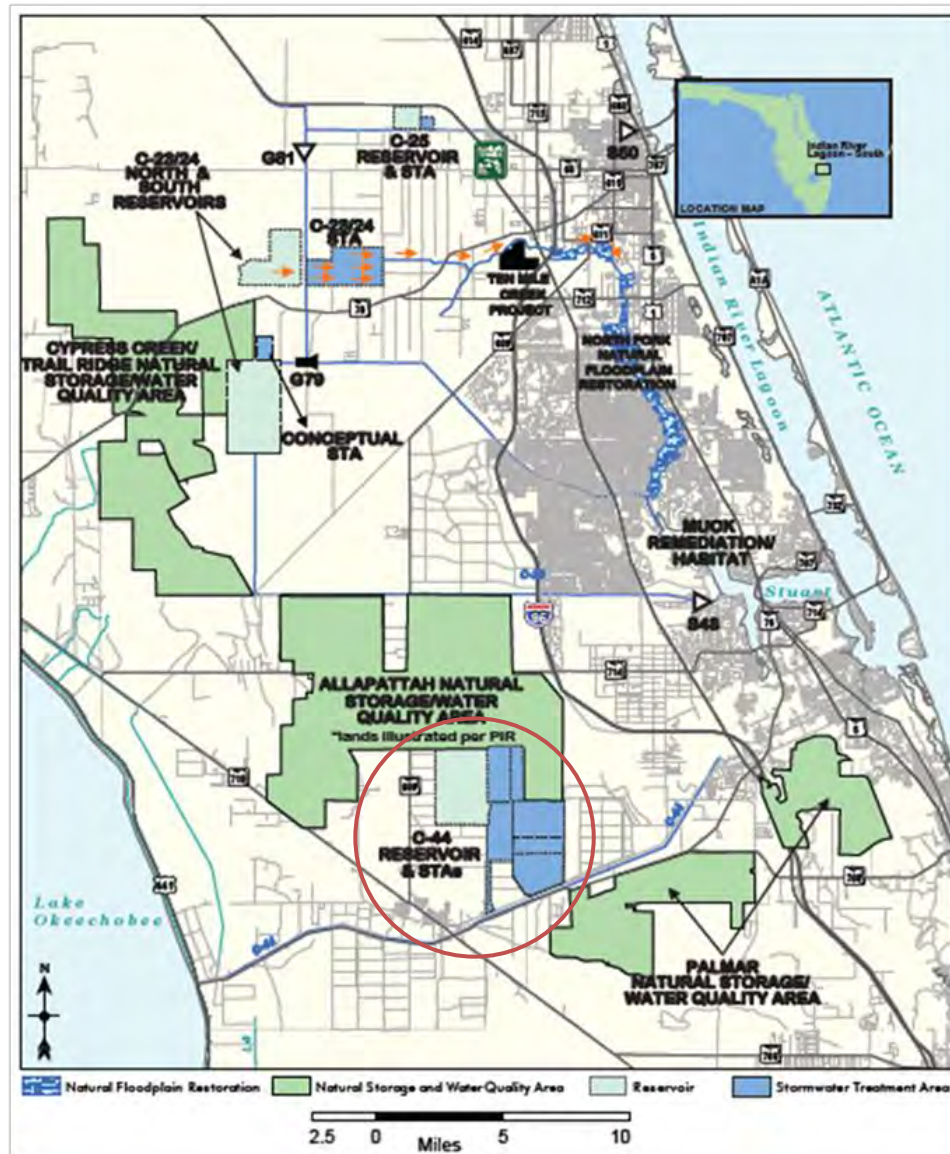


Figure 6-23. Location and Project Features of Indian River Lagoon-South Project. Location of C-44 Reservoir Identified in Red.

6.8.2.2 Savings Clause: Flood Protection

Comparison of canal stages and groundwater levels at key locations (refer to **Annex B** for complete details) indicate that implementation of the project will not reduce the levels of service for flood protection within the areas affected by the project, including the EAA, LECSA 2, and LECSA 3. This includes the areas affected by the project including the Seminole Tribe of Florida's Big Cypress Reservation and the Miccosukee Tribe of Indians of Florida's reservation areas and resort. However, modeling simulation results for one area in the South Dade Conveyance System (RSM-GL cell 4328), specifically located immediately east of the C-111 Canal between the C-103 and C-113 Canals, has shown increased stages relative to the existing base conditions simulated in the RSM-GL. As further described within **Annex B**, the predicted modeled performance for both the future without condition (IORBL1) and Alt 4R2 is likely the result of the calibrated C-111 Canal roughness coefficient likely being set too high and causing higher upstream C-111 Canal stages (and adjacent groundwater levels). The

hydrologic modeling results in this specific case are not representative of the Alt 4R2 performance that is expected following CEPP implementation, and it is recognized that the Alt 4R2 simulated stages along this reach of the C-111 Canal and adjacent agricultural areas would not be deemed acceptable to local stakeholders.

The recommended plan maintains the pre-project flood protection level of service for the EAA by providing the same total pumping capacity at the S-8 (4170 cfs) and S-7 (2490 cfs) pump stations, which provide drainage for the upstream EAA basin. CEPP will maintain this existing design capacity for the S-8 complex through a combination of pump station design modifications, a new hydraulic connection from S-8 to the degraded L-4 Levee, utilization of the existing G-404 pump station (570 cfs design capacity), and leaving the 1-2 mile segment of the Miami Canal as available getaway conveyance capacity during peak flow events. Modifications of the S-8 pump station complex for CEPP operations will be further analyzed during the PED phase of CEPP, including further confirmation that CEPP construction and implementation sequences will not adversely impact the pre-project level of service for flood protection within the EAA.

6.8.3 Project Assurances and Savings Clause Incremental Analysis during CEPP Implementation

CEPP is composed of features which can be grouped into implementation phases. The USACE and the SFWMD will undertake updated project assurances and Savings Clause analyses, if necessary, for the implementation phases that are selected to be included in a PPA or amendment thereto prior to entering into the PPA or PPA amendment. The USACE District Engineer will ensure that Project-Specific Assurances and Savings Clause requirements are met per PPA, per applicable policies and laws. NEPA Documentation will be updated, if applicable, as revisions are made to Water Control Plans and/or Project Operating Manuals associated with each PPA. Compliance with the requirements of the Savings Clause will be maintained throughout the entirety of the CEPP implementation period.

6.9 PROJECT CONCERNS AND CONTROVERSIES

The planning of CEPP and choice of the recommended plan relied on extensive existing scientific and local knowledge of the Everglades, and associated water bodies and estuaries, from the initial defining of the problems and opportunities to the evaluation of alternatives and estimation of potential restoration performance. While the recommended plan is based on this wealth of knowledge, concerns and controversies were documented during the planning process. The CEPP AM Plan (**Annex D, Part 1**) provides a forum to address the concerns and controversies exacerbated by information gaps. The AM Plan provides site and question-specific methods to inform ongoing project adjustments intended to address controversies and continually improve project performance. It should be noted that uncertainties exist in every natural resource management and restoration effort, and it is not unexpected to have controversies associated with a project of CEPP's scale with its proximity and importance to several varied users and supporters. The AM Plan documents a culmination of scientific and local knowledge that has developed over decades of experience, and structured methods for obtaining information to resolve CEPP specific questions, to promote the role of science in restoration and in the management of concerns and controversies.

6.9.1 Incremental Restoration and Future Opportunities

The National Academy of Sciences (National Resource Council 2007) has recommended the implementation of CERP through an incremental adaptive restoration (IAR) process. CEPP has adopted that recommendation and has formulated a solution for an increment of overall restoration of the south Florida ecosystem. Incidentally, there are problems and opportunities remaining. CEPP is not meeting all targets of CERP that are based on the understanding of the pre-drainage Everglades, however CEPP

does provide for significant and substantial restoration of the Everglades ecosystems and achieves approximately 2/3 of the additional water flow into the WCAs that CERP envisioned. Although the recommended plan provides a significant increase in freshwater needed for the restoration of the central Everglades, additional actions are needed to achieve the restoration envisioned in CERP. The actions may include further reduce harmful discharges of freshwater from Lake Okeechobee to the St. Lucie and Caloosahatchee Estuaries and improve estuary habitat for oysters and SAV; further reduce the intensity, frequency, duration, and spatial extent of hypersaline events in Florida Bay. Additional freshwater flows of 500,000 to 700,000 acre-feet per year, annual average, into Shark River Slough and Taylor Slough may be necessary to bring Florida Bay to full restoration. Additionally, the Seminole Tribe of Florida and the Miccosukee Tribe of Indians of Florida have voiced concerns about conditions on Tribal lands in the western basins and the lack of progress on CERP components or other initiatives that would benefit those areas. The AM Plan contains methods for informing optimization of the flows in order to maximize the portion of CERP's vision that CEPP will achieve, i.e., A-2 FEB operations will be optimized based on knowledge gained from the A-1 FEB, which will precede the construction of A-2 FEB, and based on monitoring of the A-2 FEB performance (**Annex D, Uncertainty ID#4**).

6.9.2 Water for Other Water-Related Needs

During the CEPP study, agricultural and municipal/industrial water supply stakeholders expressed concerns about lack of progress on CERP projects intended to increase agricultural and municipal/industrial water supply.

6.9.2.1 Water for Other Water-Related Needs –Lower East Coast

To address this concern, the modeled operations of the recommended plan were optimized to improve water supply performance, increasing the amount of water made available by the project in LECSA 2 (Broward County) and LECSA 3 (Miami-Dade County) without reducing the beneficial effects on the natural system that justify the project. Additional improvements in water supply for the LEC will need to be considered in future increments of CERP that provide additional storage for capturing water currently being sent to tide or other sources. Future CERP increments that provide this additional storage will increase water made available in the regional system for other water related needs.

6.9.2.2 Water for Other Water-Related Needs –Lake Okeechobee Service Area

As initially authorized in WRDA 2000, the CERP EAA Storage Reservoir – Phase I included two conceptual 20,000-acre compartments capable of storing up to 120,000 acre-feet each. Compartment I was to be used to meet EAA agricultural irrigation demands by storing excess EAA runoff. Compartment II was envisioned to capture both Lake Okeechobee regulatory releases and Compartment I overflow and served to supply environmental water deliveries to the WCAs. The CEPP PIR is recommending authorization of a portion of the Compartment 2 functions identified in the initially authorized CERP project. CEPP proposes to implement this component by constructing an approximately 14,000-acre FEB on the A-2 footprint with a maximum storage depth of 4 ft that would provide approximately 60,000 acre-feet of storage by capturing Lake Okeechobee regulatory releases. Operated in conjunction with the State Restoration Strategies' FEB on the A-1 footprint, an additional 210,000 acre-feet of water will be delivered to WCA 3A on an average annual basis.

During CEPP plan formulation and screening, multiple configurations of storage and treatment options were examined, ranging from STAs to 12-foot deep reservoirs. The amount of effective storage in a reservoir is dependent upon its release capabilities, and the release capabilities of reservoirs in the EAA are directly related to the requirement to meet State water quality standards for water delivered to the WCAs. The screening evaluations led to the conclusion that deeper reservoirs are initially able to

capture more water but do not offer the limited water quality treatment capabilities of an FEB, thereby requiring additional STAs. FEBs supplement the treatment efficiency of STAs by reducing the phosphorus concentrations of inflows; consequently, given consideration of water quality treatment requirements, FEBs were able to provide downstream water deliveries at substantially less cost than deeper reservoirs. Therefore, FEB storage components on the A-1 (State Restoration Strategies) and A-2 footprints (CEPP) were recommended as a component of all CEPP final array alternatives.

The recommended plan A-2 FEB does not preclude future increments of CERP planning for additional storage in the EAA to provide additional water supply deliveries for either agricultural irrigation or environmental water deliveries. For example, the A-2 FEB could be converted to an STA or deeper reservoir that works in conjunction with the State's existing STA system to accommodate any future upstream storage and treatment to further increase water deliveries to the Water Conservation Areas, and/or the CERP EAA – Phase I Component I storage functions could be implemented. CEPP is not seeking the deauthorization of the CERP EAA Reservoir Phase – I, recognizing that improvements in water supply for the LOSA will need to be considered in future increments of CERP that provide additional storage for capturing water currently being sent to tide from Lake Okeechobee or capturing water from other sources. Future CERP increments that provide this additional storage will increase water made available in the regional system for other water related needs.

6.9.3 Water Quality and Effects on State Facilities

The recommended plan depends on SFWMD-owned-and-operated water quality treatment facilities (STAs 2 and 3/4) and is integrated with a yet-to-be constructed flow equalization basin (A-1 FEB) included in SFWMD's "Restoration Strategies" project. To achieve restoration objectives for WCA 3A, the recommended plan involves discharges from these STAs to previously un-impacted areas. Concerns were expressed about the effects of the new discharges on water quality and native flora and fauna in those un-impacted areas. To ensure that the recommended plan meets State water quality standards, NPDES discharge permits and Everglades Forever Act watershed permits with associated effluent limits will govern STA discharges from the State facilities.

The recommended plan also increases flows into SRS in ENP subject to the limits for total phosphorus contained in Appendix A of the 1991 Settlement Agreement for U.S. vs. FDER (Case no. 1:88-01886cvHoeveler). Since the compliance determination calculation is inversely proportional to flow, increases in flow will lower the compliance limit. State and Federal water managers expressed concerns that the recommended plan may increase the probability of exceeding the compliance limit and agreed to develop a process and scope for updating, if appropriate, the SRS compliance calculation. Based on current and best available technical information, the federal parties believe at this time that the State Restoration Strategies, implemented in accordance with the state issued Consent Order and other joint restoration projects, are sufficient and anticipated to achieve water quality requirements for existing flows to the Everglades.

6.9.4 Effects on Endangered Species

To achieve restoration objectives, the recommended plan increases the amount of water delivered into areas inhabited by endangered species, including the critically-endangered CSSS. FWS supports the recommended plan and is developing measures to improve the number and distribution of sparrows, but has expressed concerns about operations during nesting periods and effects on sparrow habitat. Upon completing ESA Section 7 consultation for each PPA, USACE will undertake the agreed-to avoidance and minimization measures and implementing TCs. When USACE is closer to constructing

phases of CEPP that will affect listed species, FWS will provide separate consultation document(s) which may authorize incidental take, and provide applicable RPMs and TCs.

6.9.5 Effects of Invasive Species on the South Florida Ecosystem

South Florida contains numerous harmful invasive plant and animal species that have the potential to significantly alter ecological communities throughout the region. Concerns have been expressed that hydrologic restoration efforts to improve the greater Everglades, including the CEPP, may be ineffectual if invasive plant and animal species continue to spread and overtake natural communities of plants and animals. Scientists generally agree that restoring natural system processes and managing those areas provide greater resilience to threats posed by invasive species, refer to **Annex G**.

6.9.6 Water Levels in Water Conservation Area 3A

Sending water through historic sloughs and flow paths in northern WCA 3A, with flows, hydroperiods, and water levels that will restore topographical differences between sloughs, ridges, and tree islands, is paramount to reestablishing a 500,000-acre flowing system through the northern most extent of the remnant Everglades. Restoring topographic diversity will support plant and wildlife species that require higher or lower areas, resulting in a mosaic of habitats that are adapted to variations of topography. There is potential for adverse impacts to species that have become accustomed to the drier conditions associated with Everglades drainage, such as mammals dependent upon upland habitat. Although the historic Everglades contained higher ground, and therefore hosted these species, current drained conditions have expanded the area of high ground. As CEPP transitions the Everglades back to an environment of slowly flowing, shallow water frequently interspersed by higher ridges and tree islands, the species may have to adjust to new landscape patterns. The AM Plan contains monitoring of tree islands, topographic ridges, higher ground wildlife including mammals, sloughs, flows, and slough-inhabiting fish in order to watch for unintended effects of CEPP on these important components of the diverse Everglades, and to provide quick reporting if unintended effects are seen (**Annex D, Uncertainty ID#76**).

6.9.7 Blue Shanty Levee

The Blue Shanty flowway achieves a central goal of CERP and of CEPP: restoration of continuous sheet-flow in the historical direction and re-connection of a portion of WCA 3B to ENP. Concerns have been expressed that advancing Everglades restoration through construction of an additional levee appears counterintuitive to Decomartmentalization goals. Although the levee is controversial, it is necessary to ensure the functioning of a whole levee system in the WCA 3B area and to create the flowway. Construction of CEPP structures in WCA 3B to create the flowway will be conducted in a step-wise fashion in order to test assumptions that all of the structures are needed. The number of structures may be reduced if the on-the-ground data shows that not all are needed; this includes a small possibility that the Blue Shanty flowway could be created without constructing the Blue Shanty levee (**Annex D, Uncertainty ID#77**).

6.9.8 L-67A Water Control Structures Passive versus Control

Passive control features were screened out during the CEPP plan formulation process and will not be further considered during future CEPP implementation. Active control structures, such as the gated culverts along L-67A included in the recommended plan, are required to most effectively address: adaptive management flexibility and system uncertainties (the WCA3A regulation schedule varies seasonally, whereas passive weir elevations are most likely predetermined and static); water quality considerations and constraints; threatened and endangered species considerations within WCA 3A and ENP, including flexibility for management of recession/ascension rate targets; and surface water velocity

considerations within the flowway. Further, the CEPP modeling and preliminary draft POM recognize that the only anticipated operational constraint for the proposed controllable L-67A structures within the Blue Shanty flowway (S-632 and S-633) would be the 9.7 ft NGVD maximum stage elevation for the L-29 Canal based on the planned DOI Tamiami Trail Next Steps Tamiami Trail roadway modifications, and this same constraint would equally apply under a passive weir scenario.

