# CHAPTER 4
# ENVIRONMENTAL EFFECTS

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# 4.0 ENVIRONMENTAL EFFECTS

## 4.1 INTRODUCTION

This chapter provides a discussion of the potential environmental effects, which can be either positive or negative, that could result from implementation of the Alternatives. A detailed description of the alternatives is provided in Chapter 2. The evaluation of the effects was based on results of modeling simulations (as described below), current information including scientific literature, direct observation, project design reports, reasonable scientific judgment, the scoping process, and other environmental impact statement (EIS) documents for similar projects. The No Action Alternative considers the environmental conditions in the affected regions without the Proposed Action. However, the modeling analysis does include other planned restoration projects anticipated to be fully or partially in operation by 2015-2020 [C-43 West Reservoir, C-44 Reservoir and Stormwater Treatment Area (STA), Site 1 Impoundment, Broward Water Preserve Area (C-11 and C-9 Impoundments), C-111 Spreader Canal project, and the Loxahatchee River Watershed Restoration Plan].

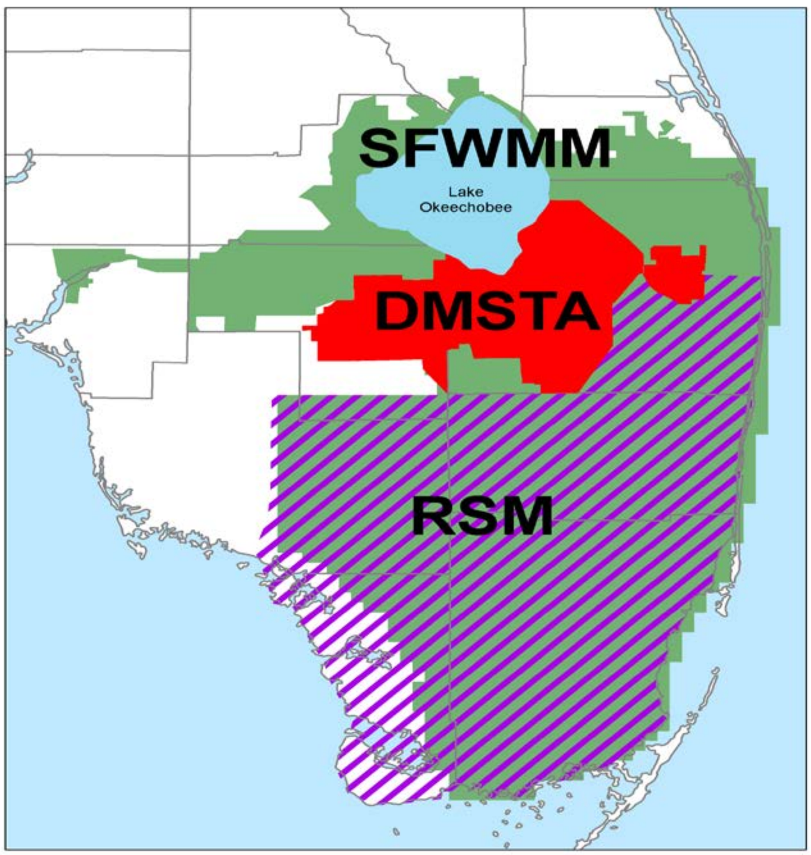
Environmental impacts include both direct and indirect effects. Under the Council on Environmental Quality (CEQ) regulations, direct effects are “caused by the action and occur at the same time and place,” while indirect effects are “caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems” (40 CFR 1508.8). Potential impacts of this project in concert with other reasonably foreseeable projects (cumulative effects) is discussed in Section 4.19, unavoidable adverse impacts, effects to the resources that cannot or would not be reversed in a foreseeable amount of time (irreversible and irretrievable commitment of resources), any conflicts and controversy associated with this project, and environmental commitments.

## 4.2 MODELING EFFORTS

The objective of the modeling efforts was to evaluate the effects on hydrology, water quality, and the downstream environment. The results of the modeling efforts that describe the overall water management is described in Section 4.5.1, surface water hydrology including surface ponding and hydroperiod in Section 4.5.2, groundwater in Section 4.5.3, and water quality in Section 4.6.

Three models were integrated into this EIS: 1) the South Florida Water Management Model [SFWMM or 2x2 (SFWMD, 2005)]; 2) the Dynamic Model for Stormwater Treatment Areas (DMSTA) Version 2 (Walker and Kadlec, 2005); and 3) the Regional Simulation Model (RSM) (SFWMD, 2005). See **Figure 4-1** for the approximate spatial extent of each of the three models used in this EIS. The Model Documentation Reports for SFWMM, DMSTA and RSM describe the methods and assumptions in detail and are provided in Appendix E. Performance measure graphics for the alternatives are provided within Section 4. These three models represent the best available tools for simulating hydrology and water quality. Each model has been developed specifically for the Everglades region, and has been developed and refined over a period of several years.

**Figure 4-1** Approximate Model Domains




## 4.2.1 SOUTH FLORIDA WATER MANAGEMENT MODEL

The SFWMM (or 2x2) is a regional, hydrologic computer model specifically developed and applied to simulate the unique hydrology of the south Florida system and its regional management. Use of the SFWMM in this EIS involved application of the model to estimate the volume and timing of surface water flows discharged from source basins contributing inflows to existing STAs and proposed project features associated with the alternatives described below, with eventual discharge into the Everglades Protection Area (EPA).

The SFWMM is a coupled surface water-groundwater model which incorporates overland flow, canal routing, unsaturated zone accounting and two-dimensional single layer aquifer flow. The model simulates the major components of the hydrologic cycle in south Florida including rainfall, evapotranspiration, infiltration, overland and groundwater flow, canal flow, canal groundwater seepage, levee seepage and groundwater pumping. The model has been exclusively developed for the south Florida region and has been calibrated and verified using water level and discharge measurements at hundreds of locations distributed throughout the region within the model boundaries. In addition to simulating the natural hydrology in south Florida, the model also simulates the management processes that satisfy policy-based rules to meet flood control, water supply and environmental needs. It can incorporate current or proposed water management control structures and current or proposed operational rules. The SFWMM simulates hydrology on a daily basis using climatic data for the 1965-2005 period of record which includes many droughts and wet periods.

The SFWMM simulation RS_BASE2 used in this EIS provided the modeled hydrologic estimates for inclusion in the DMSTA water quality modeling effort described below. The intent of the SFWMM simulation RS_BASE2 is to represent a projection of the south Florida system hydrology as it would be in the future condition (circa 2015-2020). This projection is dependent on several assumptions, including anticipated completion of current and planned projects, system operating protocols and projections of future consumptive use and environmental demands. Although the entire south Florida regional system is modeled by the SFWMM, the modeling results for this EIS focused on the basin hydrology in and in the vicinity of the Everglades Agricultural Area (EAA) specifically related to basins that contribute flow to Everglades STAs that discharge into the EPA. The period of simulation (or selected period of record) of RS_BASE2 is January 1, 1965 to December 31, 2005. For the purposes of this EIS, SFWMM simulation RS_BASE2 provides hydrologic estimates of the areas identified in **Figure 4-1**. A detailed description of the south Florida system-wide assumptions and projects that were incorporated into the RS_BASE2 scenario is provided in the SFWMM Model Documentation Report provided in detail in Appendix E.

For each basin, daily flow time series were provided from the SFWMM output. These daily flow time series provide the basis for the generation of inputs to the DMSTA model. The SFWMM daily flows were post-processed using methods that are consistent with previous DMSTA modeling efforts (Gary Goforth, Inc., 2009). Essentially, SFWMM post-processing requires the merging of historical phosphorus concentration data from contributing source basins with the

SFWMM daily flows to generate inflow datasets for DMSTA. During this process, some aspects of the SFWMM-estimated hydrology are recalculated or rescaled to more closely approximate observed historical data. Specific post-processing details are provided in the Model Documentation Report provided in Appendix E.

For this EIS, the inflow datasets for DMSTA that were prepared by post-processing SFWMM daily flows were utilized for all EIS alternatives. Any changes as a result of alternative project features and their operations were formulated and evaluated as part of the DMSTA water quality modeling effort. To be clear, SFWMM was not utilized to formulate or evaluate alternatives; this was accomplished by the DMSTA and RSM modeling efforts described below. As a planning tool, the SFWMM was applied to estimate regional-scale hydrologic responses to proposed modifications to the water management system in south Florida. Results from the regional scale investigation were then used for more detailed modeling and investigation at a sub-regional scale, which in turn provided the bases for detailed evaluation of specific alternatives. Therefore, SFWMM results are equivalent for all EIS alternatives.

### 4.2.2 DYNAMIC MODEL FOR STORMWATER TREATMENT AREAS

The DMSTA was used to simulate EAA surface water routing, and estimate the phosphorus removal performance of the STAs and Flow Equalization Basins (FEBs) in the alternatives. DMSTA was developed for the United States Department of the Interior (DOI) and the U.S. Army Corps of Engineers (USACE) (Walker and Kadlec, 2005; http://wwwalker.net/dmsta/). DMSTA was developed and calibrated to information specific to south Florida and to predict phosphorus removal performance of Everglades STAs and storage reservoirs, and has been commonly used since 2001 by state and federal agencies for STA design and evaluation. The 2005 version of DMSTA was calibrated to data from 35 fully functional STA treatment cells with vegetation communities of various types. The model provides detailed output on the water and phosphorus balances of individual treatment cells and entire STAs, regional networks of STAs and storage reservoirs.

Model input requirements include daily values for flow, phosphorus concentration, rainfall, evapotranspiration (ET), depth (optional input or simulated value) and releases (optional input or simulated), treatment area configuration, cell size, flow path width, vegetation type, estimates of hydraulic mixing, outflow hydraulics, and seepage estimates. Phosphorus removal rates (settling rates) and other phosphorus cycling parameters can be either user-defined or calculated within DMSTA based on calibration data sets. DMSTA assumes that specified vegetation types (emergent, submerged, periphyton) will be maintained over the 40-year hydrologic period used as a basis for design, with some allowance for down time required for maintenance.

Some level of forecast error may result when applying any model, reflecting the limitations of the calibration datasets (data range, measurement error, short duration, etc.). One limitation of DMSTA is that the model may not reproduce phosphorus loading spikes observed in some STA cells following periods of extended dry-out. Careful management of treatment cell water depths and operating the STA in conjunction with an FEB may be two options to minimize the frequency and duration of such conditions. DMSTA may forecast outflow concentrations below values observed in the field following extreme drought conditions if management measures are unsuccessful at maintaining sufficient water levels. To ensure a conservative analysis, annual values less than 12 parts per billion (ppb) simulated by DMSTA were replaced with a value of 12 ppb in both this EIS and the Restoration Strategies Regional Water Quality Plan.

DMSTA is the best available tool for simulating phosphorus removal performance of existing or planned storage reservoirs and STAs. DMSTA is configured to allow integration with the SFWMD's regional hydrologic models, such as the SFWMM (SFWMD, 2005) and can be configured to simulate complex regional networks of STAs and reservoirs. DMSTA's spreadsheet interface and relatively limited input data requirements allow the development and evaluation of various alternatives (Walker and Kadlec, 2011). For this EIS, DMSTA results are summarized for the water years (Water Years 1965 – 2005 or May 1, 1965 – April 30, 2005) that are contained with the SFWMM period simulation (January 1, 1965 – December 31, 2005), which is used as input for the RSM.

**DMSTA Results**

The phosphorus removal performance of Alternatives 1, 2, 3, and 4 was projected using DMSTA. DMSTA provides simulated inflow and outflow volumes, and total phosphorus concentrations and loads for the FEBs and STAs. DMSTA also provides water depths within the project area and the FEBs and STAs. These results were used, in part, to determine effects on water resources, vegetation, fish and wildlife, and threatened and endangered species in the project site, and in STA 2, and STA 3/4. However, DMSTA results alone are not sufficient for evaluating environmental effects within Water Conservation Area (WCA) 2A, WCA 3A and Holey Land Wildlife Management Area (Holey Land). Therefore, DMSTA-simulated daily flows were provided as boundary flows to Glades and Lower East Coast Service Area (LECSA) RSM for further analysis in order to understand effects of the alternatives on areas downstream of the STAs. In some areas, DMSTA flows were combined with SFWMM flows (not simulated within DMSTA) and provided as input to the Glades LECSA RSM. See the DMSTA modeling report provided in Appendix E for more information.

### 4.2.3 REGIONAL SIMULATION MODEL

The Glades and LECSA RSM model (also referred to as the Glades-LECSA model) is an application of the RSM developed by the SFWMD. RSM was used to project the hydrologic conditions downstream of the STAs. The Glades-LECSA model represents the most recent generation of integrated surface and groundwater flow models developed specifically to address the complexity of south Florida's hydrologic system. The model also has capabilities to predict the outcomes of implementing structural and operational changes to the water management system in south Florida. The Glades-LECSA model domain includes all WCAs, Everglades National Park, Big Cypress National Preserve and the Lower East Coast Service Areas south of the C-51 Canal in Palm Beach County. The Glades-LECSA model was used in this EIS to evaluate the hydrologic impacts of the EIS alternatives within the affected environment.

The RSM is an implicit, finite volume, continuous, distributed and integrated surface-water and groundwater model. It simulates the one-dimensional canal/stream flow and two-dimensional overland and groundwater flow in arbitrarily shaped areas using a variable triangular mesh. The overland and groundwater flow components are fully coupled for a more realistic representation of the hydrology in south Florida. It has physically based formulations for the hydrologic processes which include evapotranspiration, infiltration, levee seepage, and canal and structure flows. The model uses the diffusive wave approximation of Saint-Venant's equation to simulate canal and overland flows. The Manning's equation is used to simulate overland flow. The Glades-LECSA model mesh consists of 5,794 triangular cells with an average cell size of approximately one square mile. The domain takes into consideration the need for having higher spatial resolution in areas where steep hydraulic gradients and prominent physical features (e.g., levees) exist. The mesh resolution is the finest in the natural areas, especially WCA 3B, which has the smallest average cell area (0.41 square miles) and finest resolution. The mesh is designed to conform to all important flow controlling features, such as roads and levees within the model domain. A one-day time step was used for the calibration and validation of the model. The model has been stringently calibrated with goodness of fit (for bias and root mean squared error) comparable to the SFWMM. The model results show that the Glades-LECSA model is capable of simulating, with an acceptable error tolerance, the stage and other stage dependent variables such as flow, flow vectors, ponding depth and hydroperiods within the model domain.

The Glades-LECSA model used as a baseline in this EIS reflects the south Florida system hydrology as it would be in the future condition without any of the EIS alternatives, or in the No Action Alternative. It is comparable to the SFWMM model (described above) in that it includes projects and operations circa 2015-2020. It also includes the recently implemented Everglades Restoration Transition Plan (ERTP) schedule in WCA 3A. The period of simulation of the Glades-LECSA model is January 1, 1965 to December 31, 2005. For simulation of the EIS alternatives, the Glades-LECSA model boundary conditions at the northern model boundary are a combination of output from the SFWMM and DMSTA for each of the four alternatives. In other words, outflows from the EIS alternatives, as simulated by DMSTA, are combined with relevant SFWMM boundary conditions (not simulated by DMSTA) and provided as input to the Glades-LECSA model.

**Glades LECSA RSM Results**

Glades LECSA RSM simulates daily components of the hydrologic cycle (canal and structure flows, infiltration, levee seepage, evapotranspiration, etc.) resulting from daily precipitation and climate variables for the period of January 1, 1965 to December 31, 2005. Using Glades LECSA RSM, the influence of implementing the Action Alternatives and their resultant infrastructure changes and water management practices on the region's water resources can be evaluated over a 41-year period of meteorological conditions (1965-2005). The Glades LECSA RSM simulation used a baseline for this EIS represents the south Florida system hydrology as it would be in the 2015-2020 condition without any of the EIS alternatives.

Performance measure graphics are outputs of Glades LECSA RSM and were utilized for this EIS to assist in the evaluation of the effects of the EIS alternatives on WCA 2A and WCA 3A. These graphics identify the potential downstream effects to surface water hydrology, which in turn were considered in the evaluation of effects to soil; geology; water supply; surface water management; water quality; vegetation; and threatened and endangered species; fish and wildlife. See the RSM modeling results provided in Appendix E for more information.

## 4.2.4 KEY MODELING ASSUMPTIONS

A detailed description of the south Florida system-wide assumptions and projects that were incorporated into the modeling analysis is provided in Appendix D. A summary is outlined below:

- LORS2008 Lake Okeechobee Regulation Schedule
- Full Everglades Construction Project Build-out (STAs 1-6 with Comp. B and C; total effective area = 57,000 acres)
- CERP Projects: 1st and 2nd generation projects assumed (C-43 West Reservoir & C-44 Reservoir and STA, Site 1 Impoundment, Broward Water Preserve Area(C-11 and C-9

Impoundments), C-111 Spreader Canal Project) and the Loxahatchee River Watershed Restoration Plan

- WCA-1, 2A & 2B: Current C&SF Regulation Schedules
- WCA-3A & 3B: ERTP regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1
- Everglades National Park (ENP): Water deliveries to ENP are based upon ERTP, with the WCA-3A Regulation Schedule including the lowered Zone A (compared to IOP) and extended Zones D and E1. The one mile Tamiami Trail Bridge as per the 2008 Tamiami Trail Limited Reevaluation Report is modeled as a one mile weir, located east of the L67 extension and west of the S334 structure.
- Source Basin Total Phosphorus Concentration Period of Record: Water Years 2000-2009
- Total Phosphorus Concentrations for Lake Okeechobee releases conveyed to the STAs are based on water quality measurements collected at Lake outlets
- STA Duty Cycle Factor: 0.95 (i.e. STAs assumed to be offline for an average of 1 year out of 20 years for potential time needed for major maintenance or rehabilitation activities)
- Extreme Event Diversions: Inflows above STA structure capacities and when STA water depths are above 4 feet are sent directly to WCAs
- Urban Water Supply Deliveries from Lake Okeechobee not conveyed to STAs for treatment

## 4.3 LAND USE

Pursuant to grant agreement FB-4 entitled *Cooperative Agreement Among the United States Department of the Interior and the Nature Conservancy and The South Florida Water Management District* (Cooperative Agreement), lands acquired for public ownership under the Cooperative Agreement, including the A-1 project site will be used and managed for purposes of restoration in the Everglades ecosystem . Any proposed change in land use of Compartment A-1 may not be implemented until the U.S. Fish and Wildlife Service (USFWS)/DOI: 1) reviews the proposal; 2) determines that it meets the requirements of the National Environmental Policy Act (NEPA), Section 7 of the Endangered Species Act (ESA), Section 106 of the National Historic Preservation Act, and any other applicable statutes; and 3) approves the proposal. The Cooperative Agreement also includes a provision for dispute resolution. The USFWS/DOI approved an interim land use change for the A-1 project site on July 12, 2006, for utilization of the site as the A-1 Reservoir.

## 4.3.1 NO ACTION ALTERNATIVE

If the site were to remain fallow or return to agricultural use, it would no longer be used for restoration purposes pursuant to the Farm Bill and the Cooperative Agreement. Therefore, any proposed land use of the site would need to be evaluated by the USFWS/DOI pursuant to the terms of the Cooperative Agreement. The land uses for STAs 2 and 3/4 would not change. The STAs would continue to be utilized for water quality purposes, and they would continue to support ancillary recreational uses such as hunting, fishing, and wildlife viewing. The land uses in WCA 2A, WCA 3A, and the Holey Land also would not change. WCA 2A and WCA 3A would continue to store flood waters for beneficial municipal, urban, and agricultural uses and would continue to provide flood protection, water supply storage, and environmental resource protection while Holey Land would continue to provide environmental resource protection.

## 4.3.2 ACTION ALTERNATIVES

### 4.3.2.1 Project site

Alternatives 2, 3, and 4 would utilize the A-1 site in combination with STA 2 and STA 3/4 to ensure that water leaving the STA discharge points meets the WQBEL prior to discharge into the EPA. Each of the Action Alternatives would only accept existing water from Lake Okeechobee. Unlike the previous A-1 Reservoir project, the Shallow FEB, Deep FEB, and the STA are designed to store water from Lake Okeechobee that is currently budgeted to be discharged south. The change in the purpose of the projects would require the lands to be used for water quality purposes rather than water storage purposes. Therefore, each of the Action Alternatives would require approval for a land use change from the USFWS/DOI.

### 4.3.2.2 Stormwater Treatment Areas

Under the Action Alternatives, the land use for STA 2 (including Compartment B) and STA 3/4 would not change. Operations of the STAs would continue in order to provide water quality improvement in discharges to the EPA. Land use would continue to be classified as public/institutional or conservation and would continue to support ancillary recreational uses such as hunting, fishing, and wildlife viewing.

### 4.3.2.3 WCAs and Holey Land

Under the Action Alternatives, there would be no changes in the land uses for WCA 2A, WCA 3A, and the Holey Land.

# 4.4 GEOLOGY, TOPOGRAPHY AND SOILS

## 4.4.1 GEOLOGY AND TOPOGRAPHY

### 4.4.1.1 No Action Alternative

Under the No Action Alternative, surficial geology of the project site, the STAs, the WCAs, or Holey Land is not anticipated to change. The project area would likely remain undisturbed or be converted back to active agriculture. In the future, soils are expected to continue to subside within the project area due to oxidation and lack of new sediment deposition within the project area. As soil subsides, the topography is expected to lower slightly. No changes to topography are expected for the STAs, the WCAs, or Holey Land under the No Action Alternative since the land use and surface water operations within these areas are not expected to change.

### 4.4.1.2 Action Alternatives

With all the action alternatives, there would be minor geologic impacts within the project area from the removal of surface cover (e.g. vegetation and soil), of the caprock from blasting, and removal of limestone to obtain material for construction of levees, canals and roads. The depth of the caprock varies from less than 1 to 4 feet; and averages a depth of approximately 2 feet across the project site. Seepage and borrow canals would be constructed with all three of the Action Alternatives and portions of existing canals and ditches would require fill to provide elevations consistent with the adjacent wetlands for Alternatives 2 (Shallow FEB) and 3 (Deep FEB).