The recommended plan does not preclude future increments of CERP planning for increased hydrological connectivity between WCA 3A and WCA 3B, including potential consideration of passive weir components and other associated additional infrastructure, consistent with features included in the original CERP Recommended Plan.

6.9.9 CERP and CEPP Comparison

Since CERP, twelve years of updated science, new information, improved hydrologic modeling tools and varying water treatment assumptions have led to the differences in CERP components and the recommended plan. There are six CERP (Yellowbook) components which have features or increments included within the components in the recommended plan: (1) EAA Reservoirs; (2) Flow to Northwest and Central WCA 3A; (3) WCA 3 Decompartmentalization and Sheetflow Enhancement; (4) S-356 Pump Station Modifications; (5) L-31 Levee Seepage Management; and (6) System-wide Operational Changes-Everglades Rain Driven Operations. These six CERP components were built upon (additional components of CERP added) as CEPP progressed through the scoping period. Some of the components considered during scoping and detailed analysis were not retained in the recommended plan. Reference **Section 1** and **Section 3** or **Appendix E** for details. A comparison of the CERP/CEPP feature functions, elements and costs was completed for inclusion in the CEPP PIR. The differences between the CERP and CEPP features are illustrated in **Appendix B** (CERP and CEPP Comparison). A descriptive comparison is provided below.

EAA Reservoir (CERP Component G): The CERP EAA storage reservoir improves timing of environmental deliveries to the WCAs including reducing damaging flood releases from the EAA to the WCAs; reduces Lake Okeechobee regulatory releases to estuaries; meets supplemental irrigation demands; and increases flood protection within the EAA.

The CERP proposed EAA Storage Reservoir –Phase I included two conceptual 20,000-acre (6-ft deep) compartments capable of storing up to 120,000 ac-ft each. Compartment I was to be used to meet EAA agricultural irrigation demands by storing excess EAA runoff. Compartment II was envisioned to capture both Lake Okeechobee regulatory releases and Compartment I overflow and served to supply environmental water deliveries to the WCAs. CEPP proposes to implement a portion of the Compartment 2 functions identified in the initially authorized CERP project. CEPP proposes to implement this component by constructing an approximately 14,000-acre FEB on the A-2 footprint with a maximum storage depth of 4 ft, which would provide approximately 60,000 ac-ft of storage by capturing Lake Okeechobee regulatory releases. Operated in conjunction with the State Restoration Strategies’ FEB on the A-1 footprint, an additional 210,000 acre-feet of water will be delivered to WCA 3A on an average annual basis.

The recommended plan A-2 FEB does not preclude future increments of CERP planning for additional storage in the EAA to provide additional water supply deliveries for either agricultural irrigation or environmental water deliveries. For example, the A-2 FEB could be converted to an STA or deeper reservoir and STA that works in conjunction with the State’s existing STA system to accommodate any

future upstream storage to further increase water deliveries to the WCAs, and/or the CERP EAA – Phase I Component I storage functions could be implemented. CEPP is not seeking the deauthorization of the CERP EAA Reservoir Phase – I, recognizing that improvements in water supply for the LOSA will need to be considered in future increments of CERP that provide additional storage for capturing water currently being sent to tide from Lake Okeechobee or capturing water from other sources. Future CERP increments that provide this additional storage will increase water made available in the regional system for other water related needs.

Flow to Northwest and Central WCA 3A (CERP Component II): CERP proposed to increase the capacity of the pump station G-404 (from 1000 cfs to 2000 cfs) to improve the hydropattern restoration in the northwest corner of WCA 3A and increase the amount of water available in the west-central region of WCA 3A to reduce dry out periods. Modifications to the L-4 and L-5 borrow canals and the S-8 pump station were included conceptually as considerations for CERP but not explicitly included in the CERP estimated costs.

CEPP recommends modification to the S-8 pump station complex (potentially including the G-404 pump station, pending further analysis during PED) and degrading of 2.9 miles of the L-4 Levee needed to restore sheetflow and hydropattern restoration of the northwest corner of WCA 3A. CEPP also includes the modifications to the L-4 and L-5 borrow canals to increase conveyance capacity that CERP anticipated may be needed.

CEPP recommended features do not preclude future increments of CERP plan for improved hydropatterns in northwest WCA 3A or increased flows to reduce dryout in west-central WCA 3A.

Decompartmentalization of WCA 3 (CERP Components AA, QQ): CERP component AA provided additional conveyance (3000 cfs) between WCA 3A and WCA 3B (expanding on the assumed 1500 cfs conveyance capacity proposed with the original MWD project) to help in re-establishing pre-drainage hydroperiods and hydropatterns in WCA 3B and the ENP NESRS. Component QQ expanded on these concepts to remove most flow obstructions to achieve unconstrained or passive flow between WCA-3A and WCA 3B (8 passive weirs) and between WCA 3B and NESRS (remove L-29 Canal and Levee) and reestablish the ecologic and hydrologic connection between these areas.

CEPP recommends implementing a portion of these CERP components as outlined below:

- implement 3 of the 6 gated culverts in L-67A which were proposed in CERP (1500 cfs)
- backfill 13.5 miles of the approximately 35 miles of backfilling Miami canal proposed in CERP
- degrade 8 miles of the approximately 24 miles of L-67C levee removal proposed in CERP
- degrade 4.3 miles of the approximately 20 miles of L-29 Levee removal proposed in CERP

CEPP does not preclude implementation of future increments of CERP such as additional backfilling of Miami Canal, additional conveyance features in L-67A or L-67C, and L-68A or additional L-29 Levee removal.

Construction of S-356 A & B Structures (CERP Component FF): CERP proposed the removal of S-356 pump station, relocation of S-357 pump station, addition of two 900 cfs pump stations, a reroute of L-31N borrow canal, relocation of L-31N levee and backfill L-31N canal to improve deliveries to NESRS in ENP and reduce seepage to LECSA 3.

CEPP recommends removal of the existing S-356 pump station and construction of one 1000 cfs S-356 pump station to capture seepage from WCA 3 and deliver to NESRS. CEPP does not require the rerouting of L-31N borrow canal or relocation of L-31N levee, relocation of the S-357 pump station or backfilling of L-31N canal, and does not preclude implementation of these features in future increments.

L-31N Levee Seepage Management (CERP Component V): CERP proposed seepage management along the eastern edge (L-31N) of ENP to eliminate losses due to levee seepage to the East Coast and restore hydropatterns in ENP. It was contemplated that these features would be complimented by the Bird Drive Basin Recharge Area Reservoir (BDRA; CERP Component U) and Dade Broward Levee Improvements (DBL; CERP Component BB) to form the larger Everglades National Park Seepage Management Project (ENPSM).

CERP realized that more detailed planning, design and pilot studies would be conducted to determine the appropriate technology to control seepage from ENP. CERP proposed a Seepage Barrier (Cutoff Wall), a distributed system of groundwater wells and an L-31N (Pilot) project. The seepage management pilot consisted of an approximately 1.7 mile long barrier wall located between S-334 and S-335 with groundwater wells. Since CERP authorization, this pilot project was designed and costs were prepared, but the Pilot Project has not been implemented. Planning efforts on the BDRA component raised concern about the high porosity and transmissiveness of the aquifer, ability of the retention area to hold water onsite for deliveries to the SDCS, and the resulting potential for flooding impacts to urban areas east of the project site. The BDRA design and operation may not be feasible as contemplated in CERP.

CEPP recommends to implement an approximately 4 mile partial depth seepage barrier along the L-31N levee similar to the CERP proposed a cutoff wall. CEPP's wall will meet the intent of reducing seepage losses and restoring hydropatterns in ENP. There are remaining uncertainties about the effectiveness of the recommended plan seepage cutoff wall in maintaining desired stages in marshes of ENP while maintaining flood protection and canal stages to the east without limiting water availability to water users and Biscayne Bay. Therefore, additional analysis of the CEPP seepage cutoff wall will be conducted as an early phase in PED.

The CEPP recommended seepage barrier wall does not preclude future increments of the CERP plan for seepage management along eastern edge of ENP or Pennsuco Wetlands, additional restoration of hydroperiods in ENP, enhancement of hydroperiods in Pennsuco Wetlands, or any other CERP seepage management components.

Everglades Rain Driven Operations (CERP Component H): The CERP rain-driven operational concept is a basic shift from the current operational practice, which uses calendar-based regulation schedule for the WCAs. The rain-driven operational concept includes rules for importing and exporting water in order to mimic a desired target at key locations throughout the Everglades system. The target stages are based upon an estimate of the more natural water level response to rainfall.

CERP proposed operations that covered WCA 2, WCA 3 and ENP. Modifications to the regulation schedules for WCAs 2A, 2B, 3A, 3B and the current Rainfall Delivery Formula for ENP were proposed with CERP to implement rain-driven operations for all of these areas. These new operational rules were intended to improve timing and location of water depths in the WCAs and ENP and to restore more natural hydropatterns. Regulation schedules, also referred to as flood-control schedules, typically specify the release rules for a WCA based on the water level at one or more key gages. Regulation

schedules do not typically contain rules for importing water from an upstream source. The schedules also repeat every year and make no allowance for inter-annual variability. The rain driven operational concept includes rules for importing and exporting water from the Water Conservation Areas in order to mimic a desired target stage hydrograph at key locations within the Everglades system. The target stage hydrographs mimic an estimate of the more natural (pre-drainage Everglades) water level response to rainfall.

CEPP recommends to implement an Everglades Rain Driven Operations schedule for WCA 3. WCA 3A outflows are currently operated in accordance with the 2012 WCAs, ENP, ENP-South Dade Conveyance System Water Control Plan. More specifically, WCA 3A outflows adhere to the Rainfall Plan for ENP (Rainfall Plan). Under CEPP, the Rainfall Plan would be revised but still be comprised of two distinct components: (1) a regulatory component operated in accordance with the 2012 WCA 3A Interim Regulation Schedule, and (2) an environmental rainfall component that consists of Rainfall Driven Operations (RDO). The RDO is currently conceptual in nature and variables such as the target stages have not yet been developed.

The CEPP WCA 3A RDO would employ a mechanism that resists the stage going into Zone A of the WCA 3A Interim Regulation Schedule. As part of a system-wide optimization, the WCA 3A RDO would be constrained with the amount and timing of inflows upstream, and the restoration targets and constraints in WCA 3B and the ENP (these have not yet been developed for WCA 3B or ENP). It is recognized that transitioning to RDO would likely be a lengthy and complex process for the USACE, but a necessary step to achieve the proposed restoration objectives within WCA 3A and ENP.

CEPP RDO does not preclude future increments of CERP RDO.

The CERP and CEPP comparison has been completed in compliance with the CERP Programmatic Regulations. The recommended plan does preclude any future components of CERP from authorization or implementation.

6.10 RISK AND UNCERTAINTY

Issues of risk and uncertainty are inherent in the planning, design and implementation of the recommended plan. An overview of feasibility, forecasting, and implementation issues is presented in this section. The role of CEPP's adaptive management strategies in addressing risk and uncertainty is discussed in the following sections and can be reviewed in more detail in the CEPP AM Plan (**Annex D, Part 1**). Monitoring and adaptive management strategies will continue to evaluate and address issues pertaining to construction sequencing, ecosystem connectivity, and potential for early restoration benefits. Such evaluations will continue to reduce uncertainties and increase the likelihood for overall project success.

6.10.1 Planning

Two primary areas of focus for this risk and uncertainty evaluation are simulation model confidence and project performance. This analysis addresses the reliability and accuracy of the assumptions and tools used to forecast with- and without-project conditions.

6.10.1.1 Hydrologic Simulation Tools

The RSM-GL and RSM-BN regional models and the Dynamic Model for Stormwater Treatment Areas (DMSTA) were approved for use through the current USACE Engineering software validation process. The validation reviews were conducted by qualified senior USACE engineers with support from technical

experts, and USACE approval indicates that that software is technically/theoretically sound and approved for use by knowledgeable and trained staff for purposes consistent with the software's purposes and limitations. These modeling tools were used to evaluate the effects of the final array of alternatives.

Model building/generic software tools (STELLA, Excel, etc.) are generally allowed for use under the validation process, but these tools are not pre-validated and additional USACE Agency Technical Review (ATR) of the inner workings of the model is required. ATR is conducted by a qualified senior team from a separate USACE District than involved in the project. All other CEPP modeling tools, which were applied during preliminary screening efforts, were approved for use in CEPP through the ATR process.

The CEPP modeling strategy identified these tools as the best models available for assessment of the hydrologic and water quality effects of CEPP within the Everglades system. Additional information on the USACE model review process and the CEPP modeling strategy is provided in **Appendix A**.

6.10.1.2 Uncertainty of Project Benefits

6.10.1.2.1 Predicting Ecosystem Response to Hydrologic Change

There is no standardized methodology for predicting ecosystem benefits that result from habitat restoration projects. For the USACE planning process, the most apparent adverse risks of employing a given benefit estimation methodology are: 1) the most effective project alternative is not selected for implementation, 2) the selected project provides significantly fewer benefits than estimated, or 3) the selected project significantly harms the resource. An uncertainty analysis is typically used to reduce the likelihood of the adverse outcomes listed above. The CEPP team has reviewed the CEPP planning model to document qualitatively and, where possible, quantitatively assessments of how well the CEPP planning model represents the anticipated ecosystem benefits of the alternatives. This was conducted to ensure that decision-makers are informed about uncertainties that affect interpretation of planning model outputs.

For CEPP, the two most apparent sources of uncertainty in the overall benefits quantification arise from the use of regional hydrologic models for the prediction of changes in hydrology and the use of performance measures to represent the ecological significance of the predicted change in hydrologic conditions. The CEPP Planning Model underwent peer review per EC 1105-2-412, 31 May 2011, (Assuring Quality of Planning Models) and was recommended for single-use by the National Ecosystem Restoration Planning Center of Expertise (ECO-PCX) on July 24, 2013. The HQUSACE Model Certification Panel approved the CEPP Planning Model on August 13, 2013. During review of the application of the model a recommendation was received to develop a possible range of potential outcomes (i.e. Habitat Units) and associated frequencies of producing those outcomes to establish confidence limits. Development of confidence limits was not included in the CEPP planning model. Additional analyses were conducted to specifically evaluate how error in the hydrologic model could reflect alternative results' reliability. Inclusion of these additional analyses in **Appendix G** did not influence the overall rank of alternative performance, indicating that the developed methodology is robust. Additional analyses documenting the capabilities and limitations of the CEPP planning model can be found in **Appendix G**.

6.10.1.2.2 Lake Okeechobee Regulation Schedule

CEPP benefits gained from sending new water south from Lake Okeechobee are derived in part from operational refinements that can take place within the existing, inherent flexibility of the 2008 LORS,

and in part with refinements that are beyond the schedule's current flexibility. The CEPP modeling effort provided reasonable and likely implementable future operating conditions under CEPP that can be translated to an implementable regulation schedule. Since USACE has authority to do a study to revise LORS when needed and implement it after compliance with NEPA and other rules and regulations, there is a high likelihood that the LORS will be modified so that benefits of CEPP PPA New Water will be achieved. Approximately 60% of the overall CEPP benefits are attributed to sending new water south from Lake Okeechobee, based on the implementation analysis in **Section 6.7.1**. In the absence of operational refinements to Lake Okeechobee, such a drastic reduction in benefits would not be likely since it is expected that most of these benefits can be achieved under the inherent flexibility of the 2008 LORS schedule.

At the start of the CEPP plan formulation process, the FWO project condition adopted the 2008 LORS as a reasonable assumption since it would be speculation to change the operations plan based on future actions occurring independent of CEPP (e.g. HHD rehabilitation or CERP Band 1 project construction. See **Section 6.1.1**. The USACE had also determined during CEPP scoping that the expedited CEPP planning process and PIR would not be the mechanism to propose or conduct the required NEPA evaluation of modifications to the LORS. Due to these actions occurring independent of CEPP, even if a NEPA evaluation and modifications to the LORS occurred with this CEPP PIR, the actual LORS at the time of PPA New Water implementation might differ from the regulation schedule used in the NEPA analysis. Depending on the ultimate outcome of these future LORS revisions, including the level of inherent operational flexibility provided with these revisions, CEPP implementation may still require further LORS revisions prior to CEPP PPA New Water implementation. However, NEPA analysis will not be required if future LORS revisions prior to CEPP incorporate the additional flexibility needed for CEPP.

The implementation plan approach of using multiple PPAs led to the identification of separable elements for implementation. These PPAs include the construction of logical groupings of plan elements that maximize benefits to the extent practicable consistent with project dependencies. These groupings include a PPA of project features in northern WCA 3A (PPA North), a PPA of project features in southern WCA 3A, 3B and ENP (PPA South), and a final PPA which provides the new water and required seepage management that benefits the entirety of the study area (PPA New Water). PPA North and South are both justified as stand-alone elements, but PPA New Water requires the implementation of both PPA North and PPA South prior to operation of the PPA New Water components. PPA New Water is the only PPA that will require revisions to the LORS. Since NEPA analysis and Savings Clause analysis will be revisited and updated, if necessary, prior to construction of PPA New Water components (refer to **Section 6.7.1.8**), there is little risk for expending PPA New Water funds without realizing benefits. Consequently, in the unlikely event that LORS revisions as described in CEPP are untenable, either a modified regulation schedule will be proposed that provides the projected outcome of CEPP prior to the execution of PPA New Water, or PPA New Water would not be executed and neither the costs nor benefits from this PPA would be realized. However, depending on the ultimate outcome of these future LORS revisions, including the level of inherent operational flexibility provided with these revisions, CEPP implementation may still require further LORS revisions to optimize system-wide performance and ensure compliance with Savings Clause requirements.

6.10.1.3 Sea Level Change

The effects of sea level change were analyzed per (EC 1165-2-212). This analysis looked at the effect of sea level change on the benefits predicted for the recommended plan. See **Annex I** for detailed analysis. The results indicate that within a 50-year period the average annual net project benefits are likely to be reduced by less than 8 percent in comparison to the projected net annual average project benefits

estimated assuming no sea level rise. This relatively moderate decrease in average annual project benefits occurs largely because of closely matching habitat losses under the FWO condition. However, when considering total freshwater wetland habitat, sea level rise will significantly reduce this habitat area. For instance, under the high rate sea level change scenario, total project area habitat function will be reduced by 8, 21, and 37 percent at the 20, 50, and 100-year timelines, respectively. The total habitat function is significantly higher with CEPP in place under any SLR scenario and timeframe when compared to the FWO condition. The ability of the CEPP project to provide significantly higher habitat functionality when compared to the FWO is partly a function of the increase in freshwater that reduce the loss of freshwater habitat within ENP. The most significant uncertainties associated with the sea level change impact projections provided here are: 1) the lag time between when freshwater wetlands become significantly impaired due to salinity impacts and when replacement estuarine habitat becomes fully productive, and 2) the degree to which project related water reservations will protect natural system water supplies given SLR related demand from the developed areas.

6.10.2 Design and Implementation

The feasibility assessment includes evaluations of design and construction issues, such as project scheduling, technology, construction cost estimate contingencies, land availability, and hazardous or toxic waste. AM is included in the CEPP implementation schedule to reduce uncertainties during implementation using on-the-ground data.

6.10.2.1 L-31N Seepage Barrier Demonstration Project

A seepage barrier from Tamiami Trail southward approximately 4.2 miles along the L-31N Levee is critical for balancing ecological performance, including in ENP and Biscayne Bay, and water supply and flood control performance of the recommended plan. There is an existing 2-mile wall in the same vicinity that was constructed by the Miami-Dade Limestone Products Association (Association) in July 2012 as mitigation to offset authorized impacts under a CWA Section 404 permit (**Figure 6-24**). If the 2-mile wall is effective, the Association may extend the seepage wall to the south up to an additional 5 miles, if approved by the Lake Belt Mitigation Committee. Since the capability and effectiveness of the existing seepage wall to mitigate seepage losses from ENP remains under analysis, the recommended plan conservatively includes a seepage wall of the length and depth necessary for CEPP project seepage management requirements, in the event CEPP construction is necessary.



Figure 6-24. L-31N Seepage Walls

There are remaining uncertainties about the effectiveness of the recommended plan seepage wall in maintaining desired stages in marshes of ENP while maintaining flood protection and canal stages to the east without limiting water availability to water users and Biscayne Bay. Therefore, additional analysis of the CEPP seepage wall will be conducted as an early phase in PED. See **Section 6.10.1.2**, the Engineering Appendix (**Appendix A**), the analyses required by WRDA 2000 (**Annex B**), and the CEPP Adaptive Management Plan (**Annex D Part 1**) for more detail about the remaining uncertainties and suggested analysis to be completed to determine the need for and extent of a CEPP seepage barrier wall. The CEPP AM Plan contains provisions for a pre-PED assessment of existing data, which should include the Association's seepage wall monitoring results, U.S. Geological Survey (USGS) hydrologic data, and other relevant information, to determine if a CEPP seepage wall is still needed in this area given the presence of the Association's wall and changes that may occur in the future before CEPP is implemented (**Annex D, Uncertainty ID#35**). In addition, there will be an assessment of whether the existing seepage barriers have unintentionally directed seepage flow north to the 'triangle area' where CEPP is not currently planning to construct a seepage barrier. If this pre-PED assessment concludes that CEPP's seepage barrier would be needed, then further assessment will take place as part of PED to determine the length and extent of the barrier. Additionally, the CEPP AM Plan strategy on this topic includes monitoring to check performance and inform future decision-making regarding seepage management in the area as needed.

Additionally, during PED, a technical evaluation of the existing seepage barrier wall will be conducted to determine its capability and acceptability to meet the CEPP project requirements. Although CEPP proposes a similar feature, CEPP would not construct a new feature if the existing wall achieves CEPP project requirements. The existing wall is currently the Association's responsibility. If the existing wall, located on SFWMD property, and constructed in a C&SF Project feature, is necessary for CEPP implementation, it would have to become a project feature. The Association would thereafter be relieved of responsibility for the wall and operation, maintenance, repair, rehabilitation, and replacement will become a sponsor responsibility associated with the Federal project. The Association will continue to receive mitigation credit for the constructed portions of the wall pursuant to the Lake Belt Mitigation Plan.

If it is determined that the existing wall does not meet CEPP project requirements, then CEPP will have two options in order to proceed. The project can either retrofit the wall to bring it up to USACE standards and make the wall a project feature or construct a new wall as proposed in the recommended plan at a separate location within the same vicinity. The CEPP seepage wall will not adversely impact compensatory mitigation but will enhance and provide additional environmental benefits to ENP. CEPP would proceed to cost share with the local sponsor on both the construction and OMRR&R of the CEPP wall. CEPP will benefit from continued analysis of the monitoring data collected for the existing seepage wall through gained knowledge of how the barrier affects hydroperiod in the ENP and effects on seepage along the project footprint. Additionally, to the extent it functions properly and addresses CEPP requirements, CEPP may save costs by not constructing a duplicate feature or possibly retrofit the existing wall to bring it up to the standard of the USACE, if feasible. The extent to which additional seepage management features will be constructed along L-31N as part of CEPP will be determined during the PED phase.

6.10.2.2 Blue Shanty Levee

The initial location for the Blue Shanty Levee (L-67D) was aligned along the existing Blue Shanty canal since that area is an existing alteration in the landscape. The northern end of the proposed levee was

angled slightly westward to avoid impacting several large tree islands that exist north of the terminus of the Blue Shanty Canal. Although the initial location of the new levee generally along the Blue Shanty Canal minimized impacts to unexcavated wetlands, it created other concerns: 1) it was directly in the center of the western 2.6 mile Tamiami Trail Next Steps bridge and would fail to fully take advantage of the new bridge span opening, and 2) excluding the tree islands would result in a levee alignment that intercepts the desired southerly flow path dictated by landscape patterning in the area. Shifting the levee to include the tree islands within the flowway would provide an opportunity to utilize an adaptive management approach to address the uncertainties regarding restoration of water flows and levels throughout WCA 3B and maximize the benefits of the downstream bridge span opening.

The proposed alignment (**Figure 6-25**) was identified that shifts the southern terminus of the levee to the east to align with the eastern end of the bridge span opening, includes the tree islands within the 3B flowway and follows the landscape directionality to its northern most intersect the L-67A Levee. Inclusion of the tree islands within the 3B-W flow-way will provide restorative water depths, flow velocities, and flow directions, onto an area of degraded Ridge and Slough landscape.

The current proposed levee alignment spanning to the terminus of the 2.6 mile Tamiami Trail Next Steps bridge opening has concerns regarding impacts to undisturbed wetlands areas due to the length of the levee. The wetlands in the current location are in better condition than wetlands along the Blue Shanty canal. A levee in proximity of the Blue Shanty Canal would be approximately 6.25 miles long and would impact 85 acres while the proposed location would be approximately 8.5 miles long and impact 113 acres. The changes for the flow-way are: L-67D Current - 113 acres (8 miles long) versus the Blue Shanty - 85 acres (6.25 miles). Both were calculated using approximately 110 ft width for the construction corridor.



Figure 6-25. Location of Blue Shanty levee

The alignment and dimensions of the levee will be further investigated as the project progresses into the PED phase. Construction of CEPP structures in WCA 3B to create the flowway will be conducted in a step-wise fashion in order to test assumptions that all of the structures are needed. The number of structures may be reduced if the on-the-ground data shows that not all are needed; this includes a small

possibility that the Blue Shanty flowway could be created without constructing the Blue Shanty Levee (**Annex D, Uncertainty #77**).

6.10.2.3 Project Schedules

Implementation of CEPP will occur over many years and include many actions by USACE and SFWMD. There is extensive uncertainty regarding when construction will commence and complete; influenced by funding, legal requirements, permitting, and authorization among other factors. In order to manage expectations and uncertainties regarding the project schedule, the recommended plan is composed of implementation phases that include the construction of logical groupings of recommended plan features, agreed upon by the USACE and SFWMD.

6.10.2.4 Construction Cost Estimate Contingencies

A statistical analysis of cost risk was performed in **Appendix B**.

6.10.2.5 Land Availability and Acquisition Issues

Most land required for the project was previously acquired under the C&SF Project. Most of the new lands required for the project, but not already included in the C&SF project are already owned by the SFWMD – the 14,521 acre A-2 site in the EAA. An additional 146 acres owned by the State of Florida and SFWMD is needed for a canal to connect the Miami Canal to the A-2 site.

Uncertainties surrounding land acquisition include keeping on schedule to complete acquisition of estates in order to meet construction schedules; the potential for any unknown utility relocations not identified during the study; the potential presence of minerals and mineral rights on lands to be acquired; the potential for hazardous, radioactive, or toxic materials on the lands to be acquired.

6.10.2.6 Residual Agricultural Chemicals and Hazardous or Toxic Waste

The 14,521 acre A-2 site that is proposed for a FEB was surveyed for hazardous, toxic, and radioactive waste (HTRW) as well as residual agricultural chemicals in the cultivated soils. The FDEP and FWS reviewed the results of the environmental audits and risk assessments and concluded that the required remediation actions have been completed and that the detected residual agricultural chemicals in cultivated soils are present at concentrations that do not present a risk to humans or environmental receptors. Since the A-2 site is currently under cultivation, close out environmental audits and sampling will be performed again prior to certification of the lands. Consistent with the September 14, 2011 Memorandum from Jo-Ellen Darcy, ASA (CW), unless addressed as part of normal engineering and construction activities, SFWMD, the non-Federal sponsor, will be 100% responsible for the costs of all actions taken due to the presence of residual agricultural chemicals, at no expense to the Federal Government and any future costs associated with the presence of residual agricultural chemicals at the Federal project site are 100% a SFWMD cost and responsibility. As stated in the September 14, 2011 Memorandum, normal project engineering and construction activities will remain part of total project cost, provided that these are the same activities required to implement the project features absent the presence of residual agricultural chemicals. More specifically:

- SFWMD will ensure the development, planning and execution of Federal, State, and/or locally required response actions to address residual agricultural chemicals, including any soil management activities, at 100% SFWMD cost.
- SFWMD is 100% responsible for costs of characterization of the project lands necessary to determine an appropriate response action for the residual agricultural chemicals.
- Removal of soils that are RCRA hazardous waste are a 100% SFWMD responsibility.

- SFWMD is 100% responsible for the costs of characterizing the project lands in preparation for conducting a response action for removal of soils that are identified as hazardous waste.
- SFWMD will regularly update the District Commander regarding its progress in developing and ensuring execution of the required response actions.
- SFWMD agrees that any future costs associated with the presence of residual agricultural chemicals remaining on Federal project lands are 100% SFWMD responsibility, including any potential liability related to their presence. This includes future responsibility for any disposal units.
- SFWMD acknowledges that the Jacksonville District will not conduct actions to address residual agricultural chemicals during the operation, maintenance, repair, replacement and rehabilitation phase of the project.
- If the Corps determines in the future, based upon coordination with resource agencies, project soils containing residual agricultural chemicals would need to be removed or isolated, and SFWMD requests incorporation of impacted soils into project features or requests that the materials remain on site in a disposal unit, SFWMD will demonstrate compliance with the September 14, 2011 Memorandum from Jo-Ellen Darcy, ASA (CW), and the Corps will demonstrate compliance to HQUSACE prior to execution of the work.

A discussion of the CERP Residual Agricultural Chemical policy requirements as it applies to this project is in **Appendix C.2.2**. HTRW reports, sampling protocol, and correspondence are included in **Annex H**.

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CENTRAL EVERGLADES PLANNING PROJECT (CEPP)
RECOMMENDED PLAN – ALTERNATIVE 4R2

STORAGE AND TREATMENT

- Construct A-2 FEB and integrate with A-1 FEB operations
- Lake Okeechobee operation refinements

DISTRIBUTION/CONVEYANCE

- Diversion of L-6 flows, Infrastructure and L-5 canal improvements
- Remove western ~2.9 miles of L-4 levee west of S-8 (3,000 cfs capacity)
- Construct 360 cfs pump station at western terminus of L-4 levee removal
- Backfill Miami Canal and Spoil Mound Removal ~1.5 miles south of S-8 to I-75

DISTRIBUTION/CONVEYANCE

- Increase S-333 capacity to 2,500 cfs
- Two 500 cfs gated structures in L-67A, 0.5 mile spoil removal west of L-67A canal north and south of structures
- Construct ~8.5 mile Blue Shanty levee in WCA 3B, connecting L-67A to L-29
- Remove ~8 miles of L-67C levee in Blue Shanty flowway (no canal back fill)
- One 500 cfs gated structure north of Blue Shanty levee and 6,000-ft gap in L-67C levee
- Remove ~4.3 miles of L-29 levee in Blue Shanty flowway; construct gated spillway east of Blue Shanty levee at terminus of western bridge
- Tamiami Trail western 2.6 mile bridge and L-29 canal max stage at 9.7 ft NGVD 29 (FUTURE WORK BY OTHERS)
- Remove entire 5.5 miles L-67 Extension levee, backfill L-67 Extension canal
- Remove ~6 mile Old Tamiami Trail road (from L-67 Ext to Tram Rd)

SEEPAGE MANAGEMENT

- Increase S-356 pump station to ~1,000 cfs
- Partial depth seepage barrier south of Tamiami Trail (along L-31N)
- G-211 operational refinements; use coastal canals to convey seepage

Note: System-wide operational changes and adaptive management considerations will be included in project.

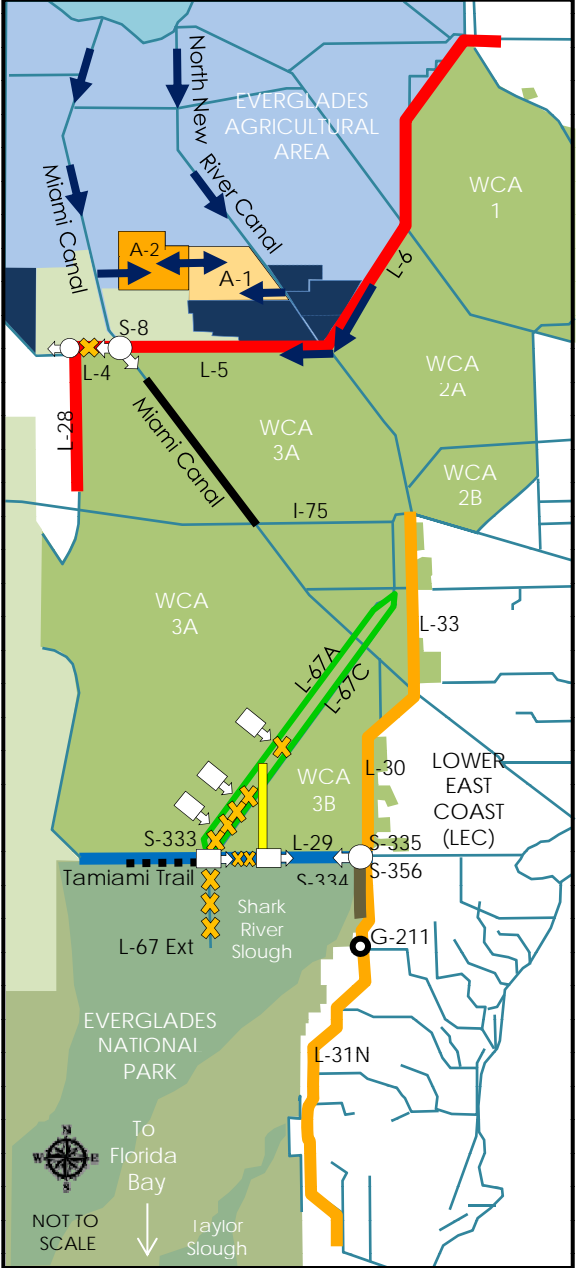
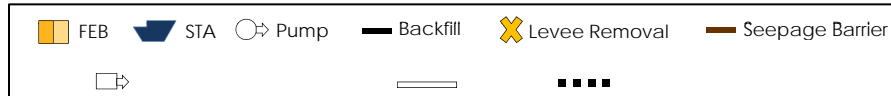


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7.0 ENVIRONMENTAL COMPLIANCE

7.1 PUBLIC INVOLVEMENT

7.1.1 Scoping

A National Environmental Policy Act (NEPA) scoping letter dated November 23, 2011 was used to invite comments from Federal, State, and local agencies, affected Indian Tribes, and other interested private organizations and individuals. Scoping comments were accepted through January 20, 2012. A Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) for the Central Everglades Planning Project (CEPP) was published in the Federal Register (FR Volume 76, Number 232) December 2, 2011. Public scoping meetings were held December 14, 2011 in Plantation, Florida and December 15, 2011 in Clewiston, Florida. A copy of the scoping letter, NOI, scoping letters received and a comment response matrix are located in **Appendix C.3**. Five NEPA public workshops were also held: December 10, 2012 in Estero, Florida, December 11, 2012 in Homestead, Florida, December 12, 2012 in Clewiston, Florida, December 13, 2012 in Stuart, Florida and December 18, 2012 in Coconut Creek, Florida to present the preliminary final array of alternatives.