Alternatives 2 and 4 would result in conversion of relatively flat, uniform agricultural lands to an FEB or STA with shallow water (4 feet maximum operating depth) and exterior levees up to 10 feet above existing grade (generally 7 to 9 feet North American Vertical Datum 1988). Alternative 2 (Shallow FEB) would require internal levees to be constructed to enable the conveyance of flows to the north end of the project site. Alternative 4 (STA) would also require additional internal levees to be constructed to delineate STA treatment cells and flow-paths.

Alternative 3 is an FEB with deep water (12.5 feet maximum operating depth) and exterior levees up to 25 feet above existing grade. For Alternative 3 (Deep FEB), additional blasting or fracturing of the caprock would be required both to construct the higher levee walls and to construct an associated pump station. The seepage buffer on the east, west, and north of the project site would have a 150-foot wide strip at existing grade.

No changes to geology or topography are expected are expected within the STAs, the WCAs, or Holey Land through implementation of any of the action alternatives as additional features, land use, and operations are not expected to change.

### 4.4.2 SOILS

#### 4.4.2.1 No Action

Under the No Action Alternative it is expected that the project site would remain fallow or return to agriculture. Currently, direct rainfall is the dominant source of water for the project site. Under the No Action Alternative, dryout conditions and the resultant loss of soil due to oxidation would persist and possibly increase in frequency dependent upon future climatic conditions. With re-wetting, the oxidized soil releases phosphorus and other nutrients into the overlying water column thereby increasing the nutrient concentrations in runoff from the site. In addition to impacts on nutrient concentrations, it is expected that the continued loss of soil due to oxidation during dry conditions will result in a slightly lower topography in the project site in the future.

Under the No Action Alternative, STAs 2 and 3/4 will continue to face substantial management challenges caused by regional hydrologic conditions. As discussed in previous chapters, insufficient rainfall during the dry season can cause extreme low water conditions that expose wetland soils and result in the oxidation of organic material and the release nutrients. These conditions hinder the treatment performance of the STAs and threaten to delay or prevent the attainment of the Water Quality Based Effluent Limit (WQBEL).

If STA discharges exceed the WQBEL as projected under the No Action Alternative, the excess phosphorus discharged downstream will increase soil phosphorus concentrations in the WCAs. The current pattern of soil phosphorus enrichment near the major inflow points would remain and the gradient of elevated nutrient levels would continue to expand over time into the interior of the marsh. Soil characterization studies of the phosphorus gradient in WCA 2A have shown a roughly proportional increase in concentration of phosphorus near the major surface water inflow points concentrations at the major inflow points to the WCAs (DeBusk et al, 2001).

Under the No Action Alternative, there would be no affect to soils in the Holey Land.

#### 4.4.2.2 Action Alternatives

During construction of levees, the muck soils would be removed and stockpiled on site to access the limestone. Following construction of the interior and exterior levees, excess muck would be redistributed over the previously scraped areas and in limited areas, back-sloped against the exterior face of the eastern and western interior levees. Alternatives 2 and 4 are expected to encourage vegetation establishment and wetland ecological function due to the shallow nature of the water levels. Muck soils would likely increase as a layer of fine sediments containing a high level of organic debris and nutrients would likely settle from the overlying water and cover the bottom. The soils within the project site are anticipated to remain hydric and retain muck properties or revert to muck properties post-construction. Alternative 3, the Deep FEB, is expected to contain less organic debris and nutrients since rooted vegetation would not be present.

The FEBs proposed in Alternatives 2 and 3 have the potential to benefit soils within STA 2 and STA 3/4 by maintaining minimum water levels and reducing the frequency of dryout conditions. Decreasing the frequency of dryout conditions will reduce the potential for soil oxidation and the resulting release of phosphorus and other nutrients from the soil. The probability of experiencing dryout conditions in STA 2 and STA 3/4 is greater under Alternative 4 (STA), as it would not operate to maintain the minimum water levels in the STAs.

Lower phosphorus concentrations coming from the STA 2 and STA 3/4 would reduce the rate of soil phosphorus accumulation in WCA soils. Over time, reductions in soil total phosphorus (TP) will help facilitate the restoration of impacted areas near the inflow points to WCA 2A and WCA 3A creating conditions more conducive to historic Everglades vegetative communities. The overall soil classification (histosol) and structure (muck) is not expected to change.

Alternatives 2 and 3 (FEBs) would have no effect on the soils in the Holey Land. Alternative 4 would require the construction of a discharge canal from the proposed STA to the L-5 Canal, which would disturb soils on the eastern portion of Holey Land adjacent to Cells 3A and 3B within STA 3/4. The remaining soils within Holey Land would remain undisturbed.

## 4.5 HYDROLOGY

## 4.5.1 OVERALL WATER MANAGEMENT

### 4.5.1.1 No Action

If agricultural activities were to resume on the A-1 project site, water would continue to enter the site via the Miami Canal and the North New River Canal; however, drainage improvements would be necessary to pump water off the property in the North New River Canal. If the site were to remain undisturbed, there would be no change in the surface water management as the water would continue to flow from the existing agricultural ditches to the STA 3/4 seepage canal.

There should be no changes to the surface water management within the STAs, WCAs, or Holey Land under the No Action Alternative.

### 4.5.1.2 Action Alternatives

#### 4.5.1.2.1 Alternative 2 (Shallow FEB)

The Shallow FEB will be operated in series with (upstream of) STA 2 and STA 3/4. Inflows would be conveyed to the Shallow FEB from the Miami Canal via the existing pump station G-372 and from the North New River Canal via existing pump station G-370. After inflows are conveyed to the north end of the Shallow FEB, the water would sheet flow from north to south. An internal collection canal would be constructed to assist in conveying water out of the Shallow FEB back to the North New River Canal when the water deliveries are needed. Two operable water control structures will be constructed to control FEB water levels and flows into and out of the FEB; one at the existing pump station G-370 at the North New River Canal and one east of the existing pump station G-372 within the west levee of the FEB to collect runoff from the Miami Canal. To send water to STA 3/4, operable water control structures may also be constructed to allow discharges to be conveyed via gravity directly to the STA 3/4 inflow canal. To send water to STA 2, water would be pumped from the North New River Canal by the G-434 and G-435 pump stations. As stated in Chapter 2, Section 2.4.2, the majority of the shallow FEB outflows (approximately 80%) would be directed to STA 3/4 for treatment while the remaining flows (approximately 20%) would be conveyed to STA 2 (including Compartment B). Thus, out of the approximately 834,000 acre-feet of water per year that flows south to STA 2 and STA 3/4, 667,200 acre-feet per year would be conveyed to STA 3/4 while 166,800 acre-feet per year would be conveyed to STA 2. No changes to the structural components of the water management systems would be required for water inflows into STA 2, STA 3/4, WCA 2A, WCA 3A, or Holey Land.

#### 4.5.1.2.2 Alternative 3 (Deep FEB)

The Deep FEB is operated in series with (upstream of) STA 2 and STA 3/4. The Deep FEB would receive water from the Miami Canal via existing pump station G-372, and from the North New River Canal via existing pump station G-370 and the new inflow pump station. Outflows would be conveyed back to the North New River Canal when water deliveries are needed. Operable water control structures may also be constructed to allow FEB discharges to be conveyed via gravity directly to the STA 3/4 inflow canal. The majority of the Deep FEB outflows (approximately 60%) would be directed to STA 3/4 for treatment while the remaining flows (approximately 40%) would be conveyed to STA 2 (including Compartment B). Thus, out of the approximately 834,000 acre-feet of water per year that flows south to STA 2 and STA 3/4, 667,200 acre-feet per year would be conveyed to STA 3/4 while 166,800 acre-feet per year would be conveyed to STA 2. No changes to the structural components of the water management systems would be required for water inflows into STA 2, STA 3/4, WCA 2A, WCA 3A, or Holey Land.

#### 4.5.1.2.3 Alternative 4 (STA)

The STA would operate in parallel with STA 2 and STA 3/4 (i.e. would provide additional STA acreage, but would not deliver water from this A-1 STA to STA 2 or STA 3/4). The proposed A-1 STA would utilize the existing STA 3/4 inflow pump stations (G-370 and G-372) to convey stormwater runoff to the proposed STA. Flows would be distributed to the STA cells [33% emerged aquatic vegetation (EAV) and 67% submerged aquatic vegetation (SAV)] via water control structures and conveyed north-to-south in internal collection canals. In order to operate the new STA, the STA discharge canal would need to be connected to the L-5 Canal, which would require the proposed discharge canal to be constructed within a small portion of the perimeter of the Holey Land. This would enable the delivery of discharges from the proposed A-1 STA to WCA 2A and/or WCA 3A via existing infrastructure, and would not alter the existing operations of STA 2, STA 3/4 and the North New River and Miami Canals. No changes to the structural components of the water management systems would be required for water inflows into STA 2, STA 3/4, WCA 2A, and WCA 3A.

### 4.5.2 SURFACE WATER HYDROLOGY

As described in Section 4.2, data obtained from the modeling efforts were used to estimate the volume and timing of surface water flows discharged from source basins contributing inflows to existing STAs and proposed project features associated with the Alternatives, with eventual discharge into the EPA. The source basins and their average annual flow volumes simulated by the SFWMM and post-processed as described above are provided in **Table 4-1**.

**Table 4-1** Source Basin Volumes

| Source Basins | Average Annual Flow Volume (acre-feet per year) |
|---|---|
| S-5A | 44,500 [1] |
| S-2/S-6 | 181,400 |
| S-2/S-7 | 263,900 [2] |
| S-3/S-8 | 218,400 |

| | |
|---|---|
| East Shore Water Control District and 715 Farms (Closter Farms) | 22,700 |
| South Florida Conservancy District | 19,100 |
| South Shore Drainage District | 11,700 |
| C-139 (via C136) | 14,700 |
| Lake Okeechobee (Regulatory Releases) | 58,300 |
| Total | 834,700 |

Notes: 1. Assumes runoff reduction resulting from the future 6,500-acre STA 1W expansion in the S-5A Basin.
2. S-7 runoff is reduced to 231,000 acre-feet per year for Action Alternatives due to runoff no longer occurring from the project site.

### 4.5.2.1 No Action

#### 4.5.2.1.1 Project Site

Under the No Action Alternative, the surface water hydrology at the project site would likely remain rainfall driven if the area remains fallow. The wetlands would continue to experience seasonal ponding and the water levels in the ditches and canals would fluctuate depending on rainfall. During the rainy season, the scraped wetlands typically contain water depths between 6 and 12 inches of water while the scrub/shrub wetlands and exotic scrub/shrub wetlands typically contain water depths greater than 12 inches of water. During the dry season, no standing water is present. The canals are approximately 12 feet in depth while the canals are 6 feet in depth. Stormwater would continue to run off the lands into existing agricultural ditches and to the STA 3/4 seepage canal. If the project site was converted back to active agriculture, drainage improvements would likely be necessary to convey stormwater to the North New River Canal.

#### 4.5.2.1.2 STA 2 and STA 3/4

Under the No Action Alternative, the surface water hydrology of STA 2 and STA 3/4 would continue to function as it does today and continue to operate under the existing operational plans. Agricultural and/or urban stormwater runoff primarily from the S-2, S-5A, S-6 and S-7 basins collected by the Hillsboro and North New River Canals would continue to be pumped directly into STA 2, while agricultural and/or urban stormwater runoff from the S-2, S-3, S-7, S-8 and C-139 basins collected by the North New River and Miami Canals would continue to be pumped directly into STA 3/4 for treatment. STA 2 and STA 3/4 would continue to receive peak stormwater flows and continue to experience dryout conditions that occur as a result of extreme hydrologic conditions that exist in south Florida. These conditions adversely impact the phosphorus removal performance of the STAs. Wet season conditions would likely continue to result in longer than optimal durations of greater than optimal water depths.

STA 2 and STA 3/4 are currently operated to encourage the growth and establishment of wetland plants within the STAs to optimize the uptake of phosphorus from stormwater passing through the cells. Maintaining minimum water stages improves the STA's phosphorus treatment performance by keeping the STAs hydrated and ensuring the viability of EAV and SAV, and regulating inflows to minimize high hydraulic loading rates. As stated in the Operations Plan dated December 2010 and August 2007 for STA 2 and STA 3/4, respectively, the treatment cells within the STA are recommended to be operated at target depths under normal operations:

- Minimum Depth: To the maximum extent practicable, a minimum static water level of 0.5 feet above the ground elevation should be maintained to avoid drying out the treatment cell, subject to available water from the upstream watershed.
- Maximum Depth: To the maximum extent practicable, a maximum static water level of 4.0 feet above the ground elevation should not be exceeded to avoid damage to the levees and marsh vegetation.

**Table 4-2** provides the average annual inflow, diversion, and outflow volumes for STA 3/4 and STA 2 for the No Action Alternative. Out of the approximately 834,000 acre-feet of water per year that flows south to STA 2 and STA 3/4, 805,000 acre-feet of water per year enters STA 2 and STA 3/4 while 29,000 acre-feet per year from these basins and 27,000 acre-feet per year of Urban Water Supply are diverted around or bypass the STAs. Water diversions consist of the delivery of water to the WCAs without treatment by the STAs, usually during extreme storm events to maintain flood control. Conversely, urban water supplies are the deliveries of water to the canals passing through the WCAs without treatment by the STAs during dry periods, but delivered to the coast to maintain freshwater gradient in the coastal wells. **Figures 4-2 and 4-3** are ponding depth hydrographs based on DMSTA modeling for STA 2 and STA 3/4, respectively, for the No Action Alternative. **Figure 4-4** shows ponding depth duration curves for STA 2 and STA 3/4 for the No Action Alternative.

**Table 4-2** STA 2 and STA 3/4 Inflow and Outflow Volumes, Diversions and Urban Water Supply

| | Average Annual Volume (acre-feet per year) | |
|---|---|---|
| | Parameter | Alternative 1: No Action |
| STA 2 | Inflow | 301,000 |
| | Diversion | 17,000 |
| | Outflow | 307,000 |
| | Outflow and Diversion | 324,000 |
| STA 3/4 | Inflow | 504,000 |
| | Diversion | 12,000 |
| | Outflow | 495,000 |
| | Outflow and Diversion | 507,000 |
| STA 2 and STA 3/4 | Inflow | 805,000 |
| | Diversion | 29,000 |
| | Outflow | 802,000 |
| | Outflow and Diversion | 831,000[1] |
| | Urban Water Supply | 27,000 |
| | Outflow, Diversion and Urban Water Supply | 858,000 |

[1]This value differs from Total Average Annual Flow Volume in Table 4-1 due to the DMSTA's dynamic simulation of rainfall, evaporation and seepage processes.

**Figure 4-2 Ponding Depth Hydrograph for STA 2 – No Action Alternative**

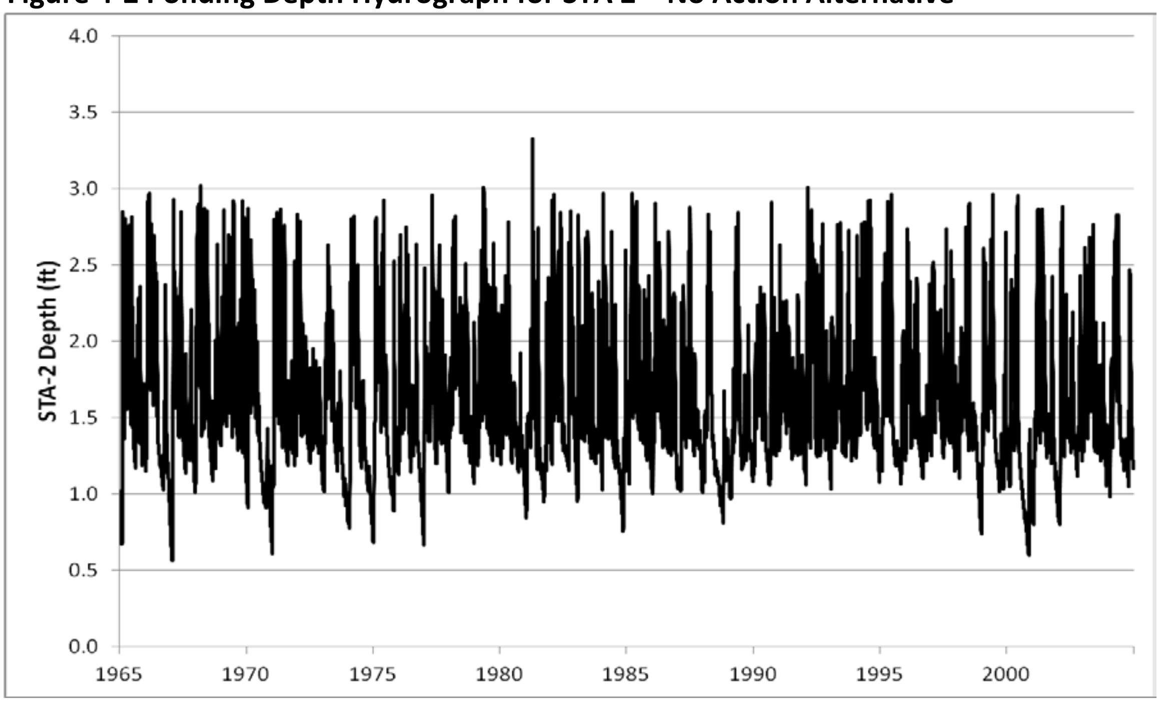


**Figure 4-3** Ponding Depth Hydrograph for STA 3/4 – No Action Alternative

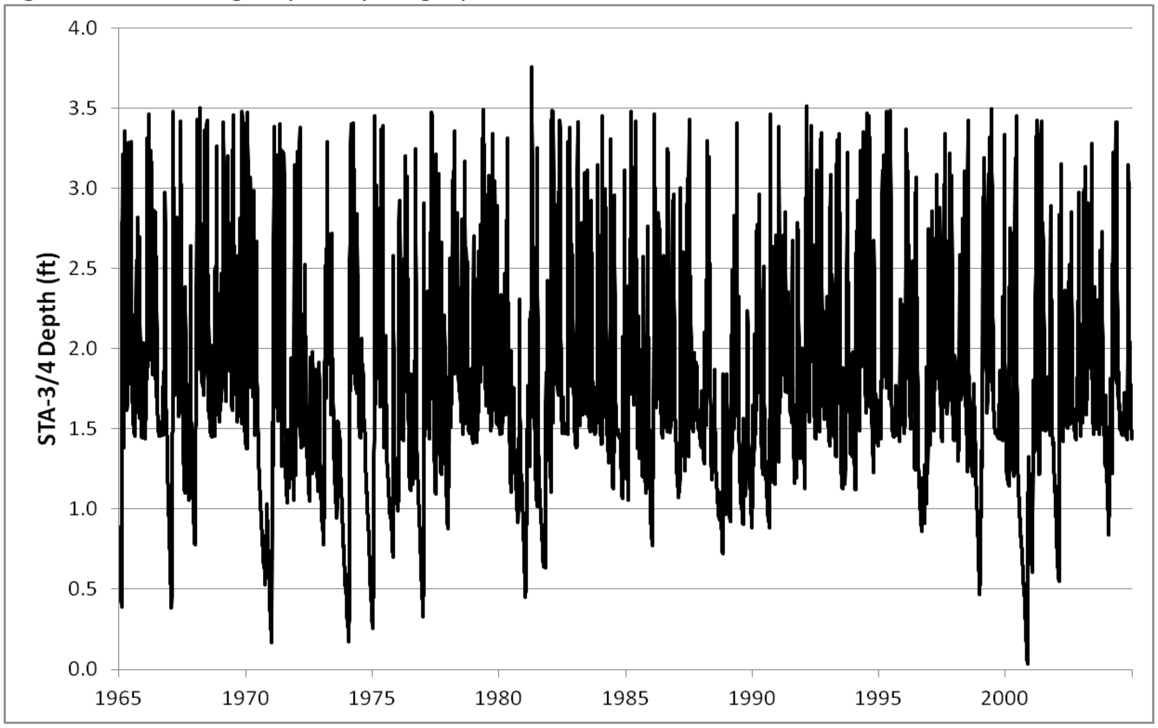
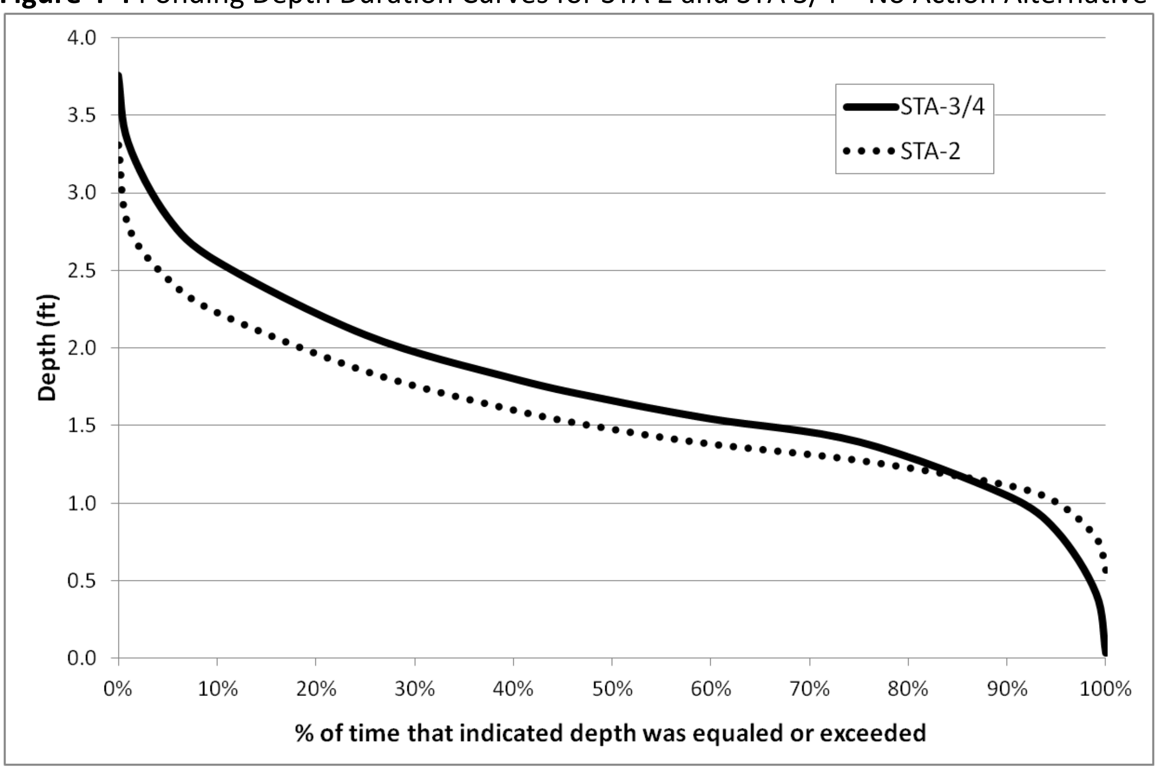