7.1.2 Agency Coordination and Public Involvement

Project Delivery Team (PDT) membership consists of those individuals designated by the U.S. Army Corps of Engineers (USACE) and the South Florida Water Management District (SFWMD), the implementing agencies, and representatives designated by other governmental agencies or Tribes. Interagency participation is encouraged to take advantage of technical skills and knowledge of other agencies. Several Federal, Tribal and state agencies are active members of the PDT. Participants include United States Environmental Protection Agency (USEPA), United States Fish and Wildlife Service (USFWS), United States Geological Survey (USGS), National Park Service (NPS), Miccosukee Tribe of Indians of Florida, Seminole Tribe of Florida, Florida Fish and Wildlife Conservation Commission (FWC), Florida Department of Agriculture and Consumer Services and Florida Department of Environmental Protection (FDEP). Representatives from Okeechobee, Glades, Martin, Palm Beach, Broward, Miami-Dade, and Monroe Counties are also active participants. Designated public comment periods provide opportunities for public participation during PDT meetings.

Agencies including the Department of the Interior, National Park Service, U.S. Fish and Wildlife Service and South Florida Water Management District, the local sponsor, were asked at the beginning of the planning process to become cooperating agencies under NEPA for the Central Everglades Planning Project (CEPP). Due to the robust interagency process planned for this project, no agencies wished to enter into a cooperating agency agreement, however, these agencies were fully involved in all phases of the CEPP planning process.

Public outreach efforts for CEPP began early in the planning process. Due to intense public, political, and media interest in restoration of the south Florida ecosystem, public participation is a critical component of the development of this Project Implementation Report (PIR). Workshops were held at key phases of CEPP planning process during the formulation of project objectives, management measures, and evaluation of alternatives. **Table C.3.2-1** in **Appendix C.3** summarizes all the agency and public meetings.

The U.S. Department of the Interior (DOI) Office of Everglades Restoration Initiatives South Florida Ecosystem Restoration Task Force (Task Force) Working Group (WG) hosted a series of public workshops and provided input to USACE. Workshops have also been held by the Task Force's Science Coordination Group (SCG) and the Water Resources Advisory Commission (WRAC). Presentations have also been

provided to SFWMD Governing Board, the South Florida Ecosystem Restoration Task Force, and the South Florida Ecosystem Restoration Task Force Joint Working Group and Science Coordination Group, Water Resources Advisory Commission, Committee on Independent Scientific Review of Everglades Restoration Progress (CISRERP), Ten County Coalition, and Biscayne Bay Regional Restoration Coordination Team Meetings.

Table C.3.2-1 in **Appendix C.3** provides a list of interagency coordination and public presentations conducted throughout the planning process for CEPP. A summary of public participation as required by NEPA is described in **Section 7.1.1** above. In addition to NEPA, coordination with agencies as required by other Federal laws, statutes, and Executive Orders has been conducted. See **Appendix C.3** for agency coordination with the FDEP, National Marine Fisheries Service (NMFS), State Historic Preservation Officer (SHPO), United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), and USFWS. Meetings were also held individually with representatives of the Miccosukee Tribe of Indians of Florida and the Seminole Tribe of Florida.

7.1.3 Draft Project Implementation Report and Environmental Impact Statement

The Notice of Availability (NOA) of the CEPP Draft PIR/EIS was published in the Federal Register (FR Volume 78, Number 169) August 30, 2013 and mailed to interested stakeholders to begin the 64 day review period. The Draft PIR/EIS was filed in accordance with ER-FRL-8994-7, Amended Environmental Impact Statement Filing System Guidance for Implementing 40 CFR 1506.9 and 1506.10 of the Council on Environmental Quality's Regulations Implementing the NEPA and made available for public and agency review. Five NEPA Draft PIR/EIS public meetings were held September 16, 2013 in Plantation, Florida, September 17, 2013 in Fort Myers, Florida, September 18, 2013 in West Palm Beach, Florida, September 19, 2013 in Stuart, Florida and September 25, 2013 in Homestead, Florida. A copy of the NOA is located in **Appendix C.3**.

7.1.4 Comments and Responses

A comment response matrix detailing comments received during the NEPA scoping process (**Table C.3-1.1**) and other public comments received during the planning process along with USACE responses are included within **Appendix C.3**. **Table C.3.2.2** provides a summary of specific concerns raised by stakeholders throughout the planning process through emails to the Task Force. Videos of each of the Task Force WG sponsored workshops are posted on and the dialogue with the public can be viewed: <http://www.sfrestore.org/cepp/cepp.html>.

The Draft PIR/EIS presented the tentatively selected plan. The Draft PIR/EIS was circulated for a 64 day review period to agencies, organizations, and other interested stakeholders. Comments received during the review period were taken into consideration in determination of the recommended plan presented in the Final PIR/EIS. Comment response matrices detailing comments received on the Draft PIR/EIS by formal letter and email are included in **Tables C.3.3-2** and **C.3.3-3**, respectively. Comment response matrices detailing comments made during the public meetings held in September of 2013 (see **Section 7.1.3**) are included in **Table C.3.3-4**.

7.1.5 Statement Recipients

Copies of the November 23, 2011 scoping letter and NOA of the Draft PIR/EIS and this document were mailed to the parties listed in **Table C.3.3-1** in **Appendix C.3**. Recipients included Federal, State, and local agencies, affected Indian Tribes, and other interested private organizations and individuals. A complete mailing list is available upon request. A copy of the Draft PIR/EIS and this document was

posted on evergladesplan.org and also on the USACE Jacksonville District website at the following address:

http://www.evergladesplan.org/pm/projects/proj_51_cepp.aspx

<http://www.saj.usace.army.mil/About/DivisionsOffices/Planning/EnvironmentalBranch.aspx>

7.2 COMPLIANCE WITH ENVIRONMENTAL LAWS, STATUTES AND EXECUTIVE ORDERS

The following table summarizes required compliance with specific Federal acts, Executive Orders (E.O.) and other applicable environmental laws. **Table 7-1** provides a summary of environmental compliance with each act, E.O. or applicable law. Detailed descriptions indicating the coordination completed to date and the status of any ongoing or compliance issues are located in **Appendix C.4**.

Table 7-1: Compliance with Environmental Laws, Regulations, and Executive Orders: Recommended Plan.

Law, Policy and Regulations	Status	Comments
Anadromous Fish Conservation Act	In compliance with this Act.	Proposed action would not adversely affect anadromous fish species.
Archaeological Resources Protection Act of 1979	CEPP is in compliance with this act and will continue to comply throughout construction and operation.	Further investigations may be needed within Federally owned lands (Everglades National Park [ENP]) once the project is authorized and the Preconstruction, Engineering and Design (PED) has started.
American Indian Religious Freedom Act	In compliance with this Act.	The policy of the U.S. is to protect and preserve for American Indians, Alaska Native Groups and Native Hawaiians, their inherent rights of Freedom to believe, express, and exercise traditional religions. These rights include, but are not limited to, access to sites, use and possession of sacred objects, and the freedom to worship through ceremony and traditional rites.
Bald and Golden Eagle Protection Act	In compliance with this Act.	Proposed action would not adversely affect the Bald eagle. No permits for takes are required.
Clean Air Act of 1972	In compliance with this Act, will obtain any required permits.	Potential for permanent sources of air emissions. Air emissions permit may be required for large diesel pumps.
Clean Water Act of 1972	In compliance with this Act and will obtain Water Quality Certification (WQC) from the State of Florida and any required National Pollutant Discharge Elimination System (NPDES) permits and will update 404(b) analysis prior to construction.	In accordance with the Clean Water Act, a Section 404(B)(1) Evaluation has been completed and is contained within Appendix C.4, Section C.4.32 . Comprehensive Everglades Restoration Plan Regulation Act (CERPRA) permit would be sought from State of Florida for Water Quality Certification.
Coastal Barrier Resources Act and Coastal Barrier Improvement Act of 1990	The official Coastal Barrier Resources System (CBRS) maps were reviewed and the CEPP project does not fall into any designated CBRS areas. These Acts are not applicable to this project.	There are no designated coastal barrier resources in the project area that would be affected by this project.
Coastal Zone Management Act of 1972	In compliance with this Act and obtaining concurrence by the State of Florida. The Corps will be in compliance with the Coastal Zone Management Act at the time of construction.	Florida Coastal Zone Consistency Determination has been prepared in accordance with the provisions of 15 CFR 930 and is located in Appendix C.4, Section C.4.32 . The USACE has determined that the proposed action is consistent to the maximum extent practicable with the enforceable policies of Florida's approved Coastal Zone management program. In a letter dated October, 11 2013, the State determined that the USACE's Draft PIR/EIS for CEPP is consistent with the Florida Coastal Management Program (FCMP). To ensure the project's continued consistency with the FCMP, the concerns identified by the reviewing agencies must be addressed prior o project

Law, Policy and Regulations	Status	Comments
		implementation. The State's continued concurrence will be based on the activities' compliance with FCMP authorities, including Federal and State monitoring of the activities to ensure their continued conformance, and the adequate resolution of issues identified during this and subsequent regulatory review.
Endangered Species Act of 1973	In compliance with this Act and ongoing consultation throughout the PED and construction phase as appropriate.	Formal consultation initiated with USFWS on August 5, 2013 with completion of Biological Assessment. The Corps received a Request for Additional Information (RAI) from USFWS on September 4, 2013. The Corps provided a Supplemental Technical Analysis in Response to USFWS' RAI for CEPP on October 24, 2013. On December 13, 2013 the Corps changed its request from formal to early consultation. The Corps entered formal consultation with USFWS on the Everglade snail kite (<i>Rostrhamus sociabilis plumbeus</i>), and its designated critical habitat, Cape Sable seaside sparrow (<i>Ammodramus maritimus mirabilis</i>), (CSSS) and its designated critical habitat, wood stork (<i>Mycteria americana</i>) and eastern indigo snake (<i>Drymarchon corais couperi</i>). A Programmatic Biological Opinion (BO) was received on April 9, 2014, which clearly states that further consultation will be needed when more specific project details are finalized during PED. While this document does not provide provisions for incidental take of three endangered avian species (CSSS, snail kite, and wood stork), it does describe the anticipated effects based on current information. Upon completing ESA Section 7 consultation for each PPA, USACE will undertake the agreed-to avoidance and minimization measures and implement any required terms and conditions (TCs). When USACE is closer to constructing portions of CEPP that will affect listed species, FWS will provide separate consultation document(s) which may authorize incidental take, and provide applicable reasonable and prudent measures (RPMs) and TCs. The preliminary conclusion is that the proposed project is not likely to jeopardize the continued existence of the species listed above and is not likely to adversely modify critical habitat, where designated. The Programmatic Biological Opinion concurred with the Corps' determination of may affect, but is not likely to adversely affect the Florida panther (<i>Puma concolor coryi</i>), West Indian manatee (<i>Trichechus manatus</i>), and its critical habitat, American crocodile (<i>Crocodylus acutus</i>) and its critical habitat, deltoid spurge (<i>Chamaesyce deltoidea</i> ssp. <i>deltoidea</i>), Garber's spurge (<i>Chamaesyce garberii</i>), Small's milkpea (<i>Galactia smallii</i>), and tiny polygala (<i>Polygala</i>

Law, Policy and Regulations	Status	Comments
		<p><i>smallii</i>). Furthermore, the Service concurred with all the “No Effect” determinations made by the Corps in regard to the applicable threatened or endangered species that are found in the action area.</p> <p>Incidental take was not provided for the Everglade snail kite, the CSSS and the wood stork, however take is anticipated on these three species. Take will be enumerated when a final biological opinion is required for each phase of CEPP implementation. Incidental take of eastern indigo snake is likely during construction and operation, particularly construction of the A-2 FEB and the Miami Canal backfill. The amount of take includes 14,000 acres of the FEB currently in sugar cane and row crops that will become inundated and mostly unusable to indigo snakes. Up to 268 snakes could be harassed through being displaced as a result of the CEPP and up to two indigo snakes may be injured or killed (harmed).</p> <p>Although the Programmatic Biological Opinion does not specify RPMs and TCs for the three avian species, endangered species monitoring costs include a conservative estimate of potential required monitoring based on information provided by USFWS to ensure the costs were captured. Estimated endangered species monitoring costs are \$3,111,200 pre construction, \$35,122,200 during the construction period and the O&M cost will be approximately \$1,885,200 annually.</p> <p>A programmatic Endangered Species Act Section 7 consultation for the Comprehensive Everglades Restoration Plan (CERP) was prepared on March 15, 2013 to evaluate potential effects of CERP on listed species and designated critical habitat under the NMFS’ purview. The Corps provided a Programmatic Biological Assessment for the Comprehensive Everglades Restoration Plan to NMFS on 2 July 2013. NMFS provided a Programmatic Biological Opinion for the Comprehensive Everglades Restoration Plan to the Corps on 17 December 2013 that includes CEPP.</p>
Estuary Protection Act of 1968	In compliance with this Act.	<p>The objectives of the proposed action are focused on environmental protection. The proposed action provides increased opportunities to redirect water that is currently discharged to the Caloosahatchee and St. Lucie Estuaries at undesirable times or in undesirable quantities for flood control purposes, allowing for the re-establishment of oyster and sea grass populations that are important for providing water quality and habitat functions within the northern estuaries. The proposed project would</p>

Law, Policy and Regulations	Status	Comments
		increase flows from southern ENP to Florida Bay and result in favorable changes to salinity levels to improve conditions for key species such as seagrasses, sea trout, pink shrimp, and crocodiles
Federal Water Project Recreation Act/Land and Water Conservation Fund Act	In compliance with this Act.	Effects of proposed action on outdoor recreation have been considered in Section 5.2.15.3 and Appendix C.2.15 . Proposed action would not adversely affect existing recreational opportunities. Recreational opportunities have been considered.
Fish and Wildlife Coordination Act of 1958, as amended.	In compliance with this Act.	Proposed action has been coordinated with USFWS. Planning Aid Letters were received. USFWS active participation on the CEPP team has provided information on fish and wildlife elements on project. The Final Fish and Wildlife Coordination Act (FWCA) Report was received on December 17, 2013 and is included in Annex A. The Corps' responses to the FWCA Report recommendations are in Annex A.3.
Farmland Protection Policy Act of 1981	The Corps is in compliance and will be in full compliance with the Act at the time of construction.	Coordination with USDA/NRCS to meet the requirements of the Farmland Protection Act is ongoing. Coordination with NRCS was done during the planning phase and NRCS concluded that they would defer to PED due to the large footprint of the project action area and the relatively smaller construction footprint in order to more accurately determine level of acres affected. When detailed design information that locates each of the plan components is completed, it can then be determined how many acres of unique farmland would be affected by the Project. Refer to Appendix C.4 for more information.
Magnuson-Stevens Fishery Conservation and Management Act	In compliance with this Act.	An Essential Fish Habitat (EFH) assessment has been prepared and coordinated with the NMFS on February 20, 2013. After review of the Draft PIR/EIS in September of 2013, NMFS determined the EFH provisions of the document were sufficient and that additional comments or EFH conservation recommendations were not needed.
Marine Mammal Protection Act of 1972	The Corps is in compliance and will be in full compliance with the Act at the time of construction.	Project sites are accessible to West Indian Manatees. Incorporation of safeguards to protect threatened and endangered species during construction would protect marine mammals in the area. No take is anticipated.
Marine Protection, Research and Sanctuaries Act	This Act is not applicable.	Term "dumping" as defined in the Act does not apply to this project. Proposed action does not consider ocean disposal of dredged material.
National Environmental Policy Act of 1969	The Corps is complying with the NEPA process and will be in full compliance with	Initial public coordination for this project began with the distribution of a scoping letter dated November 23, 2011 announcing the preparation of the

Law, Policy and Regulations	Status	Comments
	the Act at the time of construction. The Corps will update NEPA documentation as appropriate.	Draft EIS and inviting public and agency comment (Appendix C.3). On December 2, 2011 a NOI to prepare an EIS was published in the Federal Register (FR Volume 76, Number 232). Public scoping meetings were held on December 14 and 15, 2011. Public Meetings on the final array of alternatives were held on December 10, 11, 12, 13 and 18 2012. The NOA of the CEPP Draft PIR/EIS was published in the Federal Register (FR Volume 78, Number 169) August 30, 2013 and mailed to interested stakeholders to begin the 64 day review period. Five NEPA Draft PIR/EIS public meetings were held on September 16, 17, 18, 19 and 25 2013. .
National Historic Preservation Act of 1966	The Corps is currently in compliance and will continue to meet the requirements of this act throughout construction and operation.	Significant cultural resources are known to exist within the vicinity of the project area. Once the project is authorized and PED is implemented, further investigations and consultation will be needed.
Native American Graves Protection and Repatriation Act	In compliance with this Act. Neither human remains nor funerary objects were recovered during excavations on Federally owned or managed lands during the course of this feasibility study.	This Act applies to Federal owned lands, including Reservation lands. "Human remains and/or funerary objects were not recovered during excavations on Federally owned or managed lands during the course of this feasibility study. Should inadvertent discoveries occur within ENP during PED or construction phases of the CEPP, procedures established by ENP will be followed. Ground disturbing activities will not occur on Reservation Lands."
Resource Conservation and Recovery Act, as Amended by the Hazardous and Soils Waste Amendments of 1984, CERCLA as Amended by the 5.26.21 Superfund Amendments and Reauthorization Act of 1996, Toxic Substances Control Act of 1976.	The Corps is currently in compliance and will continue to meet the requirements of this act throughout construction and operation.	No items regulated under these laws or other laws related to hazardous, toxic, or radioactive waste substances have been discovered through previous Phase 1 Hazardous, Toxic, and Radioactive Wastes (HTRW) assessments of the project area. If any items regulated under these laws are discovered, the Corps and the non-Federal sponsor will comply with applicable requirements.
Rivers and Harbors Act of 1899	In compliance with this Act.	Proposed action would not obstruct navigable waters of the United States.
Submerged Lands of 1953	In compliance with the goals of this Act.	The proposed project would reduce freshwater flows to the Caloosahatchee Estuary and the St. Lucie Estuary and provide freshwater overland flow to Florida Bay that will ultimately benefit the ecological habitats that occur on submerged lands of the State of Florida. The proposed project does not occur on submerged lands and no construction is expected on submerged

Law, Policy and Regulations	Status	Comments
		lands.
Wild and Scenic River Act of 1968	This Act is not applicable.	No designated wild and scenic rivers are located within project area.
E.O. 11514, Protection of the Environment.	In compliance with this E.O	The objectives of the proposed action are focused on environmental protection.
E.O. 11593 Protection and Enhancement of the Cultural Environment	In compliance with this E.O.	The area of potential effect for cultural resources for this proposed action includes state and DOI owned lands only. Consultation is ongoing to ensure compliance for this EO.
E.O. 11988 Flood Plain Management	In compliance with this E.O.	Purpose of E.O. is to discourage Federally induced development of floodplains. Commitment of lands to restoration precludes such development.
E.O. 11990 Protection of Wetlands	In compliance with this E.O.	Areas proposed for restoration are considered freshwater wetlands. The objectives of the proposed action are focused on environmental protection.
E.O. 12962, Recreational Fisheries	In compliance with this E.O.	Proposed action would have an adverse affect on recreational fisheries in Water Conservation Area 3 (WCA 3) with the backfilling of the Miami Canal, but is expected to have a beneficial affect with improved recreational fisheries in Florida Bay and slight improvements in the Caloosahatchee and St. Lucie Estuaries, the Blue Shanty flow way and the rehydration of northern WCA 3A.
E.O. 12898 Environmental Justice	In compliance with this E.O.	CEPP does not present any environmental impacts that are high, adverse and disproportionate to low income, or minority populations. Sufficient scoping and public participation ensured potential impacts were understood by the public. No comments were presented as possible environmental impacts that may be disproportionate to low income or minority populations.
E.O 13007 Indian Sacred Sites	This E.O. is not applicable	This E.O. is directed towards executive branch agencies with statutory or administrative responsibility for the management of Federal lands. The proposed action would not affect Department of Defense owned or Corps managed lands.
E.O. 13045 Protection of Children	In compliance with this E.O.	Proposed action is not expected to have environmental or safety risks that may disproportionately affect children.
E.O. 13089 Coral Reef Protection	This E.O. is not applicable	Coral reefs are not affected.
E.O. 13122 Invasive Species	In compliance with this E.O.	A nuisance and exotic vegetation control plan has been prepared to prevent or reduce establishment of invasive and non-native species within the

Law, Policy and Regulations	Status	Comments
		project area. Control plan is located in Annex G .
E.O. 13175 Consultation and Coordination with Indian Tribal Governments	In compliance with this E.O.	Consultation with members and representatives of the Seminole Tribe of Florida and the Miccosukee Tribe of Indians of Florida have been ongoing. See Appendix C.3 and Appendix C.5 for specifics. Pursuant to E.O. 13175, the Corps developed the November 01, 2012 Tribal Policy Memorandum, which dictates Federal responsibilities, including Trust Responsibilities, to Federally recognized Tribes.
E.O. 13186, Responsibilities of Federal Agencies to Protect Migratory Birds	In compliance with this E.O.	Proposed action would not adversely affect migratory bird species. Proposed action is expected to benefit species by improving habitat and increasing availability of foraging opportunities.
Memorandum on Government to Government Regulations with Native American Tribal Governments	In compliance with this Memorandum.	The USACE has consulted with the Miccosukee Tribe of Indians of Florida and Seminole Tribe of Florida throughout CEPP planning process (see Appendix C.3 and Appendix C.5).
Seminole Indian Claims Settlement Act of 1987	In compliance with the Act	This Act also involves an agreement known as the Water Rights Compact, which specifically defines tribal water rights.

7.3 COMPLIANCE WITH USACE CERP AGRICULTURAL CHEMICAL POLICY

The USACE HTRW policy (ER 1165-2-132) directs that Construction of Civil Works projects in HTRW-contaminated areas should be avoided where practicable. In September 2011, the Assistant Secretary of the Army for Civil Works (ASA(CW)) provided clarification to this HTRW policy for CERP Projects (Memorandum for Deputy Commanding General for Civil and Emergency Operations, Subject: Comprehensive Everglades Restoration Plan (CERP) – Residual Agricultural Chemicals, Dated September 14, 2011). A copy of this policy is included in **Appendix C.4**. If specific criteria are met, this policy memorandum allows residual agrichemicals to remain on project lands and allows the USACE to integrate response actions directly into the construction plan. The SFWMD has requested application of the policy to the A-2 Flow Equalization Basin (FEB) lands. A copy of the letter from the SFWMD is included in **Annex H**.

The Agricultural Chemical section of **Appendix C.2.2** of the PIR partially fulfills the requirements established in the aforementioned policy for the A-2 FEB portion of the CEPP. Pursuant to paragraph 4 of the policy and prior to beginning construction, the Jacksonville District will obtain written documentation of regulatory approval(s) for all response actions from the SFWMD, and enter into an agreement with the SFWMD wherein the USACE accepts and expends funds, contributed by the SFWMD, for performance of the approved response action(s).

7.3.1 Recommendation

The A-2 FEB project feature requires the land conversion from agricultural production to aquatic restoration which inundates the land with water. The project site was selected to avoid significant adverse impacts to wetland communities. The avoidance of lands containing residual agricultural chemicals is not practicable. Based on limited soil sampling conducted in January and February of 2013, approximately 4,000 acres within the A-2 FEB 14,408 acre site likely contain low concentrations of residual copper and other agricultural chemicals. The testing indicated that soils do not exhibit any hazardous waste characteristic under the RCRA. Based on the sampling, it is reasonable to surmise that the chemical concentrations are indicative of the lawful application of commercially available products intended to enhance agricultural production. The chemicals detected on-site are active ingredients found in commercially available products registered under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). The USFWS and FDEP have preliminarily determined that the residual agricultural chemicals found on the A-2 FEB lands do not present a risk to protected resources. Based on the results of the 2013 soil testing, the USFWS and FDEP are recommending that during the initial operations of the A-2 FEB, the SFWMD perform testing of water for several contaminants (2,4, D, atrazine, barium, metribuzin, phorate, dieldrin, chromium, mercury, selenium, copper) as well as testing of periphyton and apple snails for copper. The water quality monitoring plan in **Appendix D** includes a start-up operation sampling event that should be performed at the 30 or 60-day period from inundation, as well as an additional surface water sampling event that should be performed after one year of operations. The FDEP and USFWS at this time are not recommending remedial action to address residual agricultural chemicals.

The A-2 lands will remain in agricultural production for several years until the A-2 project feature is set for construction at which time the agricultural leases will be terminated. Once farming has ceased on the project lands, an Exit Assessment will be performed to determine the presence of any new potential sources of HTRW since the completion of the previous Phase II ESA, and to verify the concentration of contaminants in the cultivated areas at selected locations. The results of these audits will be provided to the FDEP and USFWS for their review, comment, and concurrence regarding the need for remedial actions. The USACE Jacksonville District (CESAJ) will provide this information to the EMCX

(Environmental Munitions Center of Expertise) for review and to USACE Headquarters (HQUSACE) for concurrence prior to initiating construction of the A-2 FEB.

The non-Federal sponsor will be 100% responsible for the cost of actions taken due to the presence of residual agricultural chemicals, at no expense to the Federal Government. Any future costs associated with the presence of residual agricultural chemicals at the Federal project site will be 100% non-Federal sponsor cost and responsibility. The costs for characterization of the project lands in preparation for conducting a response action for the residual agricultural chemicals and removal of soils that are hazardous waste will be included as 100% non-Federal sponsor responsibility. The CESAJ shall not conduct actions to address residual agricultural chemicals for the SFWMD during the operation and maintenance, repair, replacement and rehabilitation (OMRR&R) phase of the project.

7.4 COMPLIANCE WITH FLORIDA STATUTES

The State of Florida has enacted several laws pertaining to implementation of CERP projects. These include amendments to Section 373.026 (8), Florida Statutes (F.S.), which establishes a requirement for the SFWMD to submit a report for review and approval by FDEP prior to formal submission of a request for authorization from Congress and prior to receiving an appropriation of State funds for construction and other implementation activities (except the purchase of lands from willing sellers); the enactment of Section 373.1501 F.S., which establishes the intent of the Florida Legislature with respect to CERP and the criteria for FDEP approval and the procedures to be followed by the SFWMD and FDEP for submitting and reviewing requests for approval; the enactment of Section 373.1502 F.S., which establishes permitting requirements and a process for the submittal, review, and issuance of certain regulatory permits for CERP projects; and the enactment of Section 373.470 and Section 373.472 F.S., establishing the “Save Our Everglades Trust Fund,” funding and reporting requirements, and procedures for distributions from the trust fund.

The SFWMD’s State Compliance Report addressing the criteria for approval listed in Section 373.1501 F.S. is included in **Annex B**. In addition to the above-described statutory requirements, other sections of Chapters 373 (Water Resources) and 403 (Environmental Control) of the F.S. include requirements that may apply to various aspects of CERP project planning and implementation. In particular, Chapter 403 F.S. and the administrative laws adopted in accordance with Chapters 373 and 403 F.S., contain the requirements for facilities that involve the discharge or potential discharge of pollutants to surface and groundwaters, and the discharge of air pollutants, including facilities regulated under the Federal Clean Water and Safe Drinking Water Acts and the Federal Clean Air Act. Based on the information contained in this PIR, the recommended plan complies with the applicable provisions of the F.S. A detailed explanation of how the project complies with the applicable requirements for CERP projects contained in the F.S. can be found in **Annex B**.

7.4.1 Permits, Entitlements and Certifications

The USACE will obtain WQC prior to advertising any construction contract. Section 402 of the NPDES permits required under the Clean Water Act may be necessary for the construction (non-point source runoff) of project features depending on means and methods of construction. This program has been delegated by the USEPA for implementation to the State of Florida (FDEP). At this time, a NPDES permit would not be required for the operation of CEPP features, as the project does not involve the discharge of pollutant. All required permits and/or modifications to existing permits would be acquired prior to construction activities.

7.4.2 Compliance with Applicable Water Quality Standards and Permitting Requirements

The CEPP is not expected to significantly affect Northern Estuaries and Southern Estuaries compliance with applicable water quality criteria. Water quality conditions in Lake Okeechobee are expected to be similar to the future without (FWO) project conditions with the exception of a slight increase in nutrient loads from increased S-308 backflow to the lake. This will slightly affect the allocation of waste loads included in the 2008, USEPA Total Maximum Daily Load (TMDL) Waste Load Allocation for Lake Okeechobee inflow sub-basins. This can be addressed through a TMDL revision or additional load reduction in other contributing sub-basins. The construction and operation of the A-2 FEB will slightly decrease Everglades Agricultural Area (EAA) basin phosphorus loads and the additional storage capacity is expected to reduce the risk that the 2012 water quality based effluent limit (WQBEL) for discharges from the EAA will not be met. Increased flows and new flow patterns may result in increase water column phosphorus concentrations at one or more total phosphorous (TP) rule stations within WCA 3A and WCA 3B; however, this should have minimal impact on TP rule compliance. It is uncertain how changes in flow distributions proposed under CEPP will impact Shark River Slough compliance with Appendix A of the 1991 Settlement Agreement. Over the long-term, distributing the flow over the northern WCA 3A marsh, reducing short-circuiting down the canals to ENP, adding more flow from the lake that is treated to the WQBEL, and distributing these flows over the marsh should result in improvements by lowering the flow weighted mean total phosphorous concentration entering the Park. In the short-term, to address the uncertainty in compliance with Appendix A, the Technical Oversight Committee is reviewing applicability of the current Appendix A compliance methodology for a restored ecosystem. Relative to FWO, no change to Settlement Agreement compliance for Loxahatchee and Taylor Slough is expected.

In general, any short-term impacts to water quality associated with construction of the recommended plan would be ameliorated by construction sequencing, best management practices for erosion and sedimentation control and monitoring during construction. If potentially adverse effects are observed or predicted, longer-term impacts to water quality associated with the operation of project features would be addressed through operational monitoring and adaptive management actions.

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8.0 DISTRICT ENGINEER'S RECOMMENDATIONS

The Central Everglades Planning Project (CEPP) will redirect some of the high volume discharges of freshwater currently flowing from Lake Okeechobee into the Northern Estuaries (Caloosahatchee and St. Lucie Estuaries) and deliver a portion of this water southward to the central Everglades. The increased flows will be directed through the storage and treatment facilities within the Everglades Agricultural Area (EAA), prior to ultimate delivery of this water to Water Conservation Area 3 (WCA 3), Everglades National Park (ENP), and Florida Bay. Reducing high discharges to the Northern Estuaries will improve salinity and turbidity conditions and benefit seagrass beds and the animals that inhabit them. The environmentally beneficial releases from Lake Okeechobee to WCA 3, ENP, and Florida Bay will restore a more natural mosaic of habitat conditions in these areas by improving the quantity, quality, timing, and distribution of flows to the central Everglades system.

The specific components of CEPP are increments of several components of the Comprehensive Everglades Restoration Plan (CERP), and the CEPP plan represents a first increment of restoration in the central Everglades system. Implementation of this plan is expected to be adaptively managed and sequenced in implementation phases that include the construction of logical groupings of recommended plan features that are compatible with other CERP and non-CERP components. This implementation strategy does not preclude future increments of restoration.

The project is integral to achieving restoration in the central Everglades and plays an important role in meeting CERP system-wide ecosystem goals and objectives. The project will enhance more than 1.5 million acres of freshwater and estuarine habitats in Palm Beach, Broward, Miami-Dade, Monroe, Martin and Lee counties. The project will deliver an average of 210,000 acre-feet per year of additional water from Lake Okeechobee to the central Everglades, which is essential to Everglades' restoration.

I find that CEPP project features located in Palm Beach, Broward, and Miami-Dade counties are an integral part of CERP. The CEPP plan includes:

Everglades Agricultural Area (EAA): 14,000 acre A-2 flow equalization basin (FEB) and associated distribution, inlet, and outlet structures. Operation of the A-2 FEB would be integrated with the future operation of the Everglades Construction Project and the State's Restoration Strategies features, including the A-1 FEB, and the State's existing stormwater treatment area (STA) 2 and STA 3/4 facilities.

WCA 2A and Northern WCA 3A: 500 cubic feet per second (cfs) gated culvert to deliver water from the L-6 Canal to the remnant L-5 Canal; 500 cfs gated spillway to deliver water from the remnant L-5 Canal to the western L-5 Canal (during L-6 diversion operations); 2,500 cfs gated spillway to deliver water from STA 3/4 to the S-7 Pump Station during peak discharge events (including L-6 diversion operations); approximately 13.6 miles of conveyance improvements to the L-5 Canal; degradation of approximately 2.9 miles of the southern L-4 Levee along the northwest boundary of WCA 3A; 360 cfs pump station to move water within the L-4 Canal to maintain water supply deliveries to retain the existing functionality of STA-5 and STA-6 and maintain water supply to existing legal users, including the Seminole Tribe of Florida; gated culverts and an associated new canal to deliver water from the Miami Canal (downstream of S-8, which pulls water from the L-5 Canal) to the L-4 Canal, along with potential design modifications to the existing S-8 and G-404 pump stations; and backfill approximately 13.5 miles of the Miami Canal and include constructed tree islands, between a point 1.5 miles south of the S-8 pump station and Interstate Highway I-75.

Southern WCA 3A, WCA 3B, and the Northern edge of ENP: 1,150 cfs gated spillway adjacent to S-333; 500 cfs gated culvert in L-67A Levee and an associated 6,000 foot gap in L-67C Levee; flowway through the western end of WCA 3B (two 500 cfs gated culverts in L-67A Levee; removal of approximately 8 miles of L-67C Levee; removal of approximately 4.3 miles of L-29 Levee; construction of new approximately 8.5 mile levee in WCA 3B); 1,230 cfs gated spillway in L-29 Canal; removal of approximately 5.5 miles of the L-67 Extension Levee; removal of approximately 6 miles of Old Tamiami Trail, and removal of spoil mounds along the northwestern side of the L-67A Canal.

Eastern edge of ENP: 1,000 cfs pump station; approximately 4.2 miles long, 35 feet deep tapering seepage barrier cutoff wall along the L-31N Levee just south of Tamiami Trail.

The Corps shall seek water quality certification on the above features as appropriate.