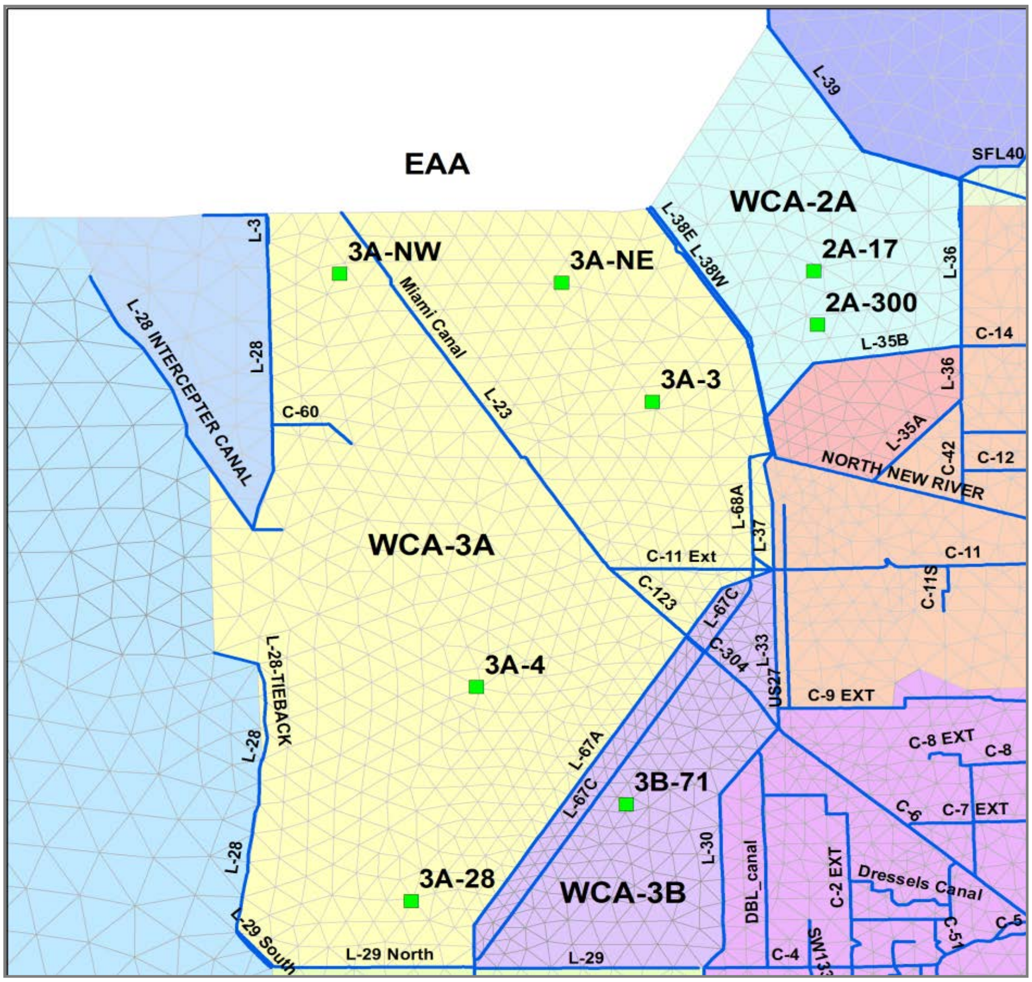

**Figure 4-4** Ponding Depth Duration Curves for STA 2 and STA 3/4 – No Action Alternative



### 4.5.2.1.3 WCA 2A

Based on the results of the Glades LECSA RSM modeling, WCA 2A receives approximately 450,000 acre-feet per year via the L-6 Canal and the S-7 pump station. These WCA 2A inflows include treated flows from STA 2 and STA 3/4, STA 2 and STA 3/4 diversion flows and urban water supply flows. The amount of urban water supplies discharged from the WCAs is offset by the same volume of water from Lake Okeechobee. A gauge location map is provided in **Figure 4-5.**

**Figure 4-5** WCA 2A and WCA 3A Gauge Location Map




The locations of two existing monitoring sites were chosen to depict the simulated changes in ponding depths within WCA 2A (2A-17 and 2A-300). Hydrographs of daily ponding depths (feet of surface water) and duration curves of ponding depths (plots of percentages of time that ponding depths equal or exceed specified values) are provided for the two WCA 2A gauge locations and changes in these hydrographs will be used to identify any potential effects of the Alternatives.

A ponding depth hydrograph and ponding depth duration curve for 2A-17 are provided in **Figures 4-6** and **4-7** for all Alternatives, respectively. Under the No Action Alternative, there are no changes to the ponding depths and water levels at this location within WCA 2A. Current ponding depths range between 3 feet above ground elevation and one foot below ground elevation at this gauge. Water levels are less than 2 feet above ground level 90 percent of the time. Ponding depth varies seasonally.

**Figure 4-6** Ponding Depth Hydrograph for 2A-17 – All Alternatives

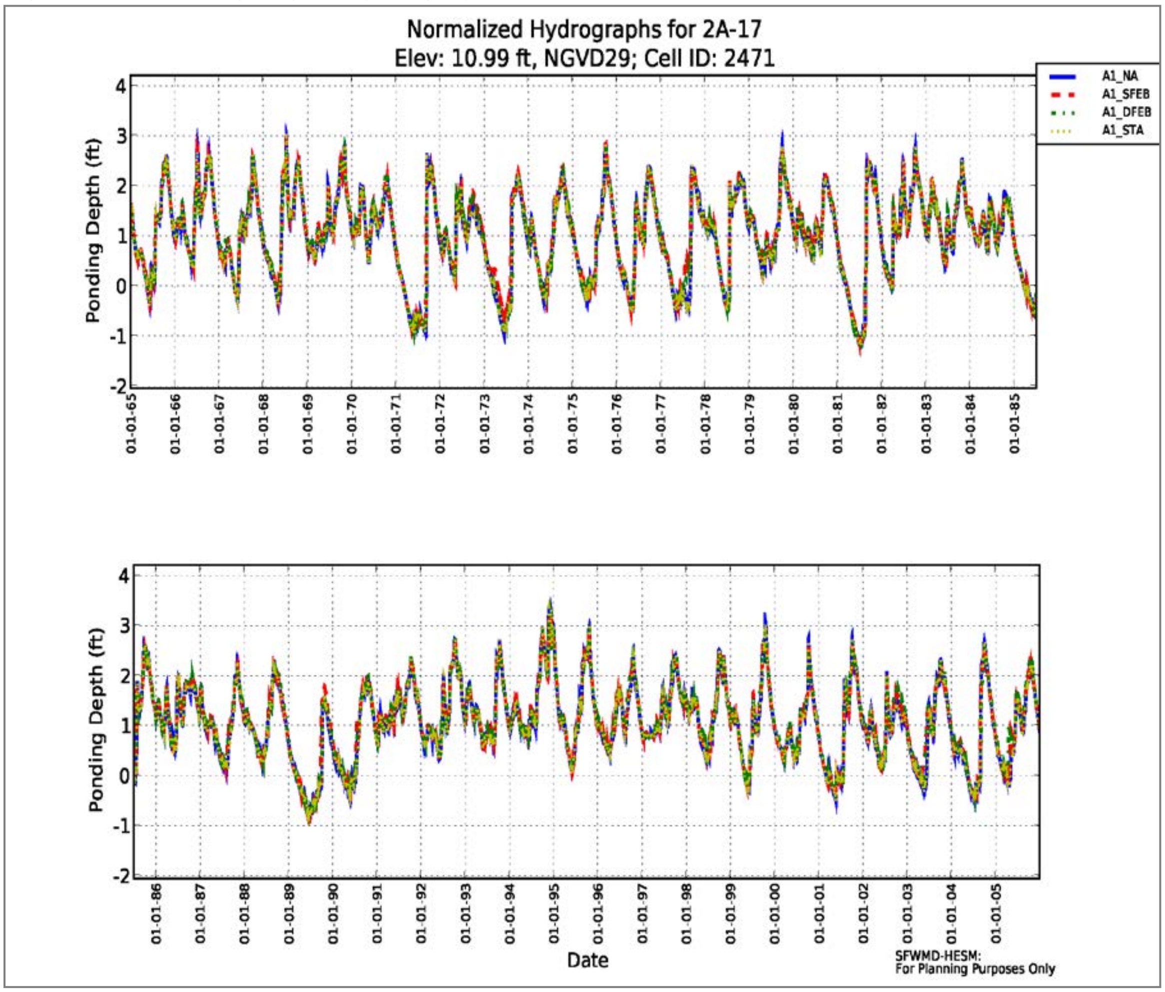
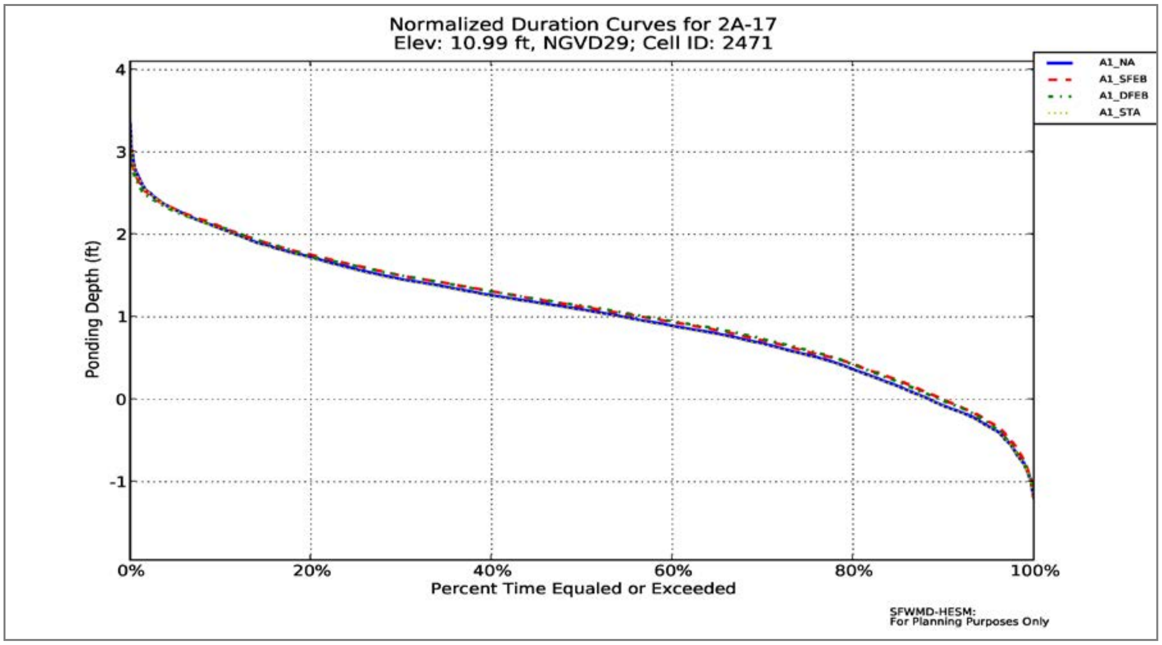


**Figure 4-7** Ponding Depth Duration Curve for 2A-17 – All Alternatives




2A-300: A ponding depth hydrograph and ponding depth duration curve for 2A-300 are provided in **Figures 4-8** and **4-9** for all Alternatives, respectively. Under the No Action Alternative, there are no changes to the ponding depths and water levels at this location within WCA 2A. Current ponding depths range between 3.5 feet above ground elevation and 0.6 foot below ground elevation at gauge location 2A-300. Water levels are approximately between 0.3 feet to 2.8 feet above ground level 90 percent of the time. Ponding depth varies seasonally.

**Figure 4-8** Ponding Depth Hydrograph for 2A-300 – All Alternatives

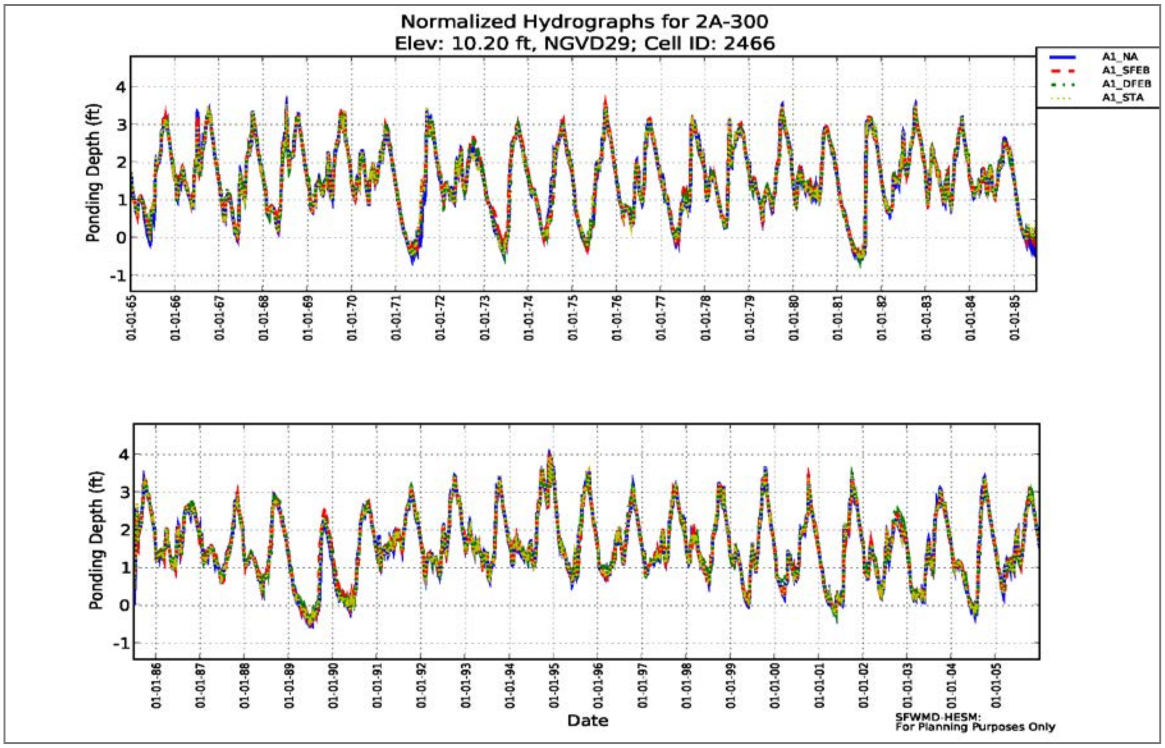



**Figure 4-9** Ponding Depth Duration Curve for 2A-300 – All Alternatives

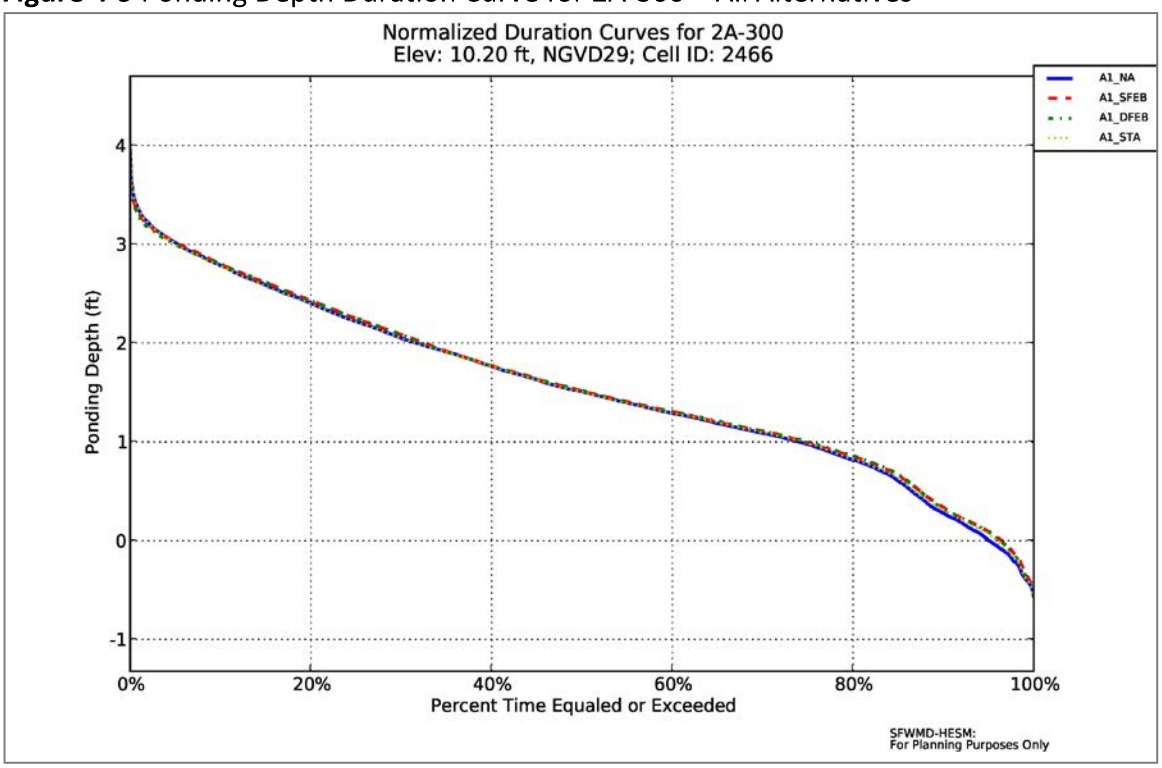


**Figure 4-10** provides average annual ponding depths for WCA 2A and WCA 3A while **Figure 4-11** provides average annual hydroperiod distribution for WCA 2A and WCA 3A. The ponding depths and hydroperiod durations in WCA 2A and WCA 3A under the No Action Alternatives will be used to identify potential changes in the WCAs for Alternatives 2, 3, and 4.

In WCA 2A, the average annual ponding depths range from 0 feet to over 3 feet above the surface level. However, the majority of WCA 2A contains water depths between 0.5 feet and 2.0 feet. Three cells contain water depths between 0 feet and 0.5 feet above the surface, three cells contain water depths between 2 and 3 feet above the surface, while two cells in the southern portion contains water depths above 3 feet. In WCA 2A, the majority of the cells contain surface water between 300 and 365 days of the year. Eight cells contain standing water for 240-300 days out of the year, while one cell contains water above the surface for 120-180 days out of the year.