Therefore, I recommend that the CEPP as described in the section of the report entitled “The Recommended Plan”, with such modifications that may be deemed advisable at the discretion of the Chief of Engineers, be authorized for construction. The total estimated first cost for the CEPP is \$1,900,000,000 (Fiscal Year (FY) 2014 price level), with an estimated Federal cost of \$950,875,000 and an estimated non-Federal cost of \$949,125,000. The project first cost includes recreation features totaling \$6,400,000. The average annual cost of the recreation features is \$355,000 and the average annual benefits are \$570,000, resulting in net benefits of \$215,000 and a 1.6 to 1 benefit to cost ratio. The estimated total annual cost of operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) for the ecosystem restoration elements is \$11,250,000 with an estimated Federal annual OMRR&R cost of \$5,625,000 and an estimated non-Federal OMRR&R cost of \$5,625,000. Average annual monitoring costs, which includes both 10-year cycle costs amortized over the period of analysis and the annual cost of longer-term monitoring requirements, totals \$5,480,000. The estimated Federal cost is \$2,740,000 and the non-Federal cost is \$2,740,000. The estimated cost for OMRR&R of the recreation elements is \$65,000 that is 100 percent non-Federal responsibility.

8.1 OPERATIONS, MAINTENANCE, REPAIR, REPLACEMENT AND REHABILITATION OF STATE FACILITIES USED BY CEPP

The non-Federal sponsor is responsible for operation, maintenance, repair, replacement, and rehabilitation of their State Restoration Strategies and Everglades Construction Project facilities. Certain of those facilities, as named below and herein after referred to as the “State facilities”, are to be used by CEPP until such time as CEPP is deauthorized or it is determined use of the State facilities are no longer necessary for the purpose of achieving CEPP project purposes. This PIR recommends congressional authorization of the project with specific statutory language allowing cost share of the OMRR&R for the following State facilities not previously cost shared for construction under the C&SF project or other Federal authority, and the listed C&SF features that are currently cost shared pursuant to executed Resolutions: (1) Stormwater Treatment Area 2, (2) Stormwater Treatment Area 3/4, (3) Flow Equalization Basin A-1, (4) G-357 Gated Culvert, (5) G-370 Pump Station, (6) G-371 Gated Spillway, (7) G-372 Pump Station, (8) G-404 Pump Station, (9) G-434 Pump Station, (10) G-435 Pump Station, (11) S-6 Pump Station, (12) S-7 Pump Station, (13) S-8 Pump Station, and (14) S-150 Gated Culverts, and their corresponding remote-control facilities. All features required for the State’s Restoration Strategies and the Everglades Construction Project are independent State facilities and are not CEPP components or features. The State facilities will not be incorporated as Federal CEPP project features; however, the operation of State facilities is required to ensure that new water made available by CEPP meets water quality standards and achieves CEPP project benefits.

The State retains sole responsibility for performing operations activities at State facilities pursuant to State Operations Plan, with the exception of the FEB A-1 which will be integrated with FEB A-2 and operated pursuant to a mutually agreed upon water control manual. The joint water control plan for the FEBs will integrate the operation of CEPP and the operation of the State facilities used by CEPP. Pursuant to the Item of Local Cooperation paragraph (f), the State has agreed that the USACE shall have the opportunity to collaborate, review, and comment on the OMRR&R of the State facilities used by CEPP, including updates to optimize operations to achieve Federal project purposes. This is intended to ensure continuous achievement of CEPP project purposes and support the Federal interest in cost sharing OMRR&R. To the extent applicable, any operational modifications to the State facilities that would impair the usefulness of any Corps project, including all CEPP and other CERP and C&SF project features, may require a 33 U.S.C. Section 408 permit from the USACE.

The aforementioned State facilities will use excess capacity to process “new water” provided by CEPP, which has been estimated to comprise approximately 19% of the total water volume that could flow through these facilities. For the purposes of this report, OMRR&R costs are assumed to be linear with flow volumes and will therefore increase the OMRR&R costs for the State facilities that are to be used by CEPP by 19%. Therefore, consistent with the general CERP authorization for cost sharing OMRR&R (WRDA2000 Section 601(e)(4)), the Corps recommends Congressional authorization of CEPP to contribute 19% of the OMRR&R costs of the aforementioned State facilities to the extent that OMRR&R activities are directly related to their use for treating “new water”. The Corps’ pro-rated share for OMRR&R for the aforementioned facilities used by CEPP is therefore 50% of the 19%, or 9.5% of the total OMRR&R costs. The 19% CEPP cost share will apply to the State facilities and C&SF features listed above to the extent that OMRR&R activities are directly related to their use for treating “new water”.

The request for authorization shall include specific statutory language allowing the Corps to cost share 19% of the yearly OMRR&R costs of State facilities and listed C&SF features from appropriations made available for CERP OMRR&R activities. The term “OMRR&R costs” is defined the same as the term “project OMRR&R costs” in Article I.E. of the Master Agreement between the Department of the Army and the non-Federal sponsor dated August 13, 2009. As a condition of the Corps’ cost share, prior to commencing replacement and rehabilitation actions for the State facilities listed above that CEPP is dependent on, approval by USACE Headquarters and the Assistant Secretary of the Army Civil Works is required. **Section 6.6.2** describes the coordination and approval process.

Pursuant to Section 601(h)(4) of WRDA 2000, the Non- Federal Sponsor is required to execute a water reservation or allocation of water identified in each CERP Project Implementation Report for the natural system¹. The Operating Manual associated with each CERP Project Implementation Report shall “...reflect the operational criteria used in the identification of the appropriate quantity, timing, and distribution of water dedicated and managed for the natural system.”² Pursuant to the Programmatic Regulations, the Corps and the SFWMD shall periodically update, as appropriate, the estimated total quantity of water expected to be generated for the natural system and for use in the human environment “based on new information resulting from changed or unforeseen circumstances, new or

¹ According to 33 CFR 385.27(b) “The Project Cooperation Agreement shall include a finding that the South Florida Water Management District or the Florida Department of Environmental Protection has executed under State law the reservation or allocation of water for the natural system as identified in the Project Implementation Report”. This finding shall be verified by the District Engineer prior to executing the PCA.

² 33 CFR §385.28(a)(6)(vi).

scientific or technical information, new or updated models, or information developed through the adaptive assessment principles contained in the Plan, or future authorized changes to the Plan integrated into the implementation of the Plan.”³ Furthermore, the Programmatic Regulations require that the PIR “...include a plan for operations of the project in the event that the project fails to provide the quantity, timing, or distribution of water described in the PIR.”⁴

After CEPP has operated for an appropriate period of time, an analysis based on monitoring data shall be undertaken to evaluate project performance and verify that CEPP successfully delivers an annual average of approximately 210,000 acre-feet of new water for the natural system as described in this PIR. If the monitoring data and analysis show that CEPP actually produces less than the anticipated 210,000 acre feet of new water on average, then the Federal project is not fully realizing the projected benefits and the State facilities are not being burdened as projected. In such a case, the analysis will be used to inform changes in operations in order to achieve the quantity, timing or distribution of water as described in this PIR, or recommend changes to the amount of water to be reserved or allocated to the natural system. Additionally, if the monitoring data and analysis show CEPP actually processes significantly more or less than the anticipated 210,000 acre-feet of “new water” on average then the analysis may be used to adjust the calculation of OMRR&R cost share upward or downward to reflect the actual average annual use of excess capacity by the Federal project. Any recommended adjustments to the OMRR&R cost share calculation may require additional Congressional approval and legislation. This will be accomplished through consultation with the State and USACE Headquarters and is necessary after operations have begun to capture the true Federal interest and cost share responsibility. Additionally, it must be recognized and the adjustment made given these State facilities are subject to legal requirements outside of the Federal project and will not be operated in such a manner that the Federal project will cause exceedances of the State’s water quality requirements under State NPDES and EFA permits and associated Consent Orders. Such State requirements may limit the anticipated Federal project benefits.

No cost share of the aforementioned State facilities shall commence before the date of the CEPP project produces “new water” and the associated Federal project feature is declared construction complete and the state assumes its OMRR&R responsibilities as established in the appropriate project partnership agreements. Similarly, no cost share for State facilities is allowed until the State facilities are shown to be construction complete and the state begins regular operation of such facility.

A number of non- CEPP projects must be in place before implementing any CEPP features and certain non- CEPP projects must be integrated into the sequencing of CEPP implementation as shown in Table 6-13 in Section 6 in order to avoid unintended adverse consequences. For example, all features of the State’s Restoration Strategies must be completed and meet State water quality standards prior to initiating construction of most CEPP project features.

Implementation of CEPP will occur over many years. The plan is composed of implementation phases that include a recommended plan feature or logical groupings of recommended plan features, agreed upon by the USACE and SFWMD, that maximize benefits to the extent practicable consistent with project dependencies and the Adaptive Management and Monitoring Plan (see **Annex D**). These implementation phases will achieve incremental hydrologic and environmental benefits. The phased implementation approach incorporates the adaptive management process, maximizing the opportunity

³ 33 CFR §385.35(b).

⁴ 33 CFR §385.35(c).

to realize incremental restoration benefits by initially building features that utilize existing water in the system that meets State water quality standards. Individual project partnership agreements, or amendments to existing project partnership agreements, will be executed prior to construction for each implementation phase.

8.2 ITEMS OF LOCAL COOPERATION

The above recommendations are made with the provision that the non-Federal sponsor and the Secretary of the Army shall enter into binding project partnership agreements defining the terms and conditions of cooperation for implementing the project, and that the non-Federal sponsor agrees to perform the following items of local cooperation:

- a. Provide 50 percent of total project costs consistent with the provisions of Section 601(e) of the Water Resources Development Act (WRDA) of 2000, as amended, including authority to perform design and construction of project features consistent with Federal law and regulation;
- b. Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations that the Government and the non-Federal sponsor jointly determine to be necessary for the construction, operation, maintenance, repair, replacement and rehabilitation of the project and valuation will be in accordance with the Master Agreement;
- c. Shall not use the ecosystem restoration features or lands, easements, and rights-of way required for such features as a wetlands bank or mitigation credit for any other non-CERP projects;
- d. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land that the non-Federal sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of constructing, completing, operating, maintaining, repairing, replacing, or rehabilitating the project;
- e. Assume responsibility for OMRR&R of the project or completed functional portions of the project, including mitigation features, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and specific directions prescribed in the OMRR&R manuals and any subsequent amendments thereto. Cost sharing for OMRR&R will be in accordance with Section 601(e) of WRDA 2000, as amended. Notwithstanding Section 528(e)(3) of WRDA 1996 (110 stat. 3770), the non-Federal sponsor shall be responsible for 50 percent of the cost of OMRR&R activities authorized under this section;
- f. The State shall provide the Corps an opportunity to collaborate, review and comment on the State Operations Plans for the State facilities used by CEPP, including updates to optimize operations for Federal project purposes.
- g. The non-Federal sponsor shall operate, maintain, repair, replace and rehabilitate the recreational features of the project and is responsible for 100 percent of the cost;
- h. Keep the recreation features, and access roads, parking areas, and other associated public use facilities, open and available to all on equal terms;

- i. Unless otherwise provided for in the statutory authorization for this project, comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the WRDA of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;
- j. Hold and save the Government free from all damages arising from construction, operation, maintenance, repair, replacement and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors;
- k. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs in accordance with the Master Agreement between the Department of the Army and the non-Federal sponsor dated August 13, 2009, including Article XI Maintenance of Records and Audit;
- l. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government;
- m. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-ways that the Government determines necessary for construction, operation, maintenance, repair, replacement and rehabilitation;
- n. As between the Government and the non-Federal sponsor, the non-Federal sponsor shall be considered the operator of the project for purposes of CERCLA liability. To the maximum extent practicable, the non-Federal sponsor shall operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA;
- o. Prevent obstruction of or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the outputs produced by the ecosystem restoration features, hinder operation and maintenance of the project, or interfere with the project's proper function;
- p. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public law 91-646, as amended by title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

q. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army;" and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 [revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)];

r. Comply with Section 106 of the National Historic Preservation Act in completion of all consultation with the Florida State Historic Preservation Officer, and other interested parties including Federally recognized Tribes and as necessary, the Advisory Council on Historic Preservation, prior to construction as part of the preconstruction engineering and design phase of the project;

s. Provide 50 percent of that portion of total data recovery activities associated with historic preservation that exceed one percent of the amount authorized to be appropriated for CEPP; data recovery costs under one percent of the authorized CEPP cost will be funded in its entirety by the Government. Any costs of data recovery that exceed one percent of the amount authorized to be appropriated for CEPP shall not be included in project construction costs or project OMRR&R costs (as defined by the Master Agreement); therefore, credit shall not be afforded to the non-Federal sponsor for costs or work in kind associated with data recovery activities that exceed one percent of the amount authorized to be appropriated for CEPP;

t. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized and in accordance with Section 601 (e)(3) of the WRDA of 2000, as amended, and in accordance with the Master Agreement;

u. The non-Federal sponsor agrees to participate in and comply with applicable Federal floodplain management and flood insurance programs consistent with its statutory authority:

1. Not less than once each year the non-Federal sponsor shall inform affected interests of the extent of protection afforded by the project;

2. The non-Federal sponsor shall publicize flood plain information in the area concerned and shall provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the project;

3. The non-Federal sponsor shall comply with Section 402 of WRDA 1986, as amended (33 U.S.C. 701b-12), which requires a non-Federal interest to have prepared, within one year after the date of signing a project partnership agreement for the project, a floodplain management plan. The plan shall be designed to reduce the impacts of future flood events in the project area, including but not limited to, addressing those measures to be undertaken by non-Federal interests to preserve the level of flood protection provided by the project. As required by Section 402, as amended, the non-

Federal interest shall implement such plan not later than one year after completion of construction of the project. The non-Federal sponsor shall provide an information copy of the plan to the Government upon its preparation;

4. The non-Federal sponsor shall prescribe and enforce regulations to prevent obstruction of or encroachment on the project or on the lands, easements, and rights-of-way determined by the Government to be required for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project, that could reduce the level of protection the project affords, hinder operation or maintenance of the project, or interfere with the project's proper function.

v. The non-Federal sponsor shall execute, or certify that FDEP executed, under State law the reservation or allocation of water for the natural system as identified in the Project Implementation Report (PIR) for this authorized CERP project as required by Section 601(h)(4)(B)(ii) of WRDA 2000 and the non-Federal sponsor shall provide information to the Government regarding such execution. In compliance with 33 CFR 385, the District Engineer will verify such reservation or allocation in writing. Any change to such reservation or allocation of water shall require an amendment to the project partnership agreement after the District Engineer verifies in writing in compliance with 33 CFR 385 that the revised reservation or allocation continues to provide for an appropriate quantity, timing, and distribution of water dedicated and managed for the natural system after considering any changed circumstances or new information since completion of the PIR for the authorized CERP project.

w. Consistent with the September 14, 2011 Memorandum from Jo-Ellen Darcy, ASA (CW) the non-Federal sponsor shall be 100% responsible for the cost of all actions taken due to the presence of residual agricultural chemicals, at no expense to the Federal Government and any future costs associated with the presence of residual agricultural chemicals at the Federal project site are 100% a non-Federal sponsor cost and responsibility. As stated in the September 14, 2011 memorandum, normal project engineering and construction activities will remain part of the total project cost provided that these are the same activities required to implement the project features absent the presence of residual agricultural chemicals.

8.3 WATER QUALITY

In addition to the aforementioned items of local cooperation, the United States Army and the State of Florida agreed to the following concepts regarding water quality that is intended to govern the implementation and operation of CEPP project features:

Restoration of the Everglades requires projects that address hydrologic restoration as well as water quality improvement. This has been recognized by the National Academy of Sciences in its most recent biennial report where it noted that near-term progress to address both water quality and water quantity improvements in the central Everglades is needed to prevent further declines of the ecosystem. The significant amount of water resulting from CEPP is contemplated to significantly improve restoration of the Everglades. Both the Federal and State parties recognize that water quantity and quality restoration should be pursued concurrently and have collaborated to develop and concur on a suite of restoration strategies being implemented by the State to improve water quality ("State Restoration Strategies"), as well as other State and Federal restoration projects, both underway and planned, to best achieve Everglades hydrologic objectives. Specific examples of Federally authorized projects include the Everglades Restoration Transition Plan, Modified Water Deliveries to Everglades National Park Project, and

the Tamiami Trail Next Steps Project.⁵ One of the goals of these projects and their associated operating plans, as well as certain components of the CERP awaiting authorization or that are being planned as part of the CEPP is to improve water quantity and quality in the Everglades through more natural water flow within the remnant Everglades which includes the water conservation areas and ENP. Variations in flows of the C&SF system may result from a variety of reasons. These reasons include natural phenomena (e.g. weather) and updates to the operating manuals to achieve the purposes of the C&SF Project such as flood control and water supply.

One goal of the Consent Decree⁶ is to restore and maintain water quality within ENP. The Consent Decree established, among other things, long-term water quality limits for water entering ENP to achieve this goal. The existing limits for ENP are flow dependent and, generally, increased volume of water results in a lower allowable concentration of phosphorus to maintain the overall load of phosphorus entering the ENP. There will be redistribution of flows and increased water volume above existing flows associated with system restoration efforts beyond the current State Restoration Strategies projects. The USACE and its Federal and State partners recognize that to achieve long-term hydrologic improvement, water quality may be impacted, particularly as measured by the current Consent Decree Appendix A compliance methodology. The USACE and the State partners agree that the monitoring locations/stations for inflows to ENP will require revision. An evaluation of this and other aspects of the compliance methodology are currently being conducted by the Technical Oversight Committee (TOC).

In an effort to address these potential impacts and determine updates to Appendix A to reflect increased inflows and new discharges into ENP since the Consent Decree was entered, the parties to the Consent Decree have established a process and scope for evaluating and identifying necessary revisions to the Appendix A compliance methodology utilizing the scientific expertise of the TOC. The TOC may consider all relevant data, including the 20 years of data collected since Appendix A was implemented. Ultimately, such evaluations and changes to the Appendix A compliance methodology would be recommended by the Consent Decree's TOC for potential agreement by all parties. Failure to develop a mutually agreed upon and scientifically supportable revised compliance methodology will impact the State's ability to implement or approve these projects.

The aforementioned State Restoration Strategies will be implemented under a Clean Water Act discharge permit that incorporates and requires implementation of corrective actions required under a State law Consent Order, as well as a Framework Agreement between the U.S. Environmental Protection Agency and the State discharge permitting agency, the Florida Department of Environmental Protection, to ensure compliance with Clean Water Act and State water quality requirements for existing flows into the Everglades. The Clean Water Act permit for the State facilities, the associated Consent Order (including a detailed schedule for the planning, design, construction, and operation of the new project features), and technical support documents were reviewed by, and addressed all of, the U.S. Environmental Protection Agency's previous objections related to the draft National Pollutant Discharge Elimination System ("NPDES") permits, prior to issuance.

⁵ The next phase of bridging for Tamiami Trail roadway as authorized by Congress.

⁶ *United States v. South Florida Water Management District, et al.*, Case No. 88-1886-CIV-Moreno (U.S.D.C., S.D. Fla.).

All parties are committed to implementing the State Restoration Strategies, joint restoration projects, and associated operational plans, in an adaptive manner that is consistent with the objectives of the underlying C&SF Project. The USACE and the State will use all available relevant data and supporting information to inform operational planning and decision making, document decisions made, and evaluate the resulting information from those decisions to avoid adverse impacts to water quality where practicable and consistent with the purposes of the C&SF Project. Based upon current and best available technical information, the Federal parties believe at this time that the State Restoration Strategies, implemented in accordance with the State issued Consent Order and other joint restoration projects, are sufficient and anticipated to achieve water quality requirements for existing flows to the Everglades. If there is an exceedance of the Appendix A compliance limits, which results from a change in operation of a Federal project, and it has been determined that an exceedance cannot be remedied without additional water quality measures, the Federal and State partners agree to meet to determine the most appropriate course of action, including what joint measures should be undertaken as a matter of shared responsibility. These discussions will include whether it is appropriate to exercise any applicable cost share authority. If additional measures are required and mutually agreed upon, then they shall be implemented in accordance with an approved process, such as a general reevaluation report or limited reevaluation report, and if necessary, supported through individual project partnership agreements. Failure to develop mutually agreed upon measures and cost share for these measures may impact the State's ability to operate the Federal project features.

8.4 REQUEST FOR CONGRESSIONAL AUTHORIZATION

The plan recommended by this PIR requires the use of several State facilities constructed and operated pursuant to State permits. The facilities are necessary for the State to meet water quality requirements as approved by the U.S. Environmental Protection Agency, and as litigated by the U.S. Department of Justice. Some of these requirements are currently subject to a Settlement Agreement filed with and overseen by the Federal District Court (United States v. South Florida Water Management District, Case No. 88-1886-CIV-Moreno (S.D. Fl. 1988)). These features are a part of the Everglades Construction Project. These State features are statutorily excluded from Federal cost sharing.

Section 528 of WRDA 1996, provides in part:

“(e) COST SHARING.—

(1) IN GENERAL.—Except as provided in sections 315 and 316 and paragraph (2), the non-Federal share of the cost of activities described in subsection (b) shall be 50 percent.

(2) WATER QUALITY FEATURES.—

(A) IN GENERAL.—Except as provided in subparagraph (B), the non-Federal share of the cost of project features to improve water quality described in subsection (b) shall be 100 percent.

(B) EXCEPTION.—

(i) IN GENERAL.—Subject to clause (ii), if the Secretary determines that a project feature to improve water quality is essential to Everglades restoration, the non-Federal share of the cost of the feature shall be 50 percent.

(ii) APPLICABILITY.—Clause (i) shall not apply to any feature of the Everglades Construction Project of the State of Florida.

(3) OPERATION AND MAINTENANCE.—The operation and maintenance of projects carried out under this section shall be a non-Federal responsibility.”

Given this explicit statutory prohibition and as explained below, this PIR recommends that the Chief of Engineers request new statutory language specifically authorizing the cost sharing of OMRR&R responsibilities at the listed State facilities and change cost sharing at the listed C&SF facilities as described above in **Section 8.1** in order to proceed with the recommended plan.

As noted above, Section 528(e) of WRDA 1996 provides that the non-Federal share of the cost of CERP project features to improve water quality shall be 100 percent, unless the Secretary determines that a project feature to improve water quality is essential to Everglades Restoration. If the Secretary determines that a project feature to improve water quality is essential to Everglades Restoration, then the non-Federal share of the cost of the feature shall be 50 percent. However, the statute expressly prohibits the application of the exception to any feature of the State of Florida's Everglades Construction Project. Furthermore, the legislative history for Section 528 clarifies that this authority is not intended to interfere with future judicial proceedings or agreements related to those features, such as the recent State Restoration features planned or under construction and in answer to litigation (See Miccosukee Tribe of Indians of Florida, et al., v. United States, et al., Case No. 04-21448-CIV-Gold/Goodman (S.D. Fl. 2004) and United States v. South Florida Water Management District, Case No. 88-1886-CIV-Moreno (S.D. Fl. 1988)).

A November 30, 2007 Assistant Secretary of the Army (Civil Works) Memorandum for the Army Corps of Engineers Director of Civil Works, Subject: *CERP, Water Quality Improvements, Policy Determination*, reiterates the assumption under the CERP Plan that water received by a Federal project will meet all water quality standards and such compliance will be 100% a non-Federal responsibility. It also allows that for CERP projects where inflows do not currently meet water quality standards, but the benefits of water quality features are determined to be essential to Everglades restoration, the Corps may recommend to Congress in a PIR that it be given specific statutory authority to build and cost share the subject water quality features to both help achieve existing water quality requirements and provide additional restoration benefits critical to the successful implementation of CERP. Per the Memorandum, the O&M costs for such features were to be limited to only the increment attributed to raising water quality standards from compliant levels for the existing use to the restoration standards necessary under CERP and the percentage prorated for cost sharing. With regard to operational activities, the Memorandum limited its discussion of cost sharing to only O&M costs.

The State has requested cost sharing OMRR&R of the State facilities as set forth in Section 8.1. Given the State features in question are Everglades Construction Project features, already constructed, or under construction pursuant to State compliance requirements and under permit for that purpose, and/or United States v. South Florida Water Management District Settlement Agreement requirements, they may not be included as Federal project features and no cost sharing for construction would be allowed. There is currently no applicable authority which would allow for cost sharing any expenses associated with such features, including the OMRR&R costs. Thus because of the current statutory and policy prohibitions against such cost sharing, as the 30 November 2007 Memorandum indicates new statutory language affording such authority must be adopted as part of the CEPP project authorization in order for the State's request to be effected.

The Jacksonville District has concluded that the additional water flows that will be delivered by CEPP are essential to Everglades restoration. Furthermore, water quality treatment of these additional flows of "new water" provided by CEPP to restoration standards utilizing State-owned and State-operated Everglades Construction Project facilities will increase the OMRR&R costs of those facilities above and

beyond the requirements of the State for treatment of existing flows to compliance levels. Given the cost of constructing separate water quality facilities that would only be used by the CEPP project, and assurances by the State that their facilities will have an excess capacity which can accommodate the average annual flow increase of approximately 210,000 acre feet per year of new water projected to be made available by the recommended CEPP, the Jacksonville District has determined that cost sharing of the increased OMRR&R costs at State facilities to be used by CEPP is the most economical alternative for achieving CERP purposes.

Additionally, this PIR recommends that the Chief of Engineers request new statutory language specifically changing current law and authorizing the cost sharing of OMRR&R responsibilities at the listed C&SF features as described above in Section 8.1 in order to proceed with the recommended plan. According to Section 203 of the Flood Control Act of 1948 and the Flood Control Act of 1954, SFWMD is 100% responsible for operation and maintenance of all project facilities not operated and maintained by the Corps of Engineers, including S-6, S-7, S-8, and S-150. SFWMD memorialized its commitment to performing and funding operation and maintenance for the S-6, S-7, S-8, and S-150 in Resolution Nos. 12, 224, and 398, all titled "Assumption of Responsibility for Compliance with Conditions of Local Cooperation with Federal Government." The project partnership agreements executed for each CEPP implementation phase shall incorporate by reference the aforementioned Resolutions and include an OMRR&R cost share provision, as described above in Section 8.1, implementing the new statutory language if adopted.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the Sponsor, the State, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.



Alan M. Dodd
Colonel, Corps of Engineers
District Engineer

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9.0 LIST OF REPORT PREPARERS

This section provides a list of persons involved in the preparation and review of this document (**Table 9-1**).

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10.0 GLOSSARY OF ACRONYMS AND TERMS**10.1 LIST OF ACRONYMS****A**

ac	Acres
ac-ft	Acre-Feet
ACHP	Advisory Council on Historic Preservation
AM	Adaptive Management
APE	Area of Potential Effect

B

BCNP	Big Cypress National Preserve
BMP	Best Management Practices

C

CEPP	Central Everglades Planning Project
CERP	Comprehensive Everglades Restoration Plan
C&SF	Central and Southern Florida
cm/s	Centimeters Per Second
COP	Combined Operational Plan

D

DSAC	Dam Safety Action Classification
DOI	Department of Interior
DPOM	Draft Project Operation Manual

E

EAA	Everglades Agricultural Area
ECB	Existing Conditions Baseline
EDR	Engineering Documentation Report
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ENP	Everglades National Park
EO	Executive Order
EPA	Everglades Protection Area
ERTP	Everglades Restoration Transition Plan
ESA	Endangered Species Act

F

F.A.C.	Florida Administrative Code
FEB	Flow Equalization Basin
FEIS	Final Environmental Impact Statement
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FIFRA	Federal Insecticide, Fungicide, Rodenticide Act
F.S.	Federal Statute
ft	feet
FWC	Florida Fish and Wildlife Conservation Commission
FWO	Future Without Project Condition (or the No Action Alternative under NEPA)

G

GDM	General Design Memorandum
GRR	General Reevaluation Report

H

HHD	Herbert Hoover Dike
HRF	Hydropattern Restoration Feature
HTRW	Hazardous, Toxic and Radioactive Waste

I

IOP	Interim Operations Plan
-----	-------------------------

J**K****L**

LEC	Lower East Coast
LERRD	Lands, Easements, Rights of Way, Relocations, and Disposals
LOOPS	Lake Okeechobee Operations Screening Model
LORS	Lake Okeechobee Regulation Schedule
LOSA	Lake Okeechobee Service Area
LNWR	Loxahatchee National Wildlife Refuge

LTGM	Long Term Geometric Mean	RSM-GL	Regional Simulation Model for the Glades and Lower East Coast Service Area
M			
MCDA	Multi Criteria Decision Analysis		
MeHg	Methyl Mercury	S	
MGD	Million Gallons per Day	SAFM	South Atlantic Fisheries Management Council
MG/L	Milligrams Per Liter	SAV	Submerged Aquatic Vegetation
MRR	Major Rehabilitation Report	SDCS	South Dade Conveyance System
MWD	Modified Water Deliveries		
N		SFWMD	South Florida Water Management District
NEPA	National Environmental Policy Act	SHPO	State Historic Preservation Office(er)
NESRS	Northeast Shark River Slough	SRS	Shark River Slough
NHPA	National Historic Preservation Act	STA	Stormwater Treatment Area
NMFS	National Marine Fisheries Service	T	
NPDES	National Pollutant Discharge Elimination System	THPO	Tribal Historic Preservation Officer
NPS	National Park Service	TMDL	Total Maximum Daily Limits
NRHP	National Register of Historic Places	TP	Total Phosphorous
NRC	National Research Council	U	
O		USACE	United States Army Corps of Engineers
OMRR&R	Operations, Maintenance, Repair, Rehabilitation, and Replacement	USEPA	United States Environmental Protection Agency
P		USFWS	United States Fish and Wildlife Service
PDT	Project Delivery Team	USGS	United States Geological Survey
PED	Preconstruction, Engineering, and Design	V	
PIR	Project Implementation Report	W	
PPA	Project Partnership Agreement	WQBELs	Water Quality Based Effluent Limits
POM	Project Operating Manual	WCA	Water Conservation Area
ppb	Parts Per Billion	WG	Working Group
ppt	Parts Per Thousand	WPA	Water Preserve Areas
PWS	Public Water Supply	WRDA	Water Resources Development Act
Q		WRRDA	Water Resources Reform and Development Act
R		X	
RECOVER	Restoration Coordination and Verification	Y	
RESOPS	Reservoir Sizing Operations Screening Model	Z	
RSM-BN	Regional Simulation Model for Basins		

10.2 GLOSSARY OF TERMS

A

Acre — Area of land equal to 43,560 square feet. In the S.I. metric system, one acre is equal to 4,046.9 square meters or 2.471 hectares.

Acre-foot — The quantity of water required to cover 1 acre to a depth of 1 foot. Equal to 43,560 cubic feet (1,233.5 cubic meters).

Action Plan — A plan that describes what needs to be done and when it needs to be completed.

Activity — A specific project task that requires resources and time to complete.

Adaptive Management — A process for learning and incorporating new information into the planning and evaluation phases of the restoration program. This process ensures that the scientific information produced for this effort is converted into products that are continuously used in management decision-making.

Adverse Effect — In relation to historic properties, an adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that will diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

Adverse Impact — The detrimental effect of an environmental change relative to desired or baseline conditions.

Affected Environment — Existing biological, physical, social, and economic conditions of an area subject to change, both directly and indirectly, as a result of a proposed human action.

Air Quality — Measure of the health-related and visual characteristics of the air, often derived from quantitative measurements of the

concentrations of specific injurious or contaminating substances.

Anthropogenic — Of, relating to, or resulting from the influence of human beings on nature.

Aquatic — Consisting of, relating to or being in water; living or growing in, on or near the water; or taking place in or on the water.

Aquifer — An underground geologic formation, a bed or layer of earth, gravel or porous stone, that yields water or in which water can be stored.

Authorization — An act by the Congress of the United States, which authorizes use of public funds to carry out a prescribed action.

B

Baseline — The initial approved plan for schedule, cost or performance management, plus or minus approved changes, to which deviations will be compared as the project proceeds.

Benthic — **Bottom** of rivers, lakes, or oceans; organisms that live on the bottom of water bodies.

Best Management Practices — The best available land, industrial and waste management techniques or processes that reduce pollutant loading from land use or industry, or which optimize water use.

Biological Opinion — Document issued under the authority of the Endangered Species Act stating the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Services finding as to whether a Federal action is likely to jeopardize the continued existence of a threatened or endangered species or result in the destruction or adverse modification of critical habitat.

Borrow Canal — Canal or ditches where material excavated is used for earthen construction

nearby. Also, typically denotes a canal with no conveyance or water routing purpose.

C

Canal — A human-made waterway that is used for draining or irrigating land or for navigation by boat.

Candidate Species — Plant or animal species not yet officially listed as threatened or endangered, but which is undergoing status review by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service.

Central and Southern Florida Project (C&SF) — A multi-purpose project, first authorized by Congress in 1948, which provides flood control, water supply protection, water quality protection and natural resource protection.

Channel — Natural or artificial watercourse, with a definite bed and banks to confine and conduct continuously or periodically flowing water.

Coastal Ridge — Area of land bordering the coast whose topography is elevated higher than land further inland.

Comprehensive Everglades Restoration Plan (CERP) — The plan for the restoration of the greater Everglades and to meet water supply and flood protection needs in the urban and agricultural regions of south Florida.

Control Structure — A human-created structure that regulates the flow of waters or the level of waters.

Conveyance Capacity — The rate at which water can be transported by a canal, aqueduct, or ditch. In this document, conveyance capacity is generally measured in cubic feet per second (cfs).

Cost-Benefit Analysis — An analysis, often stated as a ratio, used to evaluate a proposed course of action.

Critical Habitat — A description, which may be contained in a Biological Opinion, of the specific areas with physical or biological features essential to the conservation of a listed species and which may require special management considerations or protection; these areas have been legally designated via Federal Register notices.

Cubic feet per second (cfs) — A measure of the volume rate of water movement. As a rate of stream flow, a cubic foot of water passing a reference section in 1 second of time. One cubic foot per second equals 0.0283 meter /second (7.48 gallons per minute). One cubic foot per second flowing for 24 hours produces approximately 2 acre-feet.

Culture — The National Park Service defines culture as “a system of behaviors, values, ideologies, and social arrangements. These features, in addition to tools and expressive elements such as graphic arts, help humans interpret their universe as well as deal with features of their environments, natural and social. Culture is learned, transmitted in a social context, and modifiable. Synonyms for culture include life ways, customs, traditions, social practices, and folkways. The terms folk culture and folk life might be used to describe aspects of the system that are unwritten, learned without formal instruction, and deal with expressive elements such as dance, song, music and graphic arts as well as storytelling.”

Cultural Resources — Encompasses both culturally significant sites and historic properties.