**Figure 4-10** Average Annual Ponding Depth for WCA 2A and WCA 3A (No Action Alternative)

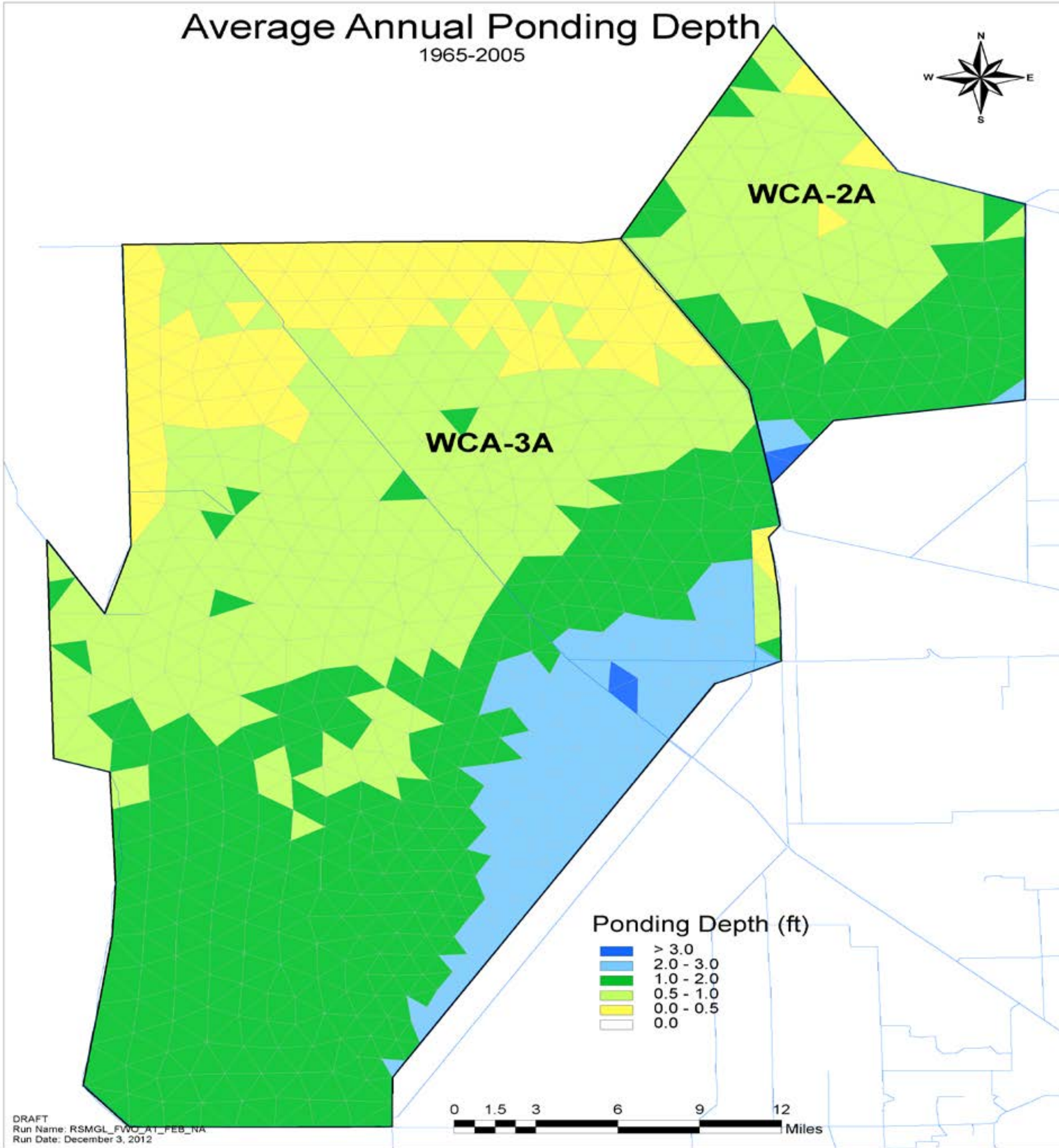
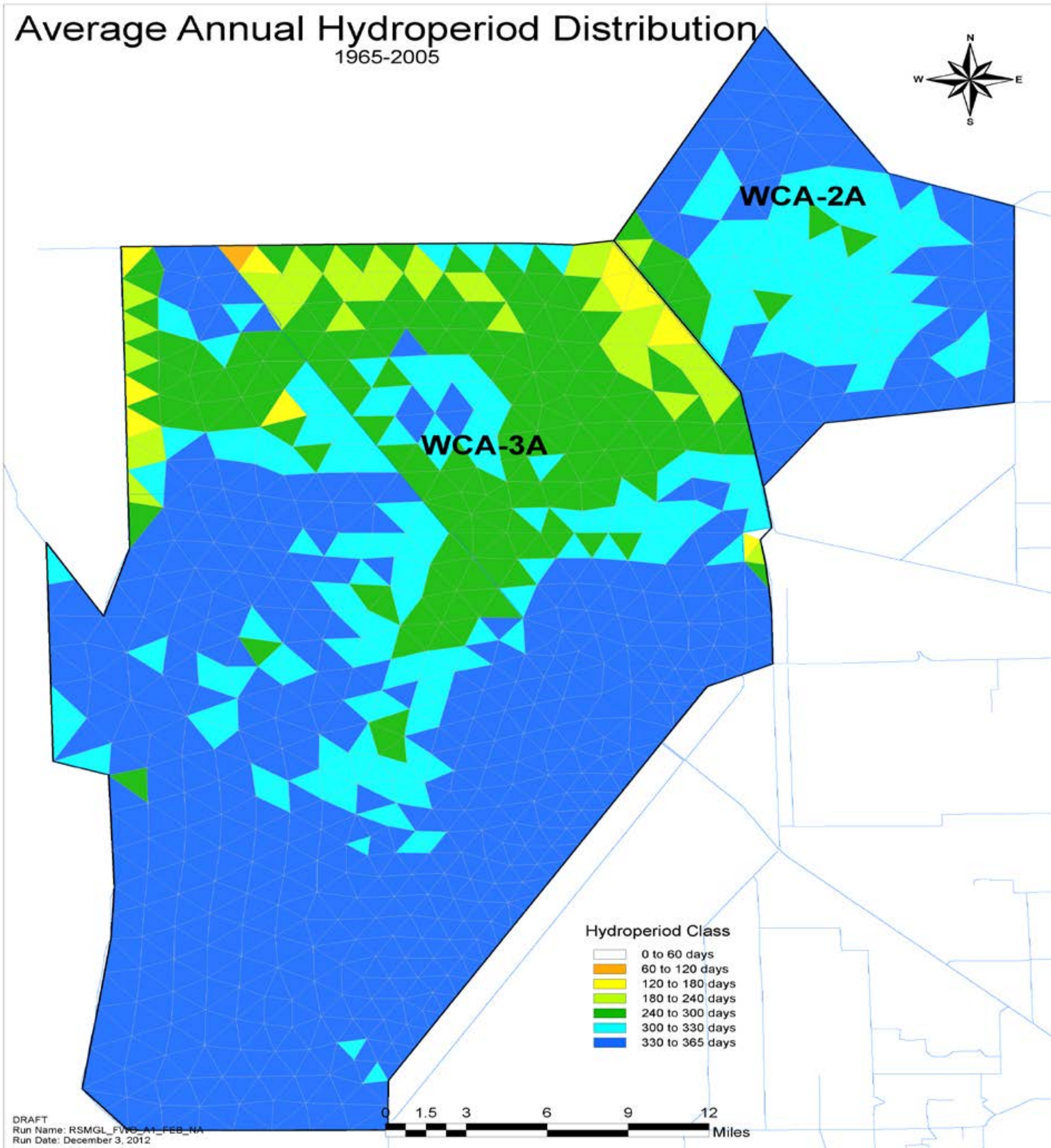


**Figure 4-11** Average Annual Hydroperiod Distribution for WCA 2A and WCA 3A (No Action Alternative)



### 4.5.2.1.4 WCA 3A

Based on the results of the Glades LECSA RSM modeling, WCA 3A receives approximately 400,000 acre-feet per year via the S-150 structure and the S-8 pump station. These WCA 3A inflows include treated flows from STA 3/4, STA 3/4 diversion flows and urban water supply flows. Performance measure graphics were generated for several gauge locations within WCA 3A and for the entire area. A gauge location map is provided in **Figure 4-5**.

Five monitoring sites were chosen to depict the changes in ponding depths within WCA 3A (3A-NW, 3A-NE, 3A-3, 3A-4, and 3A-28). Hydrographs of daily ponding depths (feet of surface water) and duration curves of ponding depths (days of surface water inundation on average per year) are provided for the WCA gauge locations. Changes in these hydrographs will be used to identify any potential effects of the Alternatives in later sections (Section 4.5.2.2.4). Water levels in WCA 3A over the period of record simulated by RSM at each gauge location is described below.

3A-NW: A ponding depth hydrograph and ponding depth duration curve for 3A-NW are provided in **Figures 4-12** and **4-13,** respectively, for all Alternatives. Under the No Action Alternative, there are no changes to the ponding depths and water levels at this location within WCA 3A. Current ponding depths at this site range between -0.8 feet below ground elevation and 1.9 feet above ground elevation. Water levels are above ground elevation 90 percent of the time. Ponding depths vary seasonally.

**Figure 4-12** Ponding Depth Hydrograph for 3A-NW – All Alternatives

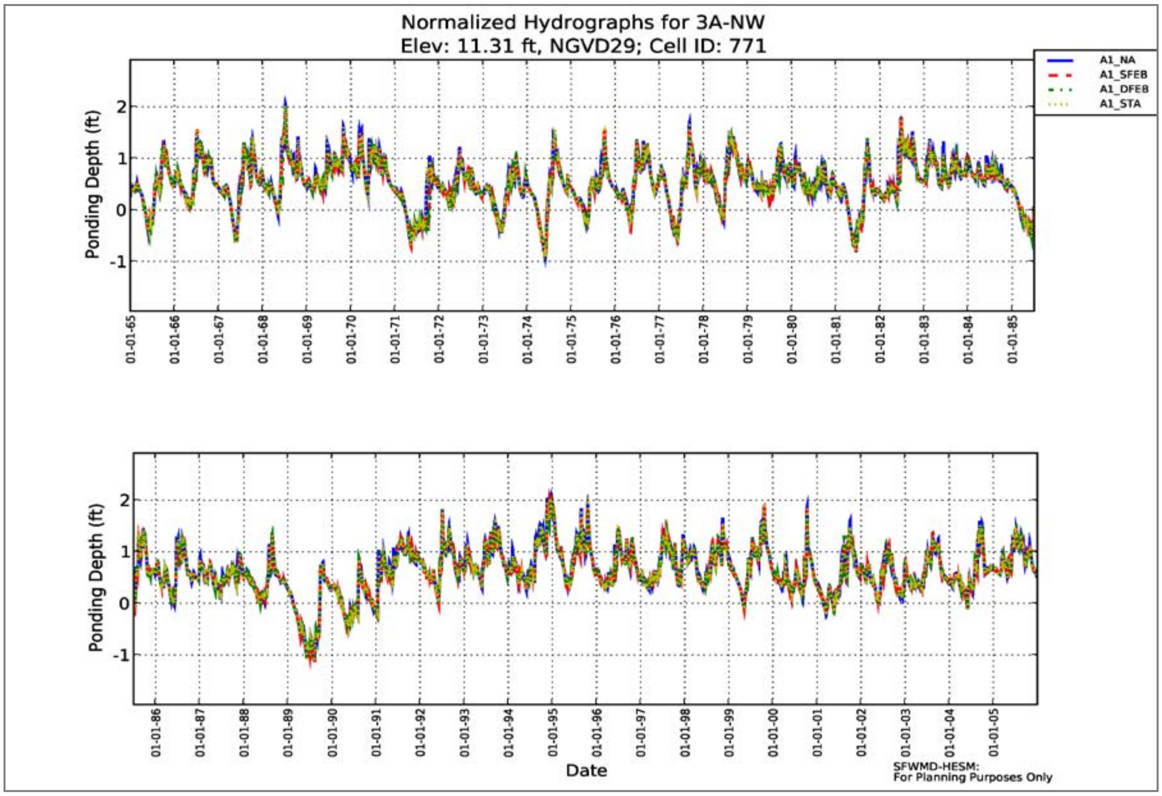
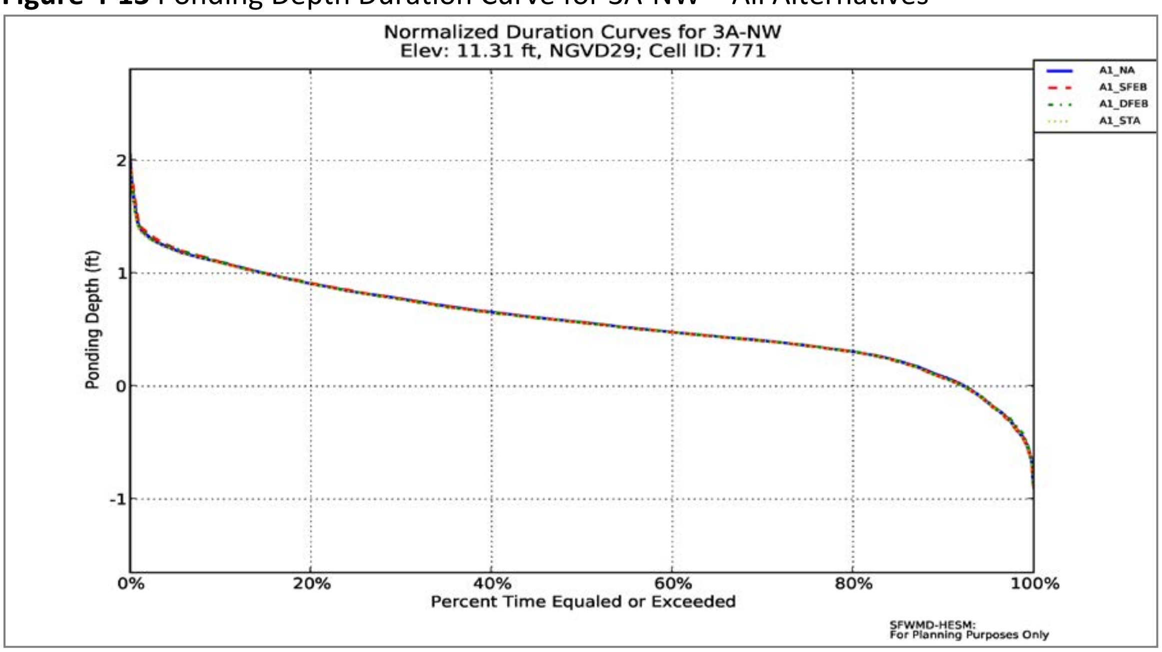



**Figure 4-13** Ponding Depth Duration Curve for 3A-NW – All Alternatives



3A-NE: A ponding depth hydrograph and ponding depth duration curve for 3A-NE are provided in **Figures 4-14** and **4-15,** respectively, for all Alternatives. Under the No Action Alternative, there are no changes to the ponding depths and water levels at this location within WCA 3A. Ponding depths at this site range between -1.2 feet below ground elevation and 2.9 feet above ground elevation. Water levels are above ground elevations for 60% of the time. Ponding depths vary seasonally.

**Figure 4-14** Ponding Depth Hydrograph for 3A-NE – All Alternatives

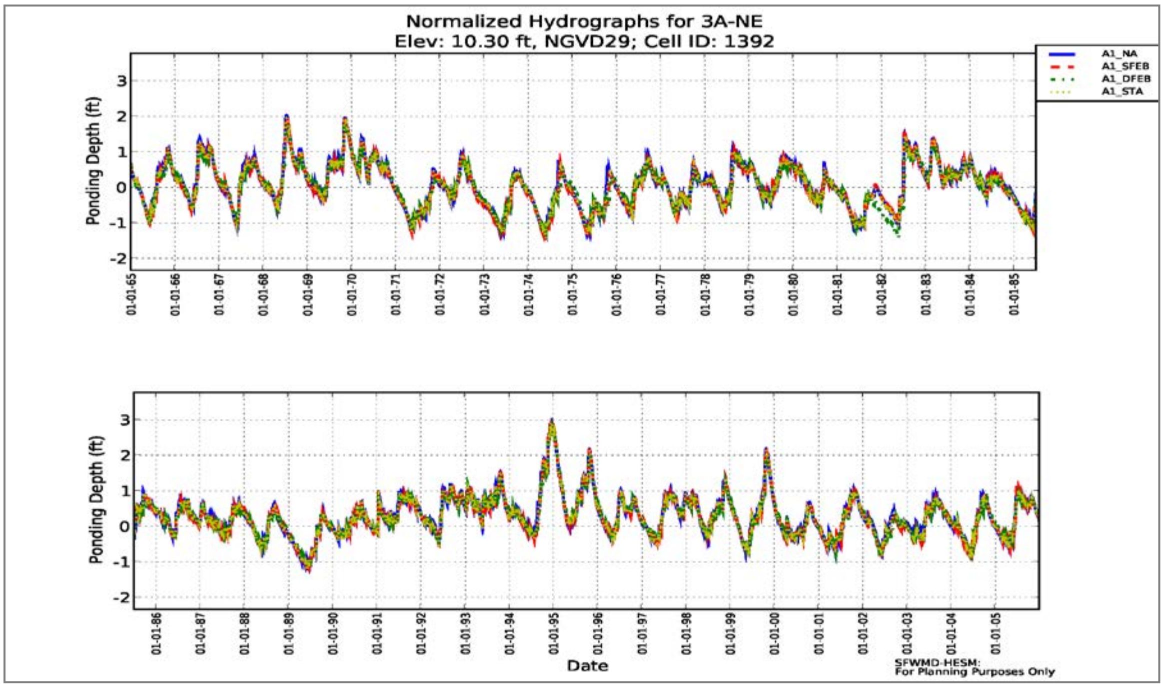
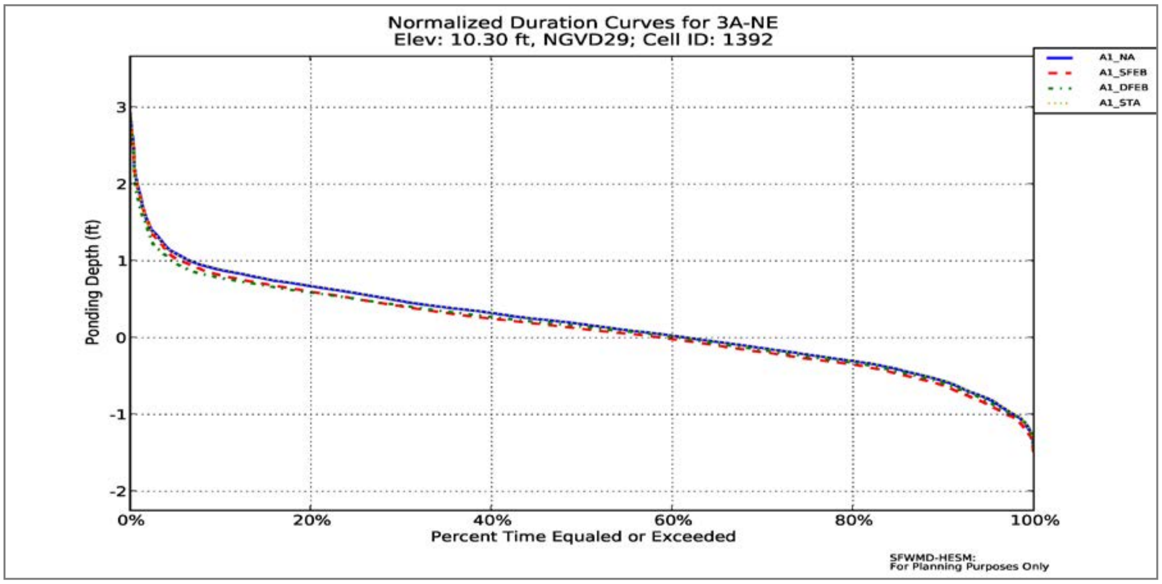


**Figure 4-15** Ponding Depth Duration Curve for 3A-NE – All Alternatives




3A-3: A ponding depth hydrograph and ponding depth duration curve for 3A-3 are provided in **Figures 4-16** and **4-17,** respectively, for all Alternatives. Under the No Action Alternative, there are no changes to the ponding depths and water levels at this location within WCA 3A. Ponding depths at this site range between -1.2 feet below ground elevation and 4.0 feet above ground elevation. Water levels are above ground elevations for 75% of the time. Ponding depth varies seasonally.

**Figure 4-16** Ponding Depth Hydrograph for 3A-3 – All Alternatives

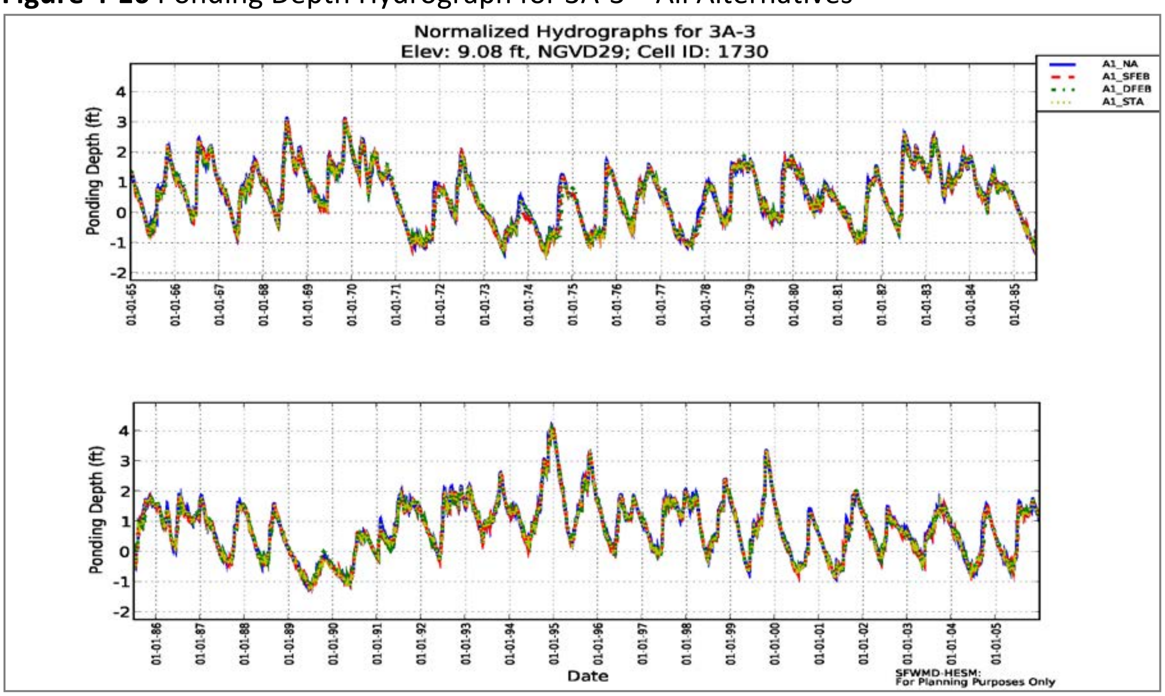
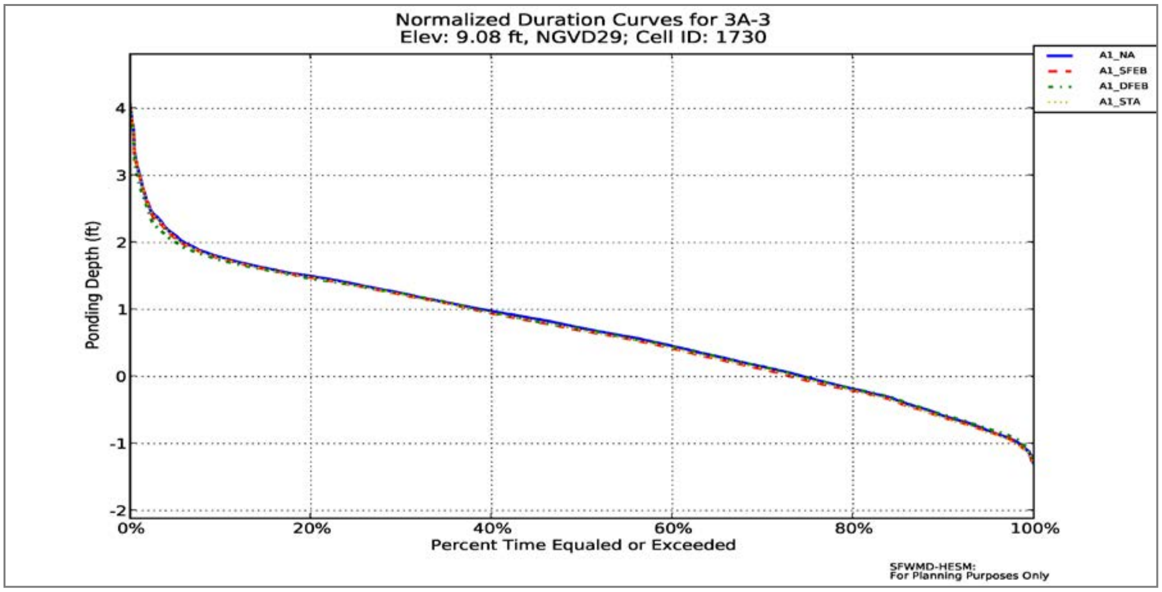


**Figure 4-17** Ponding Depth Duration Curve for 3A-3 – All Alternatives




3A-4: A ponding depth hydrograph and ponding depth duration curve for 3A-4 are provided in **Figures 4-18** and **4-19,** respectively, for all Alternatives. Under the No Action Alternative, there are no changes to the ponding depth and water levels at this location within WCA 3A. Ponding depths at this site range between -0.7 feet below ground elevation and 4.0 feet above ground elevation. Water levels are above ground elevations for 90% of the time. Ponding depth varies seasonally.

**Figure 4-18** Ponding Depth Hydrograph for 3A-4 – All Alternatives

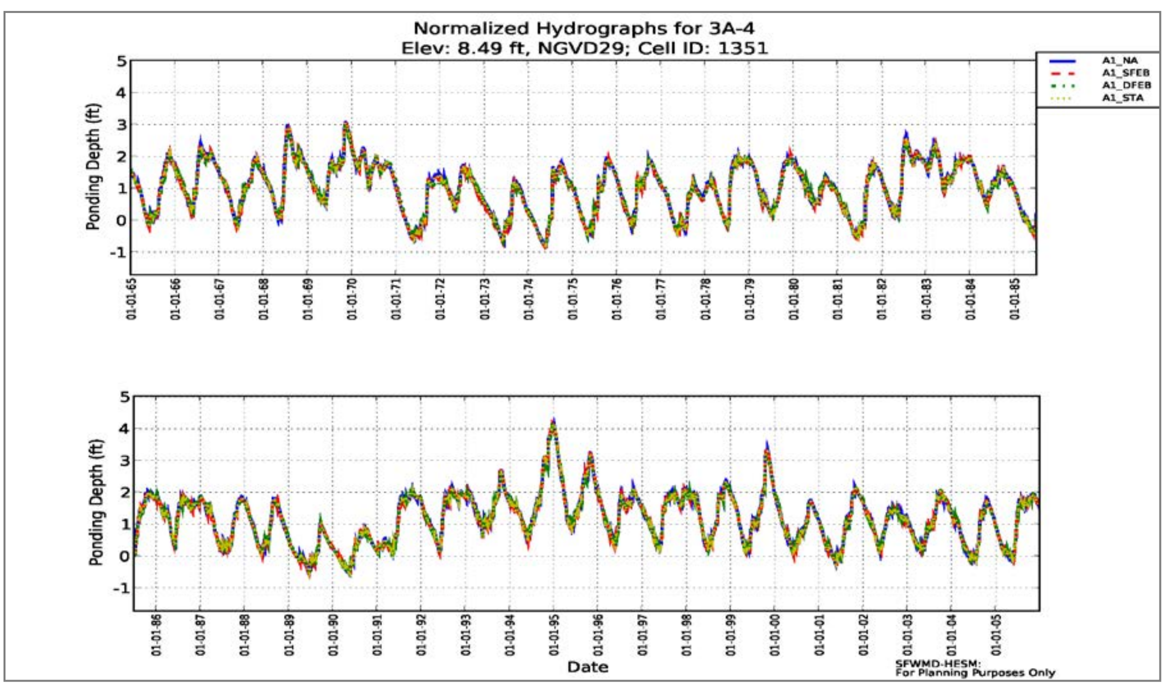
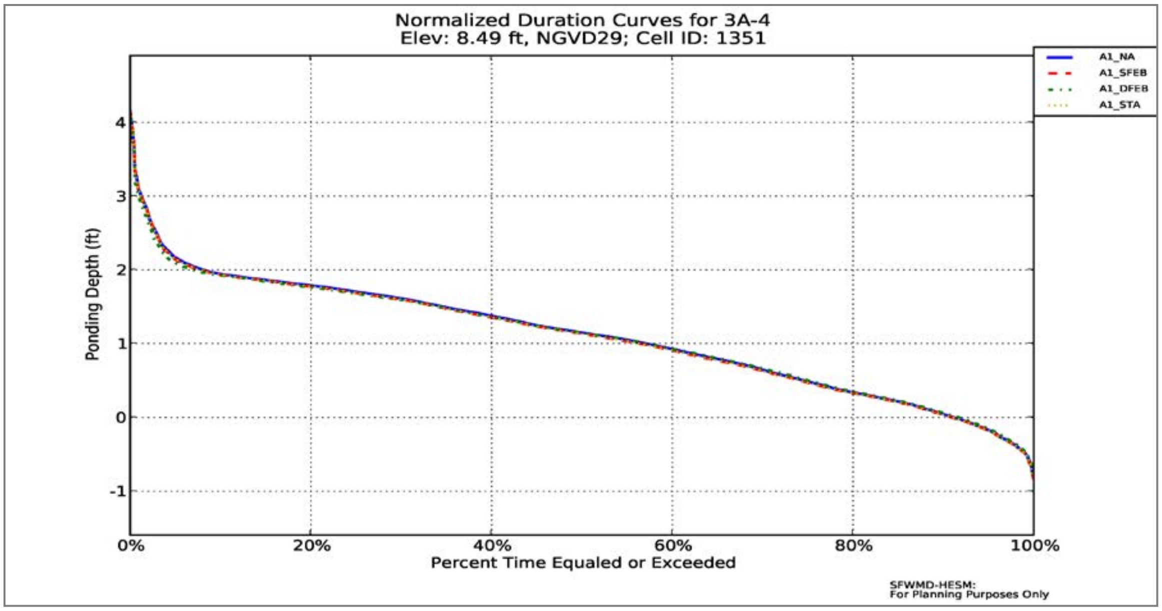


**Figure 4-19** Ponding Depth Duration Curve for 3A-4 – All Alternatives




3A-28: A ponding depth hydrograph and ponding depth duration curve for 3A-28 are provided in **Figures 4-20** and **4-21,** respectively, for all Alternatives. Under the No Action Alternative, there are no changes to the ponding depth and water levels at this location within WCA 3A. Ponding depths at this site range between -0.3 feet below ground elevation and 4.9 feet above ground elevation. Water levels are above ground elevations for 99% of the time. Ponding depth varies seasonally.

**Figure 4-20** Ponding Depth Hydrograph for 3A-28 – All Alternatives

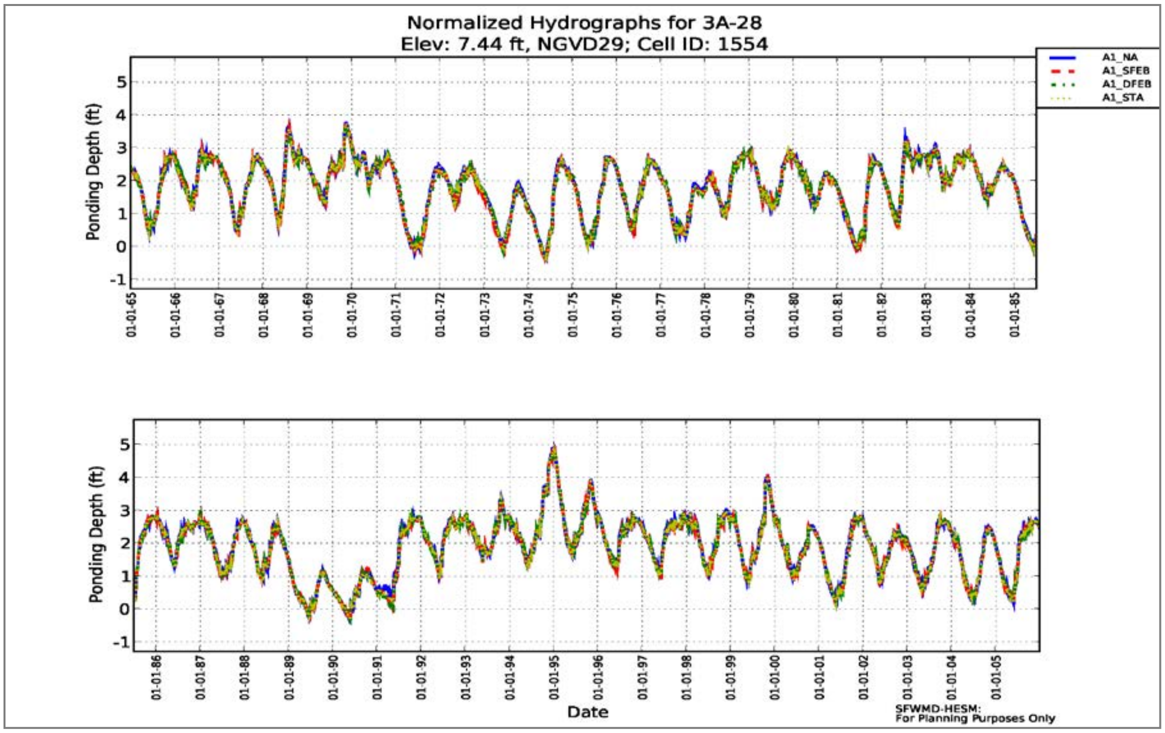
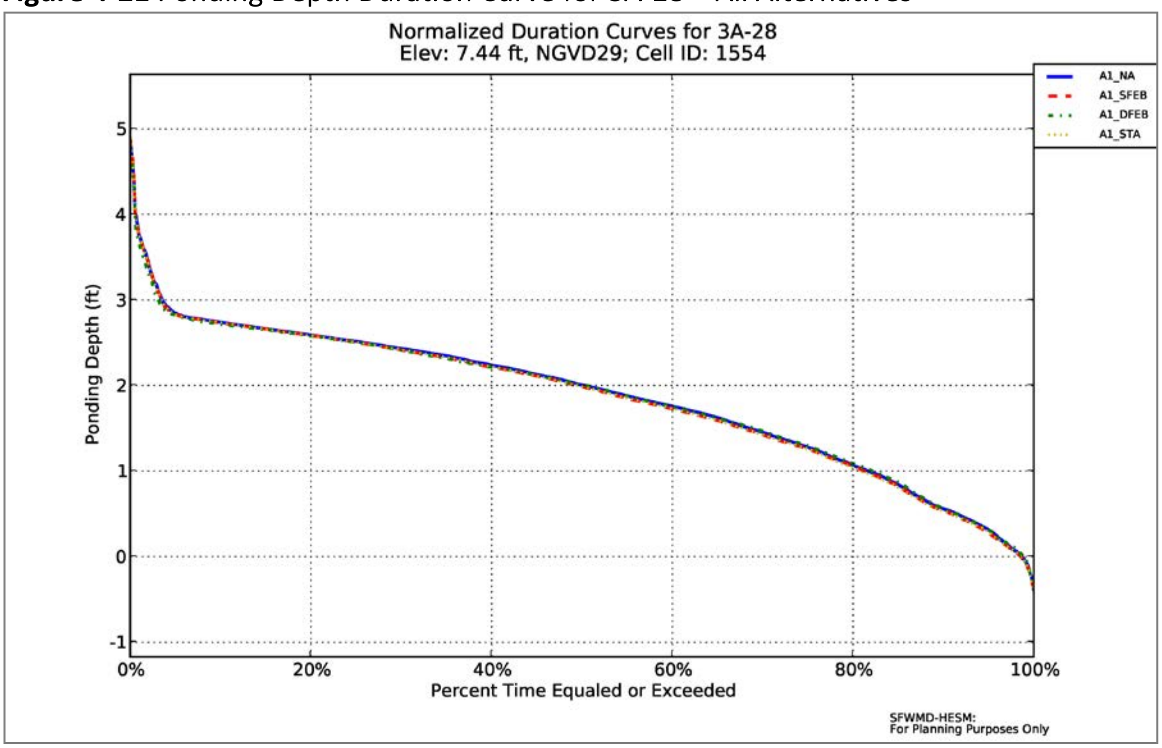



**Figure 4-21** Ponding Depth Duration Curve for 3A-28 – All Alternatives



In WCA 3A, the average annual ponding depths range from 0 feet to over 3 feet above the surface (**Figure 4-10**). The northern portion of WCA 3A is dryer (depths range between 0 and 0.5 feet) while the water levels increase as it travels south, with depths ranging between 1-2 feet above the surface. Along the southeastern border of WCA 3A, water depths are the deepest and range between 2-3 feet. Two cells in this area contain water depths above three feet.

WCA 3A contains water between 60 and 365 days of the year (**Figure 4-11**). The hydroperiod is dryer along the northern perimeter of the area and range between 120-240 days of the year, with one cell between 60-120 days of hydroperiod per year. The hydroperiod increases in the southern portion of WCA 3A, with durations between 300-365 days of the year.

### 4.5.2.1.5 Holey Land Wildlife Management Area

Under the No Action Alternative, the surface water hydrology of the Holey Land would continue to function as it does today. Ponding depth hydrographs for the No Action Alternative were produced for Holey Land using three 2x2 Model grid cells. A 2x2 model grid cell location map is provided in **Figure 4-22**. The hydrographs of the ponding depths for the three grids are shown in **Figures 4-23**, **4-24**, and **4-25**.

**Figure 4-22** 2x2 Model Grid Cell Location Map of Holey Land

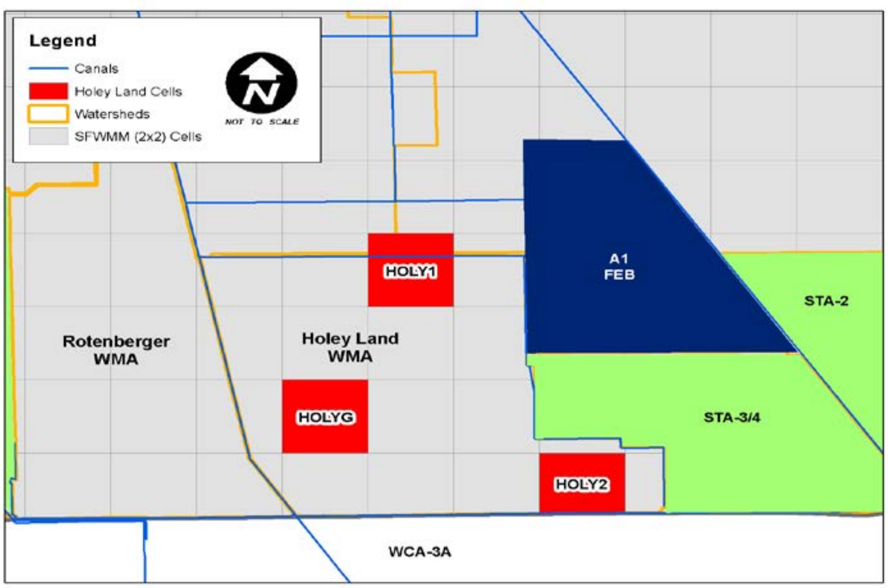


**Figure 4-23** Ponding depth at 2x2 model grid cell Holy1 within the Holey Land (Alternative 1)

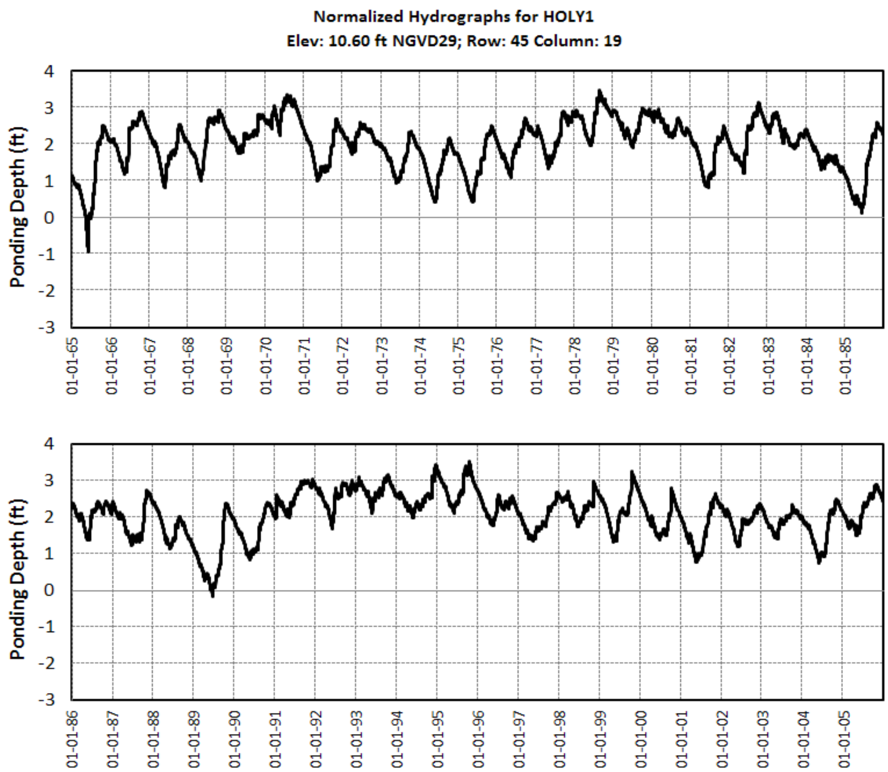



**Figure 4-24** Ponding depth at 2x2 model grid cell Holy2 within the Holey Land (Alternative 1)

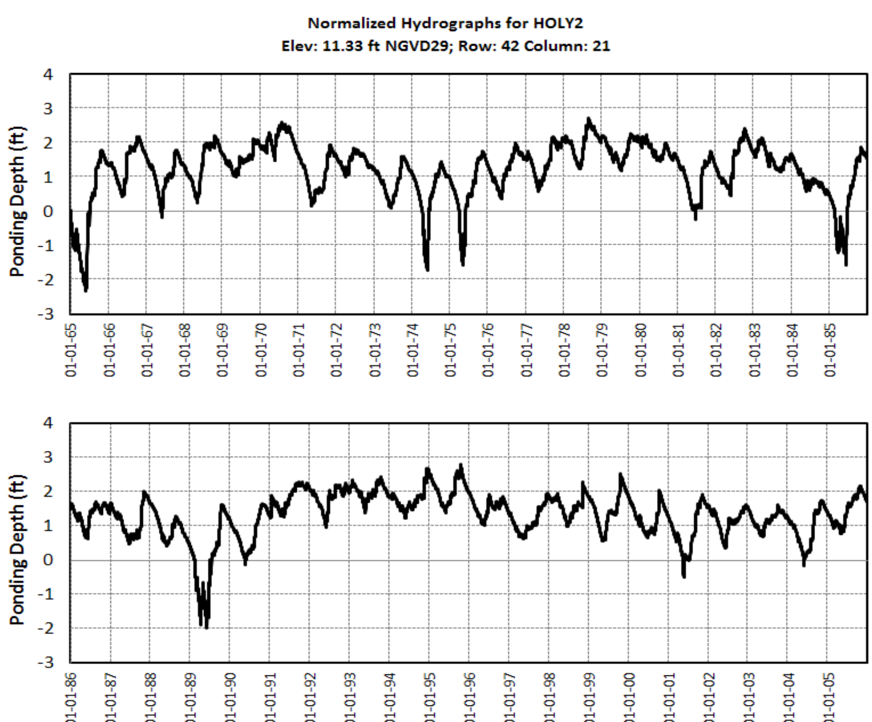
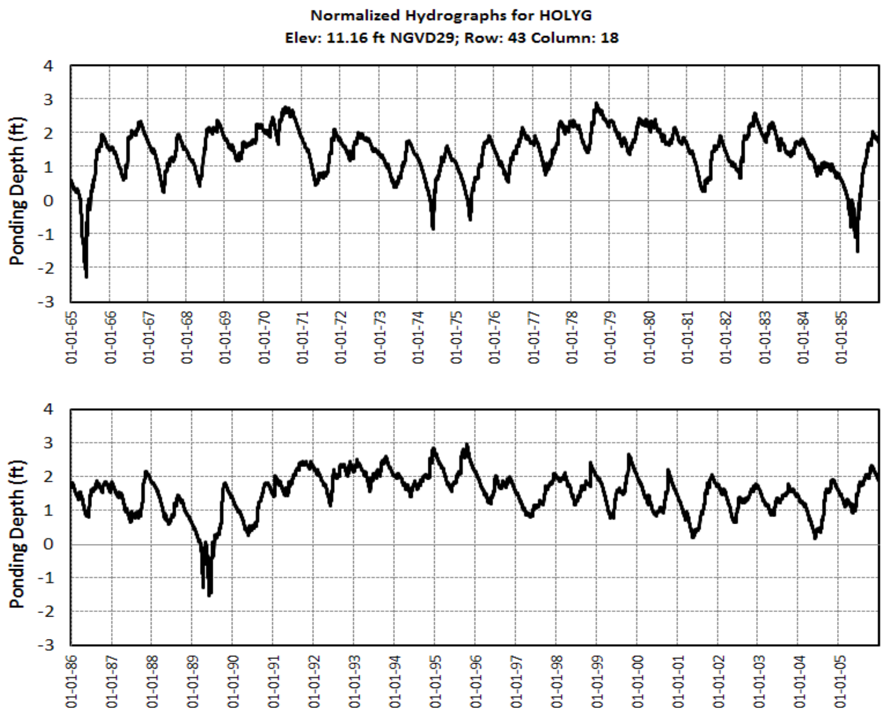


**Figure 4-25** Ponding depth at 2x2 model grid cell HolyG within the Holey Land (Alternative 1)




## 4.5.2.2 Action Alternatives

### 4.5.2.2.1 Project Site

Construction and operation of all three Action Alternatives (Shallow FEB, Deep FEB, and STA) would affect surface water hydrology within the project site. Post construction, water from the North New River Canal and the Miami Canal would be pumped into the A-1 project site, which would be either the Shallow FEB, Deep FEB or the A-1 STA, and would be contained within levees and managed at various depths, unique to each Alternative. For Alternatives 2 (Shallow FEB) and 3 (Deep FEB), water released from the project site would enter either STA 2 or STA 3/4 before being released into the WCA 2A or 3A. For Alternative 4 (A-1 STA), water released from the project site would directly enter WCA 2A or WCA 3A. A summary of DMSTA-simulated inflow and outflow volumes on the A-1 project site for all Alternatives as compared to the No Action Alternative is provided in **Table 4-3**.

The Deep FEB has the greatest Average Annual volume of inflows because it provides the greatest storage capacity, so it has the ability to temporarily store more runoff per year on average than the Shallow FEB or the STA. This would be a benefit during storm events if the additional capacity is needed. The Shallow FEB, Deep FEB, and the STA each lose approximately

2,000 acre-feet of water per year (as seen in the differences between the inflows and outflows/diversions for each alternative).

**Table 4-3** Project Site Inflow and Outflow Volumes

| | Average Annual Volume (acre-feet per year) | | | |
|---|---|---|---|---|
| Parameter | Alternative 1: No Action | Alternative 2: Shallow FEB | Alternative 3: Deep FEB | Alternative 4: STA |
| Inflow | NA | 274,000 | 336,000 | 252,000 |
| Diversion | NA | NA | NA | 5,000 |
| Outflow | NA | 272,000 | 334,000 | 245,000 |
| Outflow and Diversion | NA | 272,000 | 334,000 | 250,000 |

**Figure 4-26** provides ponding depth hydrographs for the project site for Alternatives 2, 3, and 4. **Figure 4-27** provides ponding depth duration curves for the project site for Alternatives 2, 3, and 4. **Figures 4-28, 4-29**, and **4-30** show the monthly depths for the project site with median, quartile, and 10% to 90% percentiles for Alternative 2, Alternative 3, and Alternative 4, respectively.

Under Alternative 2 (Shallow FEB) water inflows and outflows on the project site would increase compared to the No Action Alternative, which has no water entering the site. An average of 274,000 acre-feet per year of water would enter the site, while 272,000 acre-feet per year would exit the site. The Shallow FEB would be operated at inflow water depths ranging from 0 to 4 feet and would be inundated with water depths greater than 1.5 feet for 60 percent of the time (**Figures 4-26** and **4-27**). For six months of the year, the site would average around 1 foot, varying from 0.3 feet to over three feet, while water depths would average from 2 to 3.5 feet during the rainy season (**Figure 4-28**). As compared to the No Action Alternative, Alternative 2 would increase the ponding stages on the site up to four feet under a managed operation plan (**Figure 4-26**).

Alternative 3 (Deep FEB) would result in the highest water inflows and outflows on the project site. This alternative could retain more water than the other Alternatives during a storm event due to the deeper capacity. Approximately 336,000 acre-feet per year of water would enter the site, while 333,000 acre-feet per year would exit the site. The Deep FEB would be operated at inflow water depths ranging from 0-12.5 feet and would be inundated with water depths greater than 1.75 feet for 60 percent of the time, greater than 6 feet for 20 percent of the time, and greater than 10 feet for 10 percent of the time (Figures 4-26, 4-27). For five months of the year, the site would average around 2 feet, varying from 0.3 feet to almost six feet, while water depths would average from 2 to 6 feet during the rainy season (Figure 4-29). Alternative 3 would increase the ponding stages on the site up to 12.5 feet under a managed operation plan (Figure 4-26).

Alternative 4 (STA) would result in an increase in water inflows and outflows on the project site compared to the No Action Alternative. Due to the need to operate the site to maintain STA vegetation, the site would also require surface water diversions. Approximately 252,000 acre-feet per year of water would enter the site, while 250,000 acre-feet per year would exit the site. Due to the necessary diversion of 5,000 acre-feet per year, Alternative 4 only has outflows of 245,000 acre-feet of water per year. Similar to Alternative 2, Alternative 4 would result in water depths at the project site ranging from 0 to 4 feet and the site would be inundated with water at depths of 1.5 feet or more for 60 percent of the time (**Figures 4-26** and **4-27**). For five months of the year, the site would average around 1.5 feet, varying from 0.5 feet to almost 2.5 feet, while water depths would average from 1.5 to 2.5 feet during the rainy season (**Figure 4-30**). As compared to the No Action Alternative, Alternative 4 would increase the ponding stages on the site up to 4 feet under a managed operation plan (**Figure 4-26**).

**Figure 4-26** Ponding Depth Hydrographs for Project Site – Action Alternatives

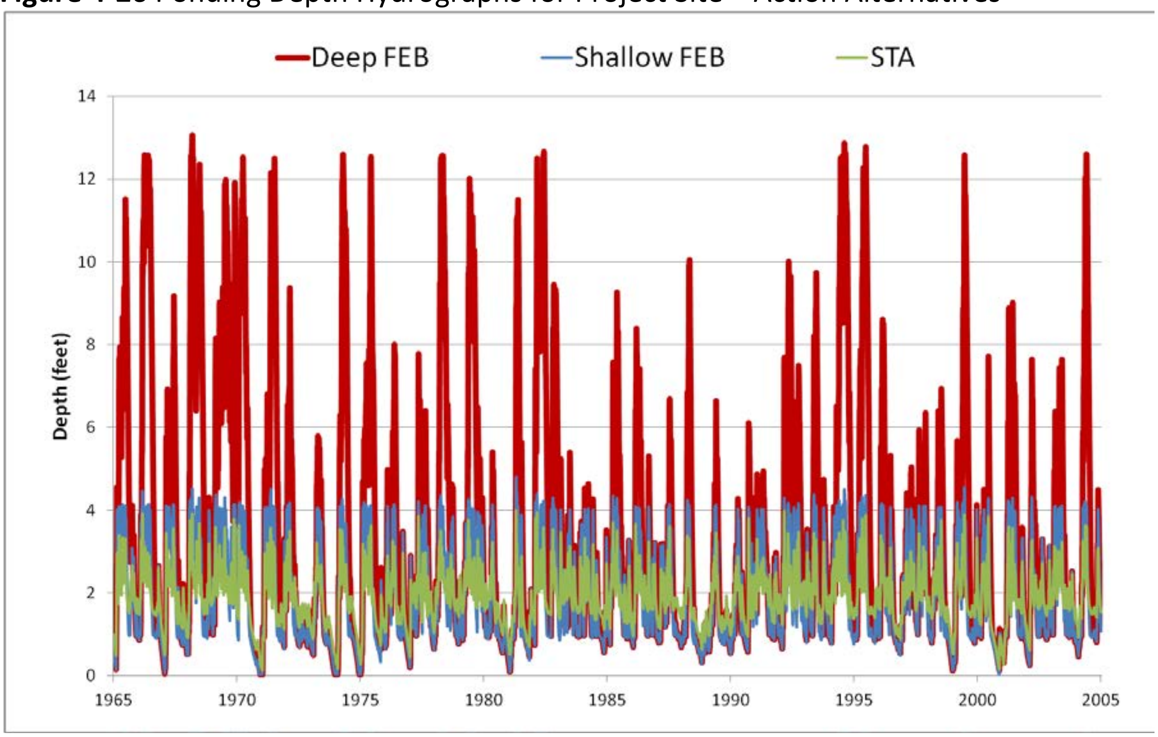
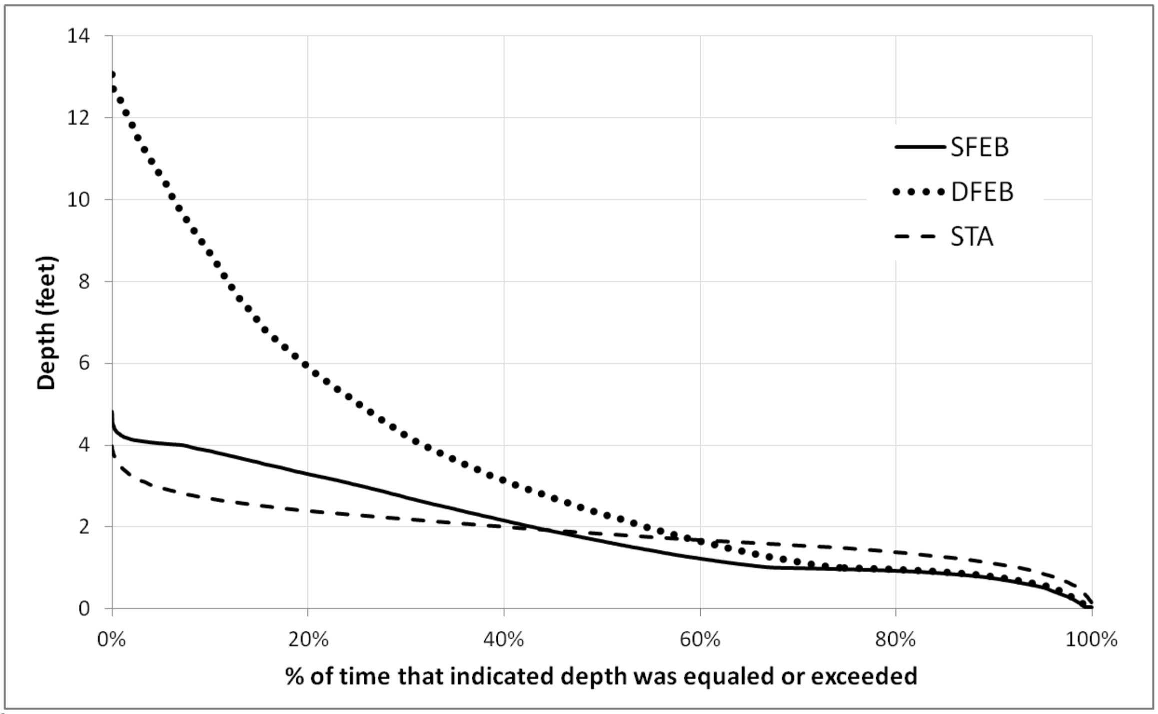


**Figure 4-27** Ponding Depth Duration Curves for Project Site – Action Alternatives[a]




[a]DMSTA does not allow a treatment cell to dry out. Therefore, the limits of the modeling do not allow the simulated water levels to fall below zero.

**Figure 4-28** Box and Whisker Plot of Monthly Depths on Project Site –Alternative 2

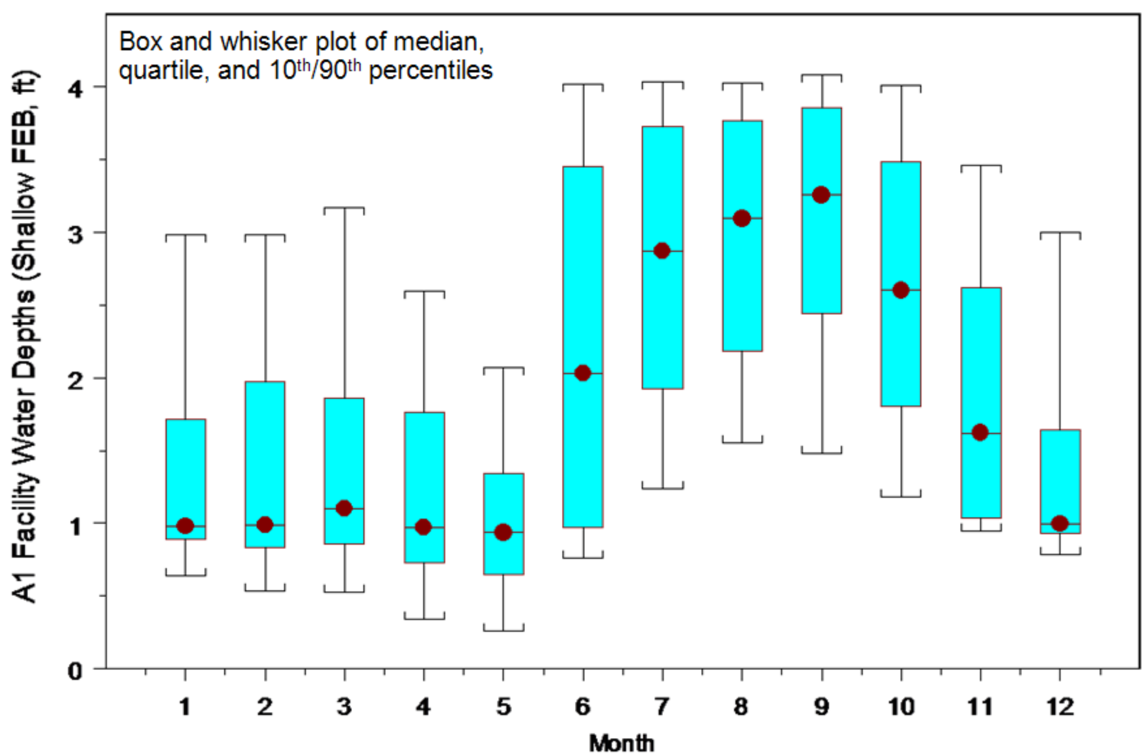


**Figure 4-29** Box and Whisker Plot of Monthly Depths for Project Site – Alternative 3

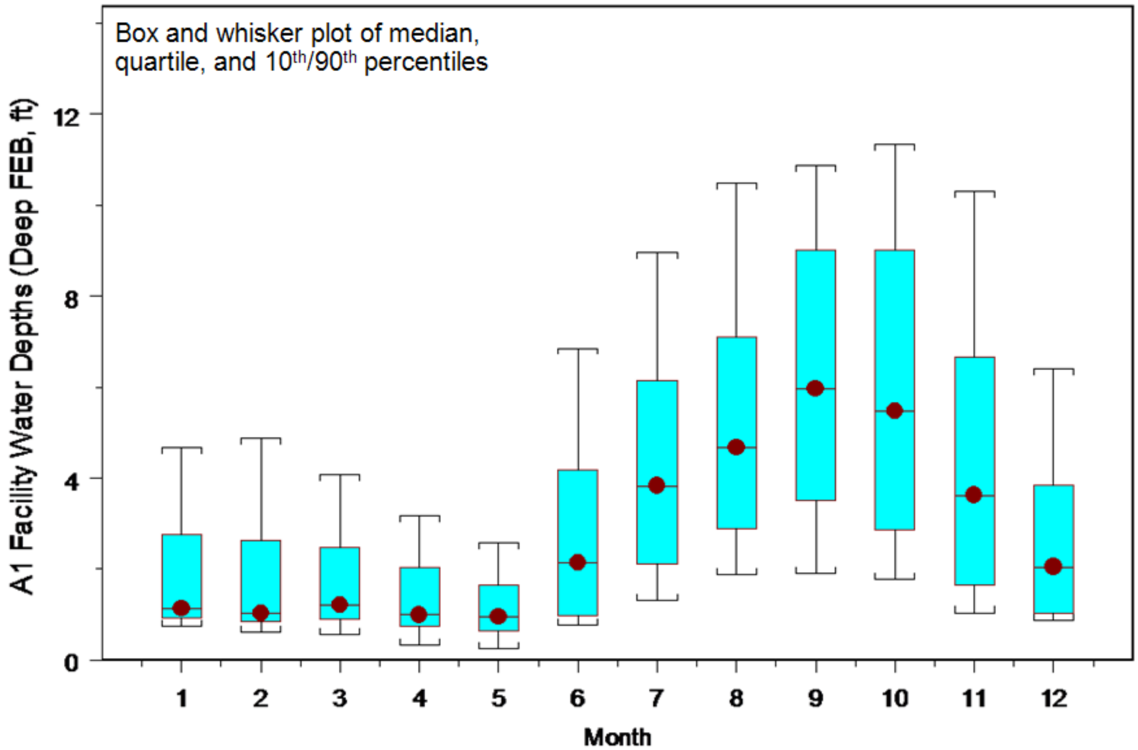
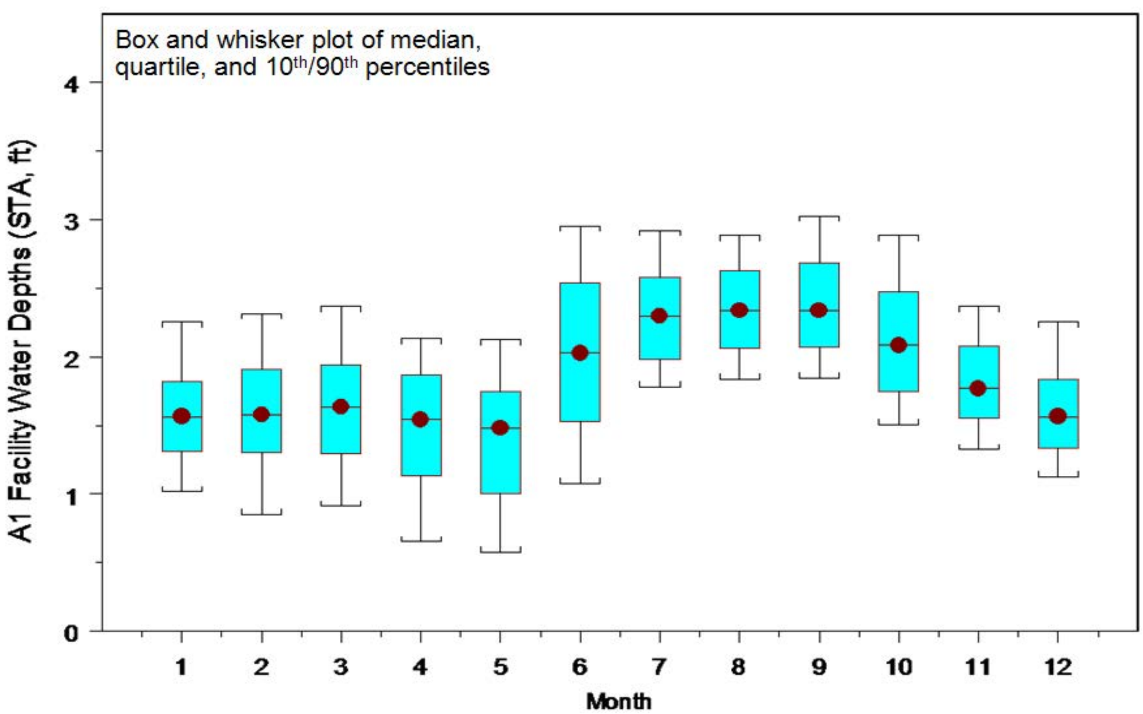



**Figure 4-30** Box and Whisker Plot of Monthly Depths for Project Site – Alternative 4



### 4.5.2.2.2 STA 2 and STA 3/4

A summary is provided of STA 2 and STA 3/4 inflow and outflow volumes, water diversions (water routed around the STAs into the WCA due to high water events), and urban water supply (water routed around the STAs during low water events) in **Table 4-4**. For the Alternatives 2, 3, and 4, which reflect the increased inflows and outflows of the project site as modeled, rainfall and evapotranspiration for the project site are simulated by the DMSTA model, which does not result in runoff from the site. Instead runoff is stored within the FEB or STA facilities and is eventually discharged from the project site with other FEB or STA discharges. For the No Action Alternative, where no discharge from the site is expected, rainfall and evapotranspiration are simulated by the 2x2 model, which results in runoff from the project site. This results in slight variation in the calculations which are explained below.

Values from the bottom seven rows (STA 2, STA 3/4 and A-1 STA) of Table 4-4 are used to compare alternatives. For the No Action Alternative, central flow-path runoff is distributed to STA 2 and STA 3/4 consistent with existing conditions. At times, when conditions do not allow for the STAs to treat all runoff water prior to discharge, diversion to the WCAs may occur without treatment. A reduction in the diversion volumes in **Table 4-4** means that less untreated runoff is sent to the WCAs.

Alternatives 2, 3, and 4 all result in less STA diversion, although some STA diversion is still expected to occur as there will continue to be some flows that will exceed the physical capacity of the STA inflow structures or result in substantial damage to the STAs. Water diversions in the dry season, referred to as urban water supplies, are not affected by any Alternative. Under the No Action Alternative, the 'Inflow and Diversion' row in Table 4-4 is consistent with the Total Source Basin Flow Volume from **Table 4-1**. The change from the 'Inflow and Diversion' row and the 'Outflow and Diversion' row, from 834,000 to 831,000 (a 3,000 acre-feet per year or 0.3% difference) can be attributed to seepage, evaporation and effects from the modeling analysis. Change across the rows from the No Action Alternative to Alternatives 2, 3, and 4 will be due to factors such as runoff reduction, diversion/urban water supply, and rainfall/evapotranspiration/seepage.

Alternatives 2, 3, and 4 each result in different volume of water being diverted and different evapotranspiration and seepage rates. The resultant decreases in inflow and outflow volumes (to STA 2, STA 3/4, and the A-1 STA) summarized in Table 4-4 are due mainly to the following two reasons: 1) the project site has external levees and act as an impoundment and surface water runoff is not being exported as aggressively from the project site as compared to the No Action Alterative since water levels within the project site are not being managed for agricultural production; and 2) simulated water levels within an FEB or STA are substantially greater than water levels under the No Action Alternative and will result in greater evapotranspiration losses from the project site as compared to the No Action Alternative. Therefore, the volume of water as shown in the outflows, diversions, and urban water supply varies.

**Table 4-4** STAs 2, 3/4, and A-1 Inflow and Outflow Volumes, and Diversions and Urban Water Supply

| | Parameter | Average Annual Volume (acre-feet per year) | | | |
|---|---|---|---|---|---|
| | | Alternative 1: No Action | Alternative 2: Shallow FEB | Alternative 3: Deep FEB | Alternative 4: STA |
| STA 2 | Inflow | 301,000 | 387,000 | 386,000 | 253,000 |
| | Diversion | 17,000 | 5,000 | 5,000 | 5,000 |
| | Outflow | 307,000 | 391,000 | 389,000 | 259,000 |
| | Outflow and Diversion | 324,000 | 396,000 | 394,000 | 264,000 |
| STA 3/4 | Inflow | 504,000 | 401,000 | 407,000 | 275,000 |
| | Diversion | 12,000 | 6,000 | 1,000 | 5,000 |
| | Outflow | 495,000 | 392,000 | 397,000 | 269,000 |
| | Outflow and Diversion | 507,000 | 398,000 | 398,000 | 274,000 |
| A-1 STA | Inflow | NA | NA | NA | 252,000 |
| | Diversion | NA | NA | NA | 5,000 |
| | Outflow | NA | NA | NA | 245,000 |
| | Outflow and Diversion | NA | NA | NA | 250,000 |
| STA 2, STA 3/4, and A-1 STA | Inflow | 805,000 | 788,000 | 793,000 | 780,000 |
| | Diversion | 29,000 | 11,000 | 6,000 | 15,000 |
| | Inflow and Diversion | 834,000 | 799,000 | 799,000 | 795,000 |
| | Outflow | 802,000 | 783,000 | 786,000 | 773,000 |
| | Outflow and Diversion | 831,000 | 794,000 | 792,000 | 788,000 |
| | Urban Water Supply | 27,000 | 27,000 | 27,000 | 27,000 |
| | Outflow, Diversion and Urban Water Supply | 858,000 | 821,000 | 819,000 | 815,000 |

**Figures 4-31 and 4-32** provide ponding depth hydrographs for STA 2 and STA 3/4, respectively, for Alternatives 2, 3, and 4. These figures show that the operation of Alternatives 2, 3, and 4 result in similar water depths in STA 2 and STA 3/4.

**Figure 4-31** Ponding Depth Hydrographs for STA 2 – Action Alternatives

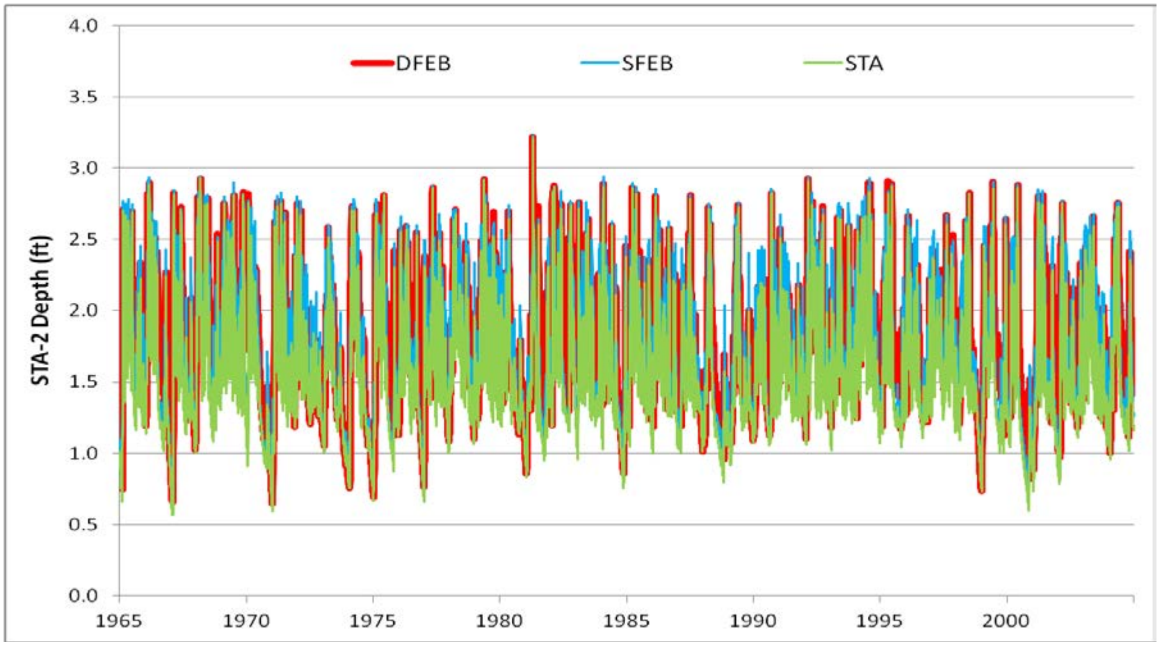
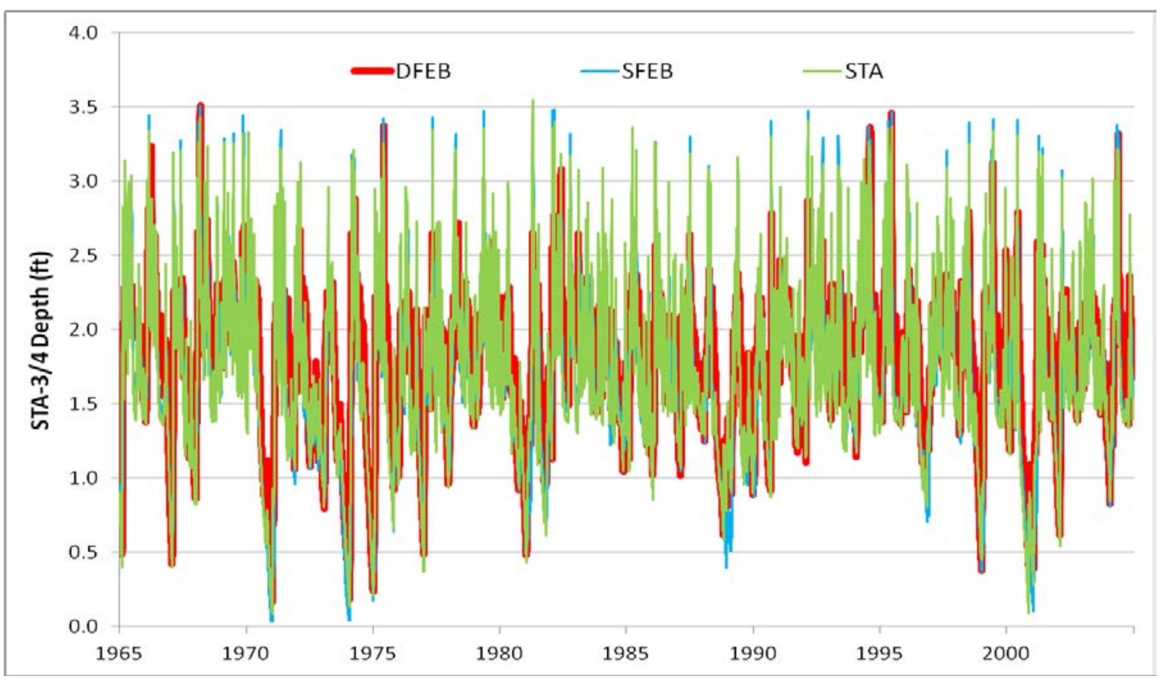



**Figure 4-32** Ponding Depth Hydrographs for STA 3/4 – Action Alternatives



Compared to the No Action Alternative, average daily depths within STA 3/4 and STA 2 for each Action Alternative are described below:

**Alternative 2 (Shallow FEB):**

As compared to the No Action Alternative, the Shallow FEB would increase inflows into STA 2 by 72,000 acre-feet per year and outflows by 84,000 acre-feet per year, while diversions are decreased by 12,000 acre-feet per year (**Table 4-4**). **Figures 4-33 and 4-34** provide ponding depth hydrographs for STA 2 and STA 3/4, respectively, for Alternative 2. The Shallow FEB would slightly decrease the peak stages and raise the low water stages in STA 2.

For STA 3/4, the Shallow FEB would decrease inflows 103,000 acre-feet per year and outflows by 103,000 acre-feet per year, while diversions are decreased by 6,000 acre-feet per year (Table 4-4). In general, the Shallow FEB would lower the peak water stages in STA 3/4 as the majority of high water elevations are lowered.

**Figure 4-33** Ponding Depth Hydrographs for STA 2 – Alternative 2 (Shallow FEB) and No Action Alternative

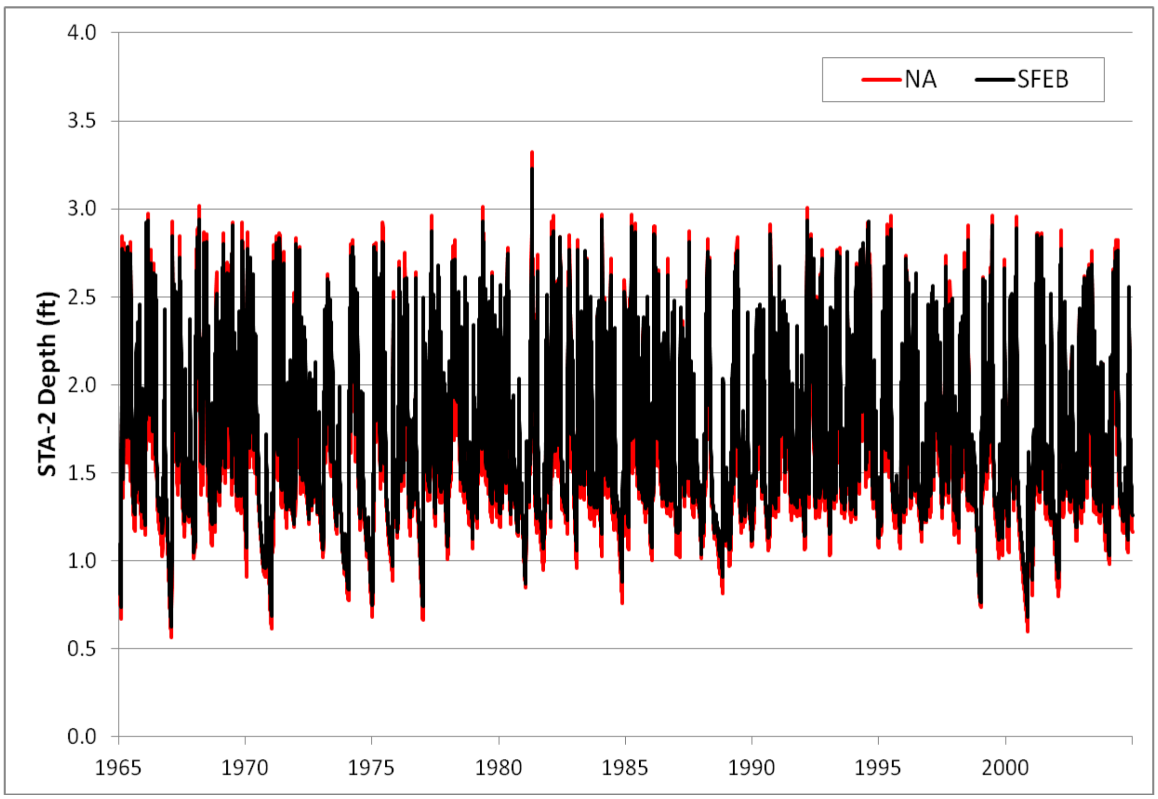
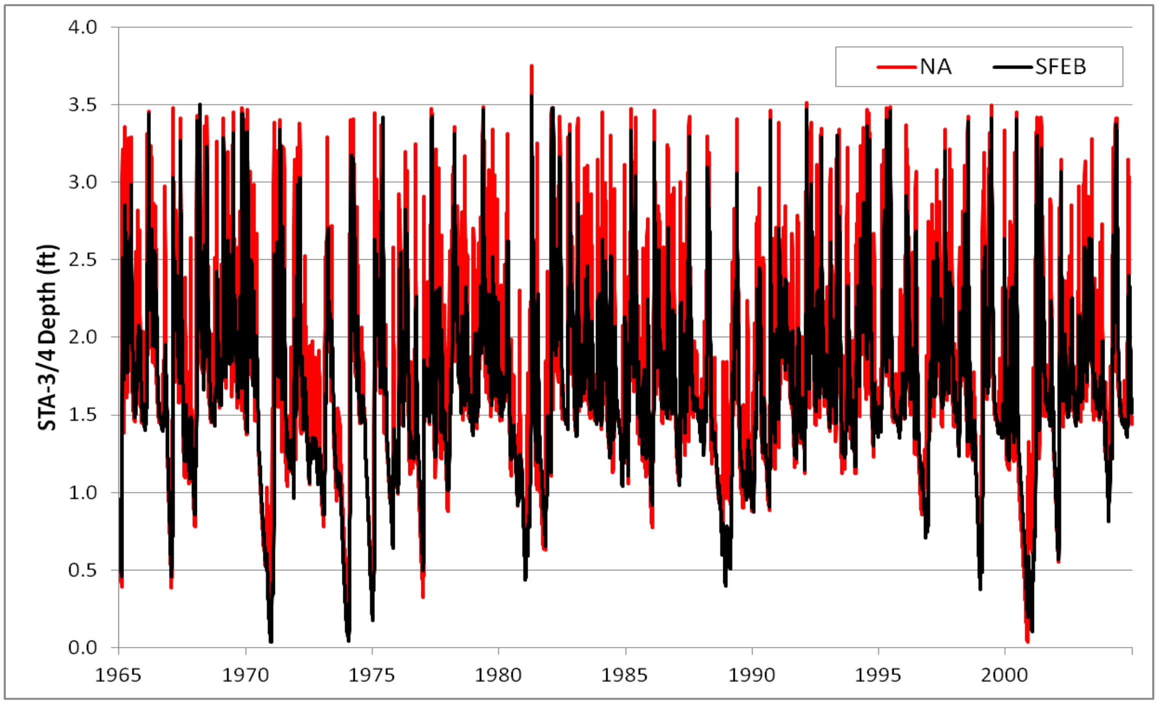


**Figure 4-34** Ponding Depth Hydrographs for STA 3/4 – Alternative 2 (Shallow FEB) and No Action Alternative




**Alternative 3 (Deep FEB):**

As compared to the No Action Alternative, the Deep FEB would increase inflows into STA 2 by 85,000 acre-feet per year and outflows by 82,000 acre-feet per year, while reducing the diversions by 12,000 acre-feet per year (**Table 4-4**). **Figures 4-35** and **4-36** provide ponding depth hydrographs for STA 2 and STA 3/4, respectively, for Alternative 3. The Deep FEB would slightly lower the peak water stages in STA 2, and increase the low water stages as the majority of low water events would be raised (**Figure 4-35**).

For STA 3/4, the Deep FEB would decrease inflows by 97,000 acre-feet per year and outflows by 98,000 acre-feet per year, while decreasing diversions by 11,000 acre-feet per year (**Table 4-4**). The Deep FEB would lower the peak water stages in STA 3/4 approximately one foot as the high water events would be reduced (**Figure 4-36**).

**Figure 4-35** Ponding Depth Hydrographs for STA 2 – Alternative 3 (Deep FEB) and No Action Alternative

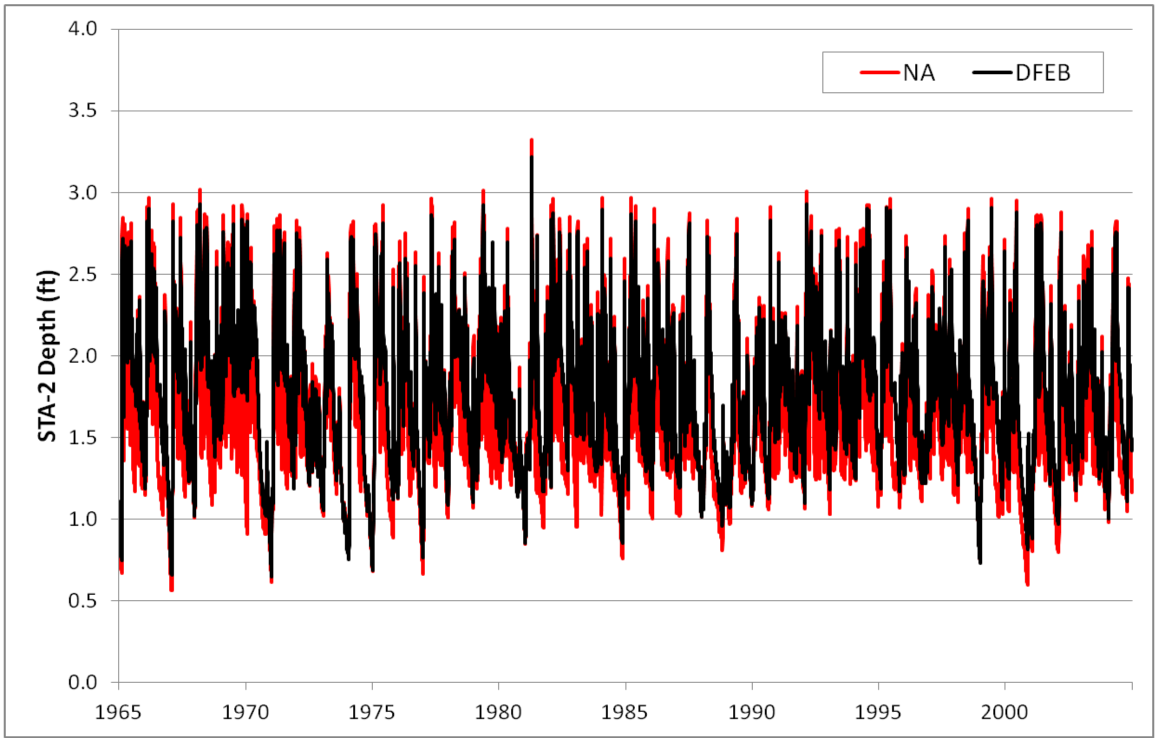
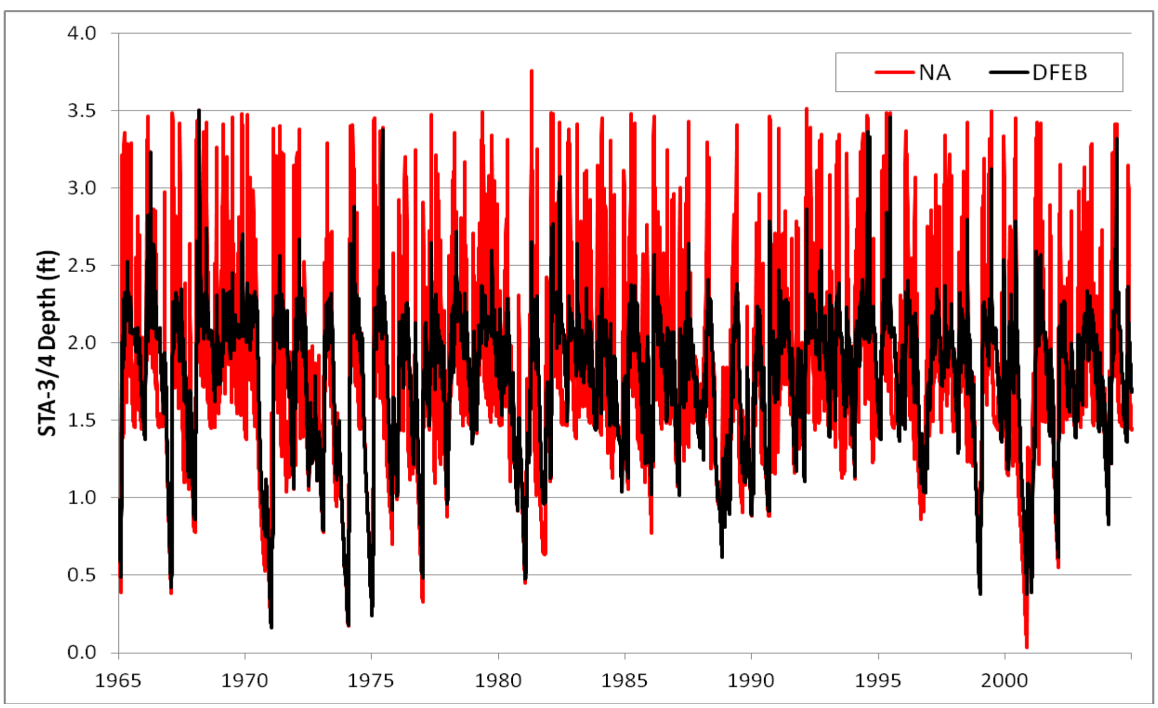



**Figure 4-36** Ponding Depth Hydrographs for STA 3/4 – Alternative 3 (Deep FEB) and No Action Alternative



**Alternative 4 (STA):**

As compared to the No Action alternative, utilization of the A-1 STA would decrease inflows into STA 2 by 48,000 acre-feet per year and outflows by 48,000 acre-feet per feet, while diversions are decreased by 12,000 acre-feet per year (**Table 4-4**). **Figure 4-37** and **Figure 4-38** provide ponding depth hydrographs and ponding depth duration curve for STA 2 and STA 3/4, respectively. The A-1 STA would decrease the peak stages in STA 2 and STA 3/4 as excess water would be shared among the STAs (STA 2, STA 3/4, and the project site STA). However, the need to maintain water levels in the A-1 STA would limit the ability to preferentially route water to STA 2 to maintain water levels resulting is more frequent low water stages in STA 2.

For STA 3/4, utilization of the A-1 STA would decrease inflows 229,000 acre-feet per year and outflows by 226,000 acre-feet per year (**Table 4-4**). Diversions would also be decreased 7,000 acre-feet per year for STA 3/4. For STA 3/4, the STA would lower the peak water stages, and decrease the low water stages resulting in lower water tables during the dry seasons. The lower water elevations during the dry season are due to the STA requiring water to maintain its wetland vegetation. **Figure 4-39** and **Figure 4-40** provide ponding depth hydrographs and ponding depth duration curve for STA 3/4 for Alternative 4.

**Figure 4-37** Ponding Depth Hydrographs for STA 2 – Alternative 4 (STA)

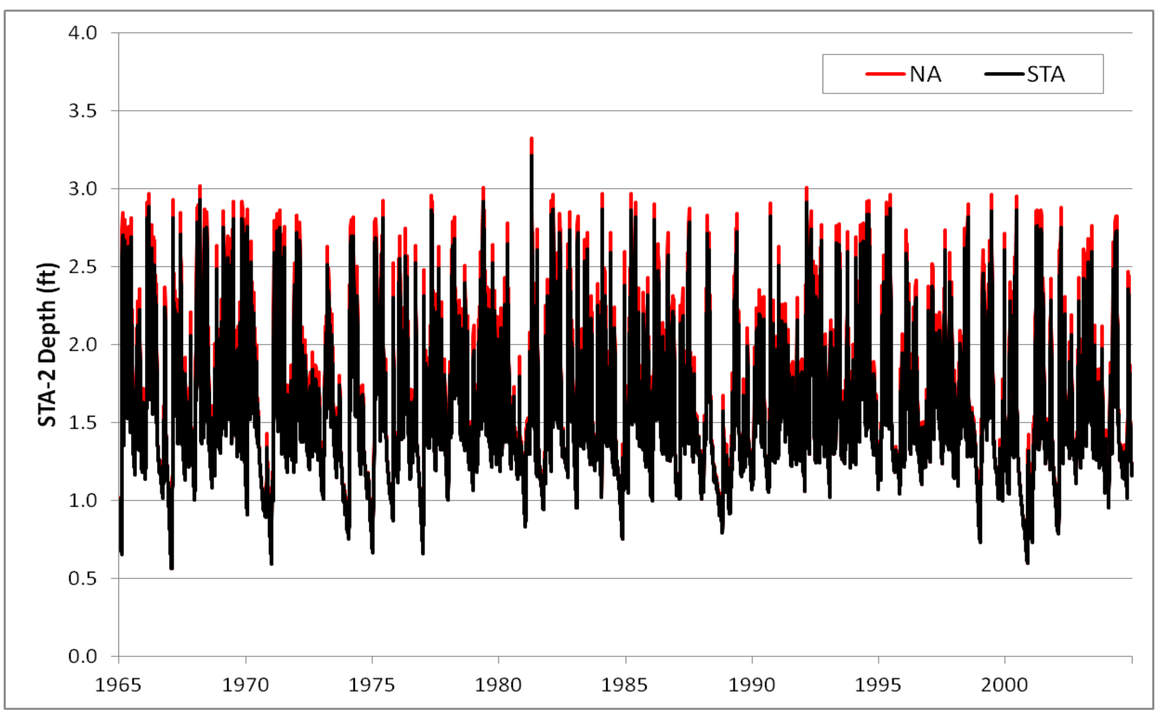


**Figure 4-38** Ponding Depth Duration Curves for STA 2 – All Alternatives

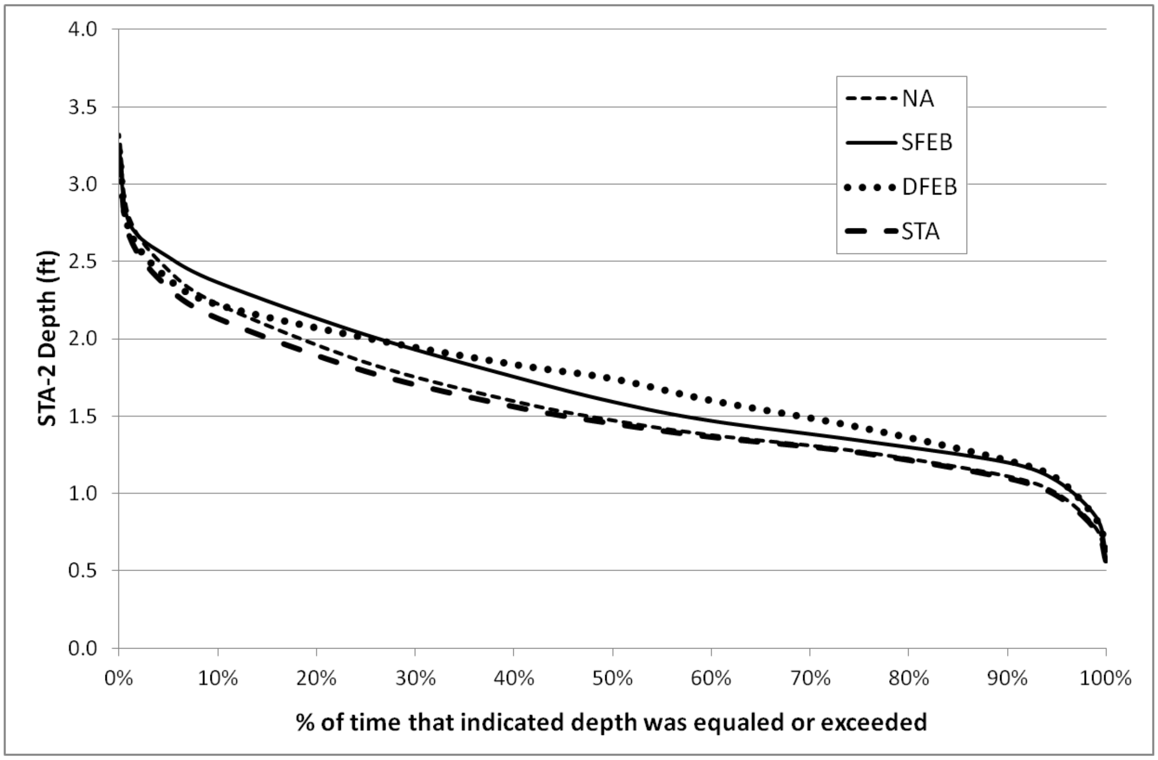



**Figure 4-39** Ponding Depth Hydrographs for STA 3/4 – Alternative 4 (STA)

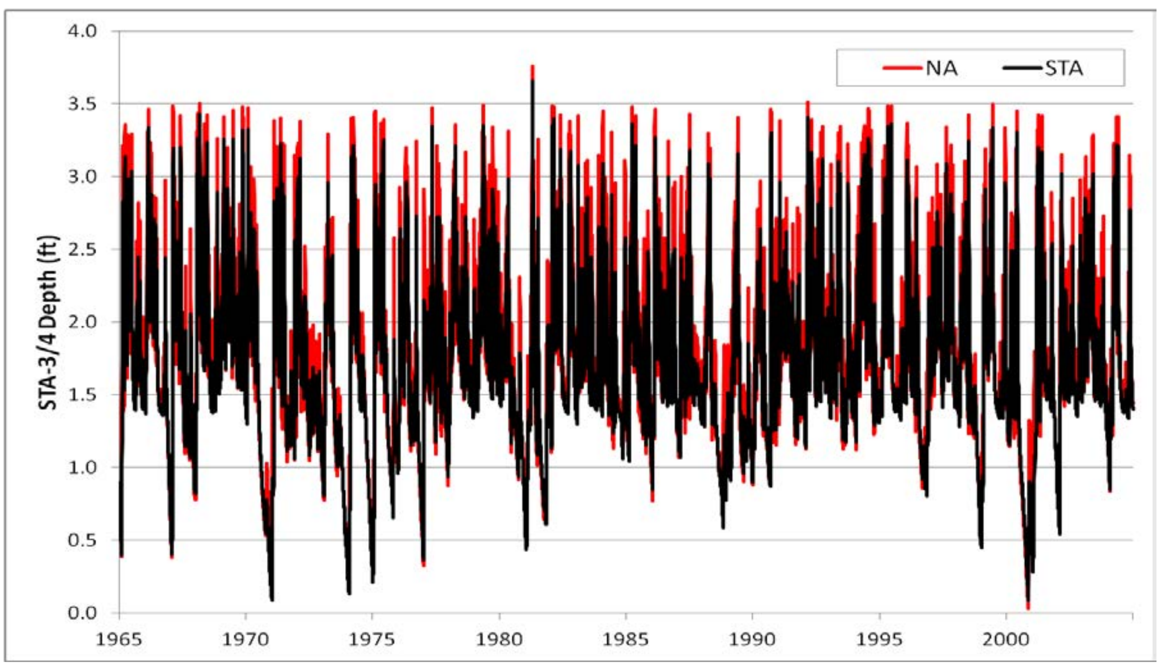
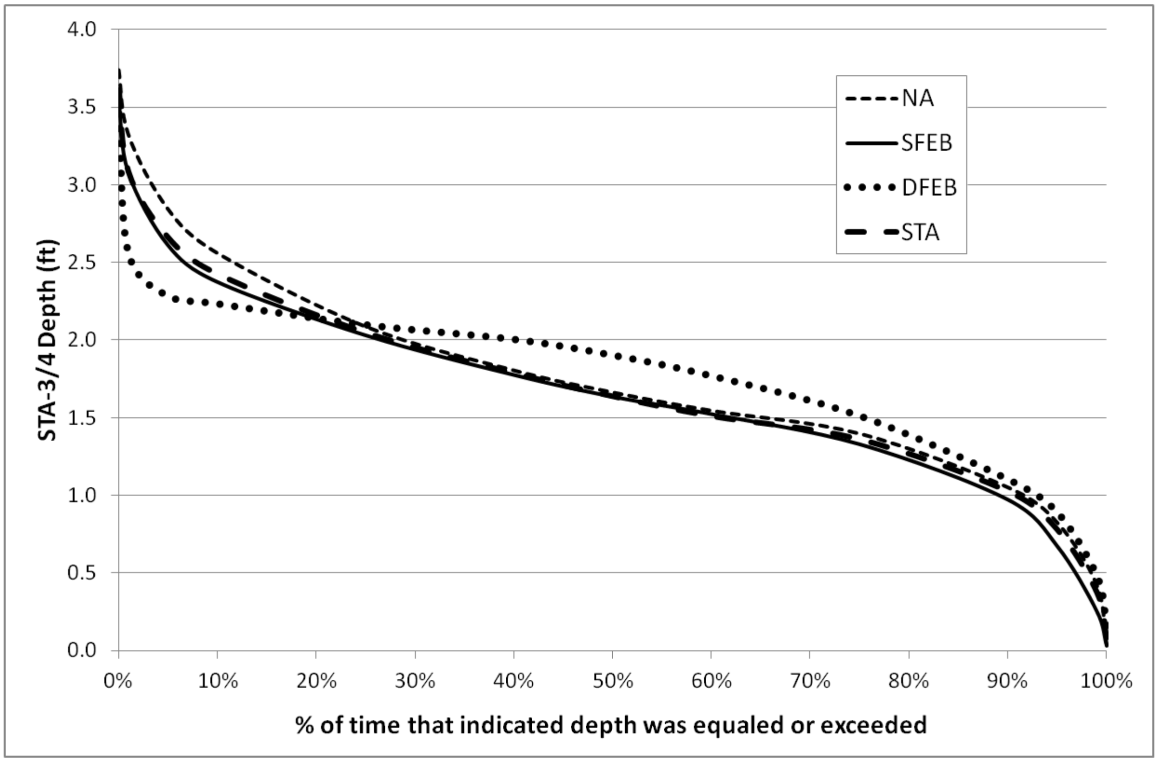


**Figure 4-40** Ponding Depth Duration Curves for STA 3/4 – All Alternatives




The ability of DMSTA to accurately predict the duration and severity of STA dryout is limited. Therefore, it is difficult to quantify the number of dryout events simulated to be eliminated/created within STA 2 and STA 3/4 by the different alternatives. It can be conceived that Alternatives 2 and 3 would result in less frequent dryout conditions in STA 2 and STA 3/4 since these alternatives send water in an advantageous manner to the existing STA. As for the A-1 STA Alternative, dry-outs in the existing STAs could actually increase with Alternative 4 due the operations of the proposed STA, which would need a portion of water currently sent to the existing STAs to keep it hydrated during dry periods. Dryouts are considered deleterious to STA performance because with rewetting there may be an undesirable release of phosphorus.

## 4.5.2.2.3 WCA 2A

WCA 2A inflows include treated flows from STA 2 and STA 3/4, STA 2 and STA 3/4 diversion flows and urban water supply flows. The total outflows from STA 2 and STA 3/4 including diversions and urban water supply is 858,000 acre-feet per year under the No Action Alternative. Based on the results of the Glades LECSA RSM modeling, WCA 2A would receive approximately 458,000 acre-feet per year of inflows via the L-6 Canal and the S-7 pump station for the No Action Alternative. All of the action alternatives produced ponding and hydroperiods very similar to the No Action Alternative, with only some minor variations (**Table 4.5**).

Alternatives 2, 3, and 4 result in 10,000; 14,000; and 13,000 acre-feet less water per year entering into WCA 2A. This reduction is mainly due to operating a 15,000 acre FEB or STA as compared to the No Action Alternative, which retains water without any discharge to the surrounding area.

**Table 4-5** WCA 2A Average Annual Volume of Inflows

| | Parameter | Average Annual Volume (acre-feet per year) | | | |
|---|---|---|---|---|---|
| | | Alternative 1: No Action | Alternative 2: Shallow FEB | Alternative 3: Deep FEB | Alternative 4: STA |
| **WCA 2A** | **Inflows** | 458,000 | 448,000 | 444,000 | 445,000 |

Performance measure graphics were generated for several gauge locations within WCA 2A and for the entire area. A gauge location map is provided in **Figure 4-5**. Hydrographs of daily ponding depths and duration curves of ponding depths are provided for two WCA 2A gauge locations (2A-17 and 2A-300) in **Figures 4-6, 4-7, 4-8 and 4-9**. **Figures 4-41, 4-42 and 4-43** provide average annual ponding depths, hydroperiod distribution and the hydroperiod difference for Alternative 2 respectively for WCA 2A. **Figures 4-44, 4-45 and 4-46** provide average annual ponding depths, hydroperiod distribution and the hydroperiod difference for Alternative 3 respectively for WCA 2A. **Figures 4-47, 4-48 and 4-49** provide average annual ponding depths, hydroperiod distribution and the hydroperiod difference for Alternative 4 respectively for WCA 2A.

**Alternative 2:**

For Alternative 2, there is an increase in the total outflows (72,000 acre-feet more per year) from STA 2 as compared to the No Action Alternative, while there is a decrease in total outflows from STA 3/4 (109,000 acre-feet less per year). This change is seen in the downstream areas as Alternative 2 (Shallow FEB) delivers approximately 10,000 acre-feet per year less flow via the L-6 Canal and S-7 pump station to WCA 2A, producing very slightly deeper ponding and slightly longer hydroperiods in localized areas in northwest WCA 2A as compared to the No Action Alternative. Alternative 2 results in approximately 600 acres of WCA 2A (0.6 percent) experiencing hydroperiods 17 days per year longer than the No Action Alternative (**Figure 4-43**).

**Figure 4-41** Average Annual Ponding Depth for WCA 2A and WCA 3A – Alternative 2 (Shallow FEB)

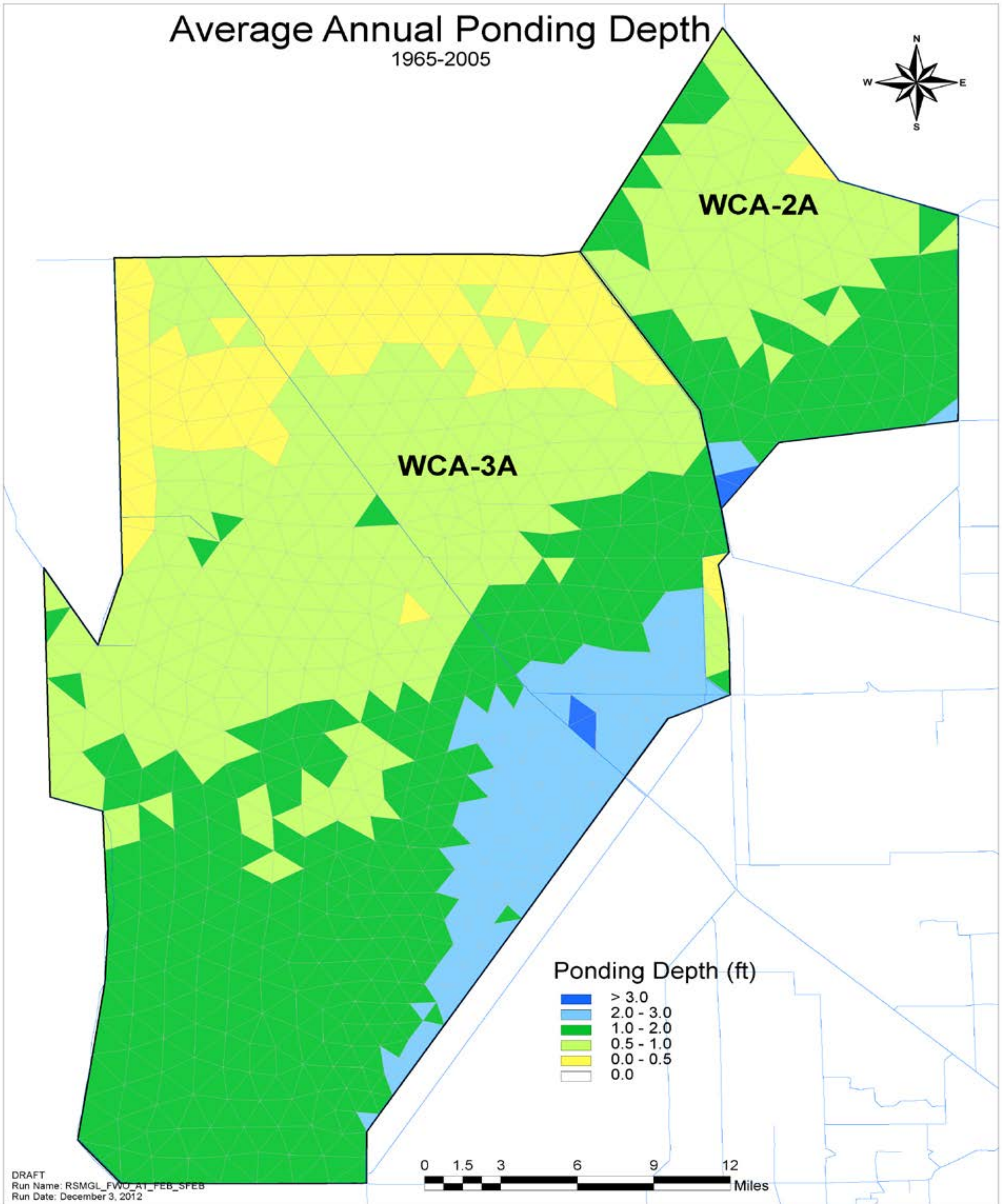


**Figure 4-42** Average Annual Hydroperiod for WCA 2A and WCA 3A – Alternative 2 (Shallow FEB)

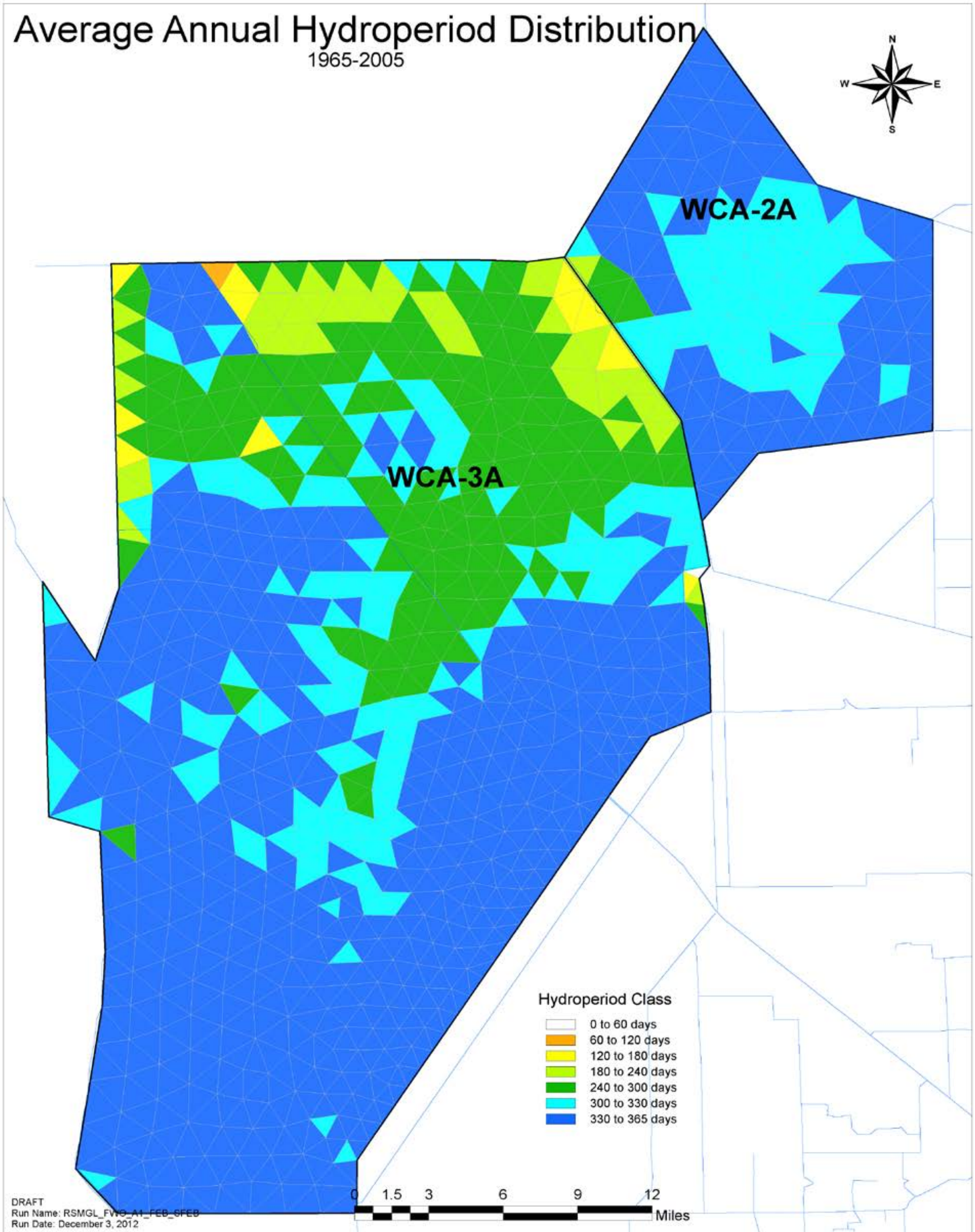