Culturally Significant Site — Geographically defined areas supporting current or past human use such as a community meeting area, spiritual sites, places of worship, medicinal plant gathering areas or cemeteries and burial sites.

Culvert — A concrete, metal or plastic pipe that transports water.

D

Data — (cultural resources) Per Engineering Regulation 1105-2-100(b)(10), the DOI defines “data” as “evidence about historic and prehistoric periods, which are buried in the ground” and recovered as evidence...when construction projects pose threats that would result in their irreparable loss or destruction.”

Data Recovery — (cultural resources) also known as Mitigative Excavations is a way to remedy or offset an adverse effect or a change in qualifying characteristics within an archaeological site. Through mitigative excavations, important information that makes the site eligible for NRHP listing is retrieved from the site before the site’s integrity is compromised or destroyed.

Discharge — The rate of water movement as volume per unit time, usually expressed as cubic feet per second.

Dissolved Oxygen (D.O.) — The concentration of oxygen dissolved in water, sometimes expressed as percent saturation, where saturation is the maximum amount of oxygen that theoretically can be dissolved in water at a given altitude and temperature.

Dry Downs — Refers to marsh water levels going below ground in the Everglades. Dry downs occur naturally in the pre-drainage Everglades, but were not as frequent, nor as long in duration as does occur in the current system.

Dry Season — Hydrologically, for south Florida, the months associated with a lower incident of rainfall, typically November through May.

Duration — The period of time over which a task occurs, in contrast to effort, which is the amount of labor hours a task requires; duration

establishes the schedule for a project, and effort establishes the labor costs.

E

Ecology — The science of the relationships between organisms and their environments, also called bionomics; or the relationship between organisms and their environment.

Ecosystem — A functional group of animal and plant species that operate in a unique setting that is mostly self-contained.

Ecotone — A transitional zone between two communities containing the characteristic species of each.

Effectiveness — A measure of the quality of attainment in meeting objectives; this is distinguished from efficiency, which is measured by the volume of output achieved for the input used.

Endangered Species — Any species or subspecies of bird, mammal, fish, amphibian, reptile, or plant which is in serious danger of becoming extinct throughout all, or a significant portion of its range. Federally endangered species are officially designated by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service and published in the Federal Register.

Enhancement — Measures which develop or improve the quality or quantity of existing conditions or resources beyond a condition or level that would have occurred without an action; i.e., beyond compensation.

Environmental and Economic Equity (EEE) — A program-level activity, referred to in early phases of the program as Socioeconomic and Environmental Justice.

Environmental Consequences — The impacts to the Affected Environment that are expected from implementation of a given alternative.

Environmental Impact Statement (EIS) — An analysis required by the National Environmental Policy Act for all major Federal actions, which evaluates the environmental risks of alternative actions.

Estuary — A water passage where the tide meets a river current; an arm of the sea at the lower end of a river.

Eutrophic — Referring to a body of water which is naturally or artificially enriched in dissolved nutrients, and often shallow with a seasonal deficiency in dissolved oxygen due to high primary production.

Evaluate — To appraise or determine the value of information, options or resources being provided to a project.

Evaporation — The change of a substance from the solid or liquid phase to the gaseous (vapor) phase.

Evapotranspiration — Evapotranspiration is part of the hydrologic cycle that is a combination of evaporation and transpiration. Solar energy induces evaporation, causing water vapor to condense and fall as precipitation. A portion of the precipitation seeps into the ground and is consumed by plants. It is then recycled back into the atmosphere in the form of transpiration.

Exotic species — Introduced species not native to the place where they are found.

F

Fallowed Land — Cultivated land that lies idle during a growing season.

Feasibility Study — The second phase of a project. The purpose is to describe and evaluate alternative plans and fully describe recommended project.

Federally Endangered Species — An endangered species which is officially designated by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service and published in the Federal Register.

Flood Control Storage Capacity — Reservoir capacity reserved for the purpose of regulating flood inflows to reduce flood damage downstream [compare with reservoir storage capacity].

Flow — The volume of water passing a given point per unit of time.

Instream Flow Requirements — Amount of water flowing through a stream course needed to sustain instream values.

Minimum Flow — Lowest flow in a specified period of time.

Peak Flow — Maximum instantaneous flow in a specified period of time.

G

Geospatial Data — Information, which includes, but is not limited to surveys, maps, aerial photography, aerial imagery, and biological, ecological and hydrological modeling coverage's.

Goal — Something to be achieved. Goals can be established for outcomes (results) or outputs (efforts).

Groundwater — Water stored underground in pore spaces between rocks and in other alluvial materials and in fractures of hard rock occurring in the saturated zone.

Groundwater Level — Refers to the water level in a well, and is defined as a measure of the hydraulic head in the aquifer system.

Groundwater Pumping — Quantity of water extracted from groundwater storage.

Groundwater Seepage — Groundwater flow in response to a hydraulic gradient.

Groundwater Table — The upper surface of the zone of saturation, except where the surface is formed by an impermeable body.

H

Habitat — Area where a plant or animal lives.

Hammock — Localized, thick stands of trees that can grow on natural rises of only a few inches in the land.

Hectare — A unit of measure in the metric system equal to 10,000 square meters or 2.47 acres.

Historic Properties — Encompasses archaeological, traditional, and built environment resources, including but not limited to buildings, structures, objects, districts and sites over 50 years of age.

Hydraulic Gradient — Denotes slope of watercourse, above or below ground water level. Typically, defines energy loss or consumption in the conveyance process.

Hydraulic Head (Lift) — Denotes relative comparison of water stages for gravity flow. Pump stations generally provide lift or increase water level elevations.

Hydrologic Condition — The state of an area pertaining to the amount and form of water present. For example, saturated ground (water table at surface), lake stage and river flow rate.

Hydric — Characterized by, relating to, or requiring an abundance of moisture.

Hydrologic Response — An observed decrease or increase of water in a particular area.

Hydrology — The scientific study of the properties, distribution and effects of water on the

earth's surface, in the soil and underlying rocks, and in the atmosphere.

Hydropattern — Refers to depth as well as hydroperiod. Hydropatterns are best understood by a graphic depiction of water level (above as well as below the ground) through annual cycles.

Hydroperiod — For non-tidal wetlands, the average annual duration of flooding is called the hydroperiod, which is based only on the presence of surface water and not its depth.

I

Impoundment — An above ground reservoir used to store water.

Independent Technical Review Team — A group autonomous of the Project Team established to conduct reviews to ensure that design products are consistent with established criteria, guidance, procedures and policies.

Indicator Species — Organism, species, or community which indicates presence of certain environmental conditions.

Invertebrate — A small animal that does not have a backbone, examples include crayfish, insects and mollusks, which can be indicators of ecosystem status.

J

K

L

Lag — The amount of time after one task is started or completed before the next task can be started or completed.

Land Classification — An economic classification of variations in land reflecting its ability to sustain long-term agricultural production.

Levee — A human-created embankment that controls or confines water.

Littoral Zone — The shore of land surrounding a water body that is characterized by periodic inundation or partial saturation by water level. Typically defined by species of vegetation found.

Local Sponsor — The South Florida Water Management District.

M

Macrophytes — Visible plants found in aquatic environments, including sawgrass, sedges and lilies.

Marl — Soils comprised of clays, carbonates, and shell remains.

Marsh — An area of low-lying wetland.

Master Program Management Plan (MPMP) — A document which describes the framework and processes to be used by the USACE and the SFWMD for managing and monitoring implementation of the Comprehensive Everglades Restoration Plan.

Mercury — Heavy metal that is toxic to most organisms when converted into a byproduct of inorganic-organic reaction. Distributed into the environment mostly as residual particles from industrial processes.

Mitigation — To make less severe; to alleviate, diminish or lessen; one or all of the following may comprise mitigation: (1) avoiding an impact altogether by not taking a certain action or parts of an action; (2) minimizing impacts by limiting the degree or magnitude of an action and its implementation; (3) rectifying an impact by repairing, rehabilitating or restoring the affected environment; (4) reducing or eliminating an impact over time by preservation and maintenance operations during the life of an action; and (5) compensating for an impact by

replacing or providing substitute resources or environments.

Model — A tool used to mathematically represent a process which could be based upon empirical or mathematical functions. Models can be computer programs, spreadsheets, or statistical analyses.

Monitoring — The capture, analysis and reporting of project performance, usually as compared to plan.

Muck — Soil type consisting of 25% to 65% plant material mixed with sand silt, and clay.

N

National Economic Development (NED) — Corps of Engineers benefit evaluation process used to justify Recreation expenditures.

No Action Alternative — The planning process by which the action agency decides to not carry forth any planned action to alter existing conditions. In this report the No Action Alternative is the same as the Future Without Project Condition (FWO) and is referred to throughout the document as FWO.

O

Objective — A goal expressed in specific, directly measurable terms.

Off-peak — Less than peak design flow rate during storm runoff producing events.

Operation, Maintenance, Repair, Rehabilitation, Replacement (OMRR&R) — 100% local sponsor responsibility to OMRR&R recreation facilities and amenities.

Outreach — Proactive communication and productive involvement with the public to best meet the water resource needs of south Florida.

Oxygen Demand — The biological or chemical demand of dissolved oxygen in water. Required by biological processes for respiration.

P

Peat — Soil type consisting of 65% or more plant material with relatively little mineral matter. Everglades peat is formed mostly from partially decayed sawgrass. The upper 12 inches is a nearly black, finely fibrous peat which contains approximately 10% mineral soil. The sub-soil is brown, fibrous peat which rests on the underlying rock, sand or marl.

Performance Measure — A desired result stated in quantifiable terms to allow for an assessment of how well the desired result has been achieved.

Periphyton — The biological community of microscopic plants and animals attached to surfaces in aquatic environments, for example algae.

Phosphorus (P) — Element or nutrient required for energy production in living organisms. Distributed into the environment mostly as phosphates by agricultural runoff (fertilizer) and life cycles. Frequently the limiting factor for growth of microbes and plants in south Florida.

Programmatic Regulations — Section 601(h) of WRDA 2000 states that the overarching purpose of the Comprehensive Plan is the restoration, preservation and protection of the south Florida ecosystem while providing for the other water related needs of the region, including water supply and flood protection. The purpose of the regulations is to ensure that the goals and objectives of CERP are achieved. The regulations will contain: (1) processes for the development of Project Implementation Reports, Project Cooperation Agreements and operating manuals that ensure the goals and objectives of the plan are achieved; (2) processes that ensure new scientific, technical, or other information such as that developed through adaptive man-

agement is integrated into the implementation of the plan; and (3) processes to establish interim goals to provide a means by which the restoration success of the plan may be evaluated throughout the implementation process.

Project — A sequence of tasks with a beginning and an end that uses time and resources to produce specific results. Each project has a specific, desired outcome, a deadline or target completion date and a budget that limits the amount of resources that can be used to complete the project.

Project Partnership Agreement (PPA) — A document that describes the roles and responsibilities of the USACE and SFWMD for real estate acquisition, construction, construction management and operations and maintenance.

Project Delivery Team — An interdisciplinary group formed from the resources of the implementing agencies, which develops the products necessary to deliver the project.

Project Duration — The time it takes to complete an entire project from starting the first task to finishing the last task.

Project Implementation Report (PIR) — A decision document that will bridge the gap between the conceptual design contained in the Comprehensive Plan and the detailed design necessary to proceed to construction.

Proposed Action — Plan that a Federal agency intends to implement or undertake and which is the subject of an environmental analysis. Usually, but not always, the proposed action is the agency's preferred alternative for a project. The proposed action and all reasonable alternatives are evaluated against the no action alternative.

Public Involvement — Process of obtaining citizen input into each stage of the development of planning documents. Required as a major input into any EIS.

Public Outreach — A program-level activity with the objectives of keeping the public informed of the status of the overall program and key issues associated with restoration implementation and providing effective mechanisms for public participation in the restoration plan development.

Pump Station — A human constructed structure that uses pumps to transfer water from one location to another.

Q

Quality Assurance (QA) — The process of evaluating overall project performance on a regular basis to provide confidence that the project will satisfy the relevant quality standards.

Quality Control (QC) — The process of monitoring specific project results to determine if they comply with relevant quality standards, and identifying means of eliminating causes of unsatisfactory performance.

R

Recharge — The processes of water filling the voids in an aquifer, which causes the piezometric head or water table to rise in elevation.

Record of Decision — Concise, public, legal document which identifies and publicly and officially discloses the responsible official's decision on the alternative selected for implementation. It is prepared following completion of an Environmental Impact Statement.

Regional Water Supply Plan — Detailed water supply plan developed by the District under Ch. 373.0361, F.S.

Reservoir — Artificially impounded body of water.

Reservoir Storage Capacity — Reservoir capacity normally usable for storage and regulation of reservoir inflows to meet established reservoir operating requirements.

Flood Control Storage Capacity — Reservoir capacity reserved for the purpose of regulating flood inflows to reduce flood damage downstream.

Restoration — The recovery of a natural system's vitality and biological and hydrological integrity to the extent that the health and ecological functions are self-sustaining over time.

Restoration Coordination and Verification (RECOVER) — A program-level activity whose role is to organize and apply scientific and technical information in ways that are most effective in supporting the objectives of the Comprehensive Everglades Restoration Plan.

Restudy — The Central and South Florida Project Comprehensive Review Study, authorized by the Water Resources Development Act of 1992, which examined the Central and Southern Project to determine the feasibility of modifying the project to restore the south Florida ecosystem and provide for other water-related needs of the region, and which resulted in The Final Integrated Feasibility Report and Programmatic Environmental Impact Statement, which was transmitted to Congress on July 1, 1999.

Risk Analysis — An evaluation of the feasibility or probability that the outcome of a project or policy will be the desired one; usually conducted to compare alternative scenarios, action plans or policies.

S

Scoping — The process of defining the scope of a study, primarily with respect to the issues, geographic area, and alternatives to be considered. The term is typically used in association with environmental documents prepared under the National Environmental Policy Act.

Scrub — A community dominated by pinewoods with a thick understory of oaks and saw palmetto, and which occupies well-drained, nutrient-poor sandy soils.

Seepage — Water that escapes control through levees, canals or other holding or conveyance systems.

Sheet Flow — Water movement as a broad front with shallow, uniform depth.

Slough — A depression associated with swamps and marshlands as part of a bayou, inlet or backwater; contains areas of slightly deeper water and a slow current; can be thought of as the broad, shallow rivers of the Everglades.

South Florida Ecosystem — An area consisting of the lands and waters within the boundary of the South Florida Water Management District, including the Everglades, the Florida Keys and the contiguous near-shore coastal waters of South Florida.

Spatial Extent — Area that is continuous without non-integrating internal barriers or land usage.

Spillway — Overflow structure of a dam.

Spreader berm — A lateral weir used to spread water in creation of a sheetflow system over a very shallow depth.

Spreader canal — Canal used to equalize flow (to some degree) across a bank into an area with a shallow water depth. The spreader canal depth allows a water source to be delivered across the full reach enabling a deeper depth of sheetflow to occur.

Stakeholders — People or organizations having a personal or enterprise interest in the results of a project, who may or may not be involved in completing the actual work on that project.

Stormwater — Surface water resulting from rainfall that does not percolate into the ground or evaporate.

Subsidence — A local mass movement that principally involves the gradual downward settling or sinking of the earth's surface with little or no horizontal motion. It may be due to natural geologic processes or mass activity such as removal of subsurface solids, liquids, or gases, ground water extraction, and wetting of some types of moisture-deficient loose or porous deposits.

Surficial Aquifer — An aquifer that is closest to the surface and is unconfined; the water level of a surficial aquifer is typically associated with the groundwater table of an area.

Sustainability — The state of having met the needs of the present without endangering the ability of future generations to be able to meet their own needs.

Swamp — A generally wet, wooded area where standing water occurs for at least part of the year.

T

Threatened species — Legal status afforded to plant or animal species that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range, as determined by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service.

Tiering — Procedure which allows an agency to avoid duplication of paperwork through incorporation by reference of the general discussions and relevant specific discussions from an environmental impact statement (EIS) of broader scope into a subsequent EIS of narrower scope.

Trade-Off — Allowing one aspect of a project to change, usually for the worse, in return for another aspect of the project getting better.

Traditional Cultural Property – The NPS defines “traditional” in this context as referring “to those beliefs, customs, and practices of a living community of people that have been passed down through the generations, usually orally or through practice. The traditional cultural significance of a historic property, then, is significance derived from the role the property plays in a community's historically rooted beliefs, customs, and practices.”

Tributary — A stream feeding into a larger stream, canal or waterbody.

U

V

W

Water Budget — An account of all water inflows, outflows and change in storage for a pre-specified period of time.

Water Conservation Areas (WCAs) — Marshland areas that were designed for use as storage to prevent flooding, to irrigate agriculture and recharge well fields and as input for agricultural and urban runoff; the Water Conservation Areas WCA-1, WCA-2A, WCA-2B, WCA-3A and WCA-3B comprise five surface water management basins in the Everglades; bounded by the Everglades Agricultural Area on the north and the Everglades National Park basin on the south, the WCAs are confined by levees and water control structures that regulate the inflows and outflows to each one of them.

Watershed — A region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water.

Wetlands — Areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetative or aquatic life that re-

quires saturated or seasonally saturated soil conditions for growth and reproduction.

Wet Season — Hydrologically, for south Florida, the months associated with a higher than average incident of rainfall, June through October.

Wildlife Corridor — A relatively wide pathway used by animals to transverse from one habitat arena to another.

Wildlife Habitat — An area that provides a water supply and vegetative habitat for wildlife.

X

Y

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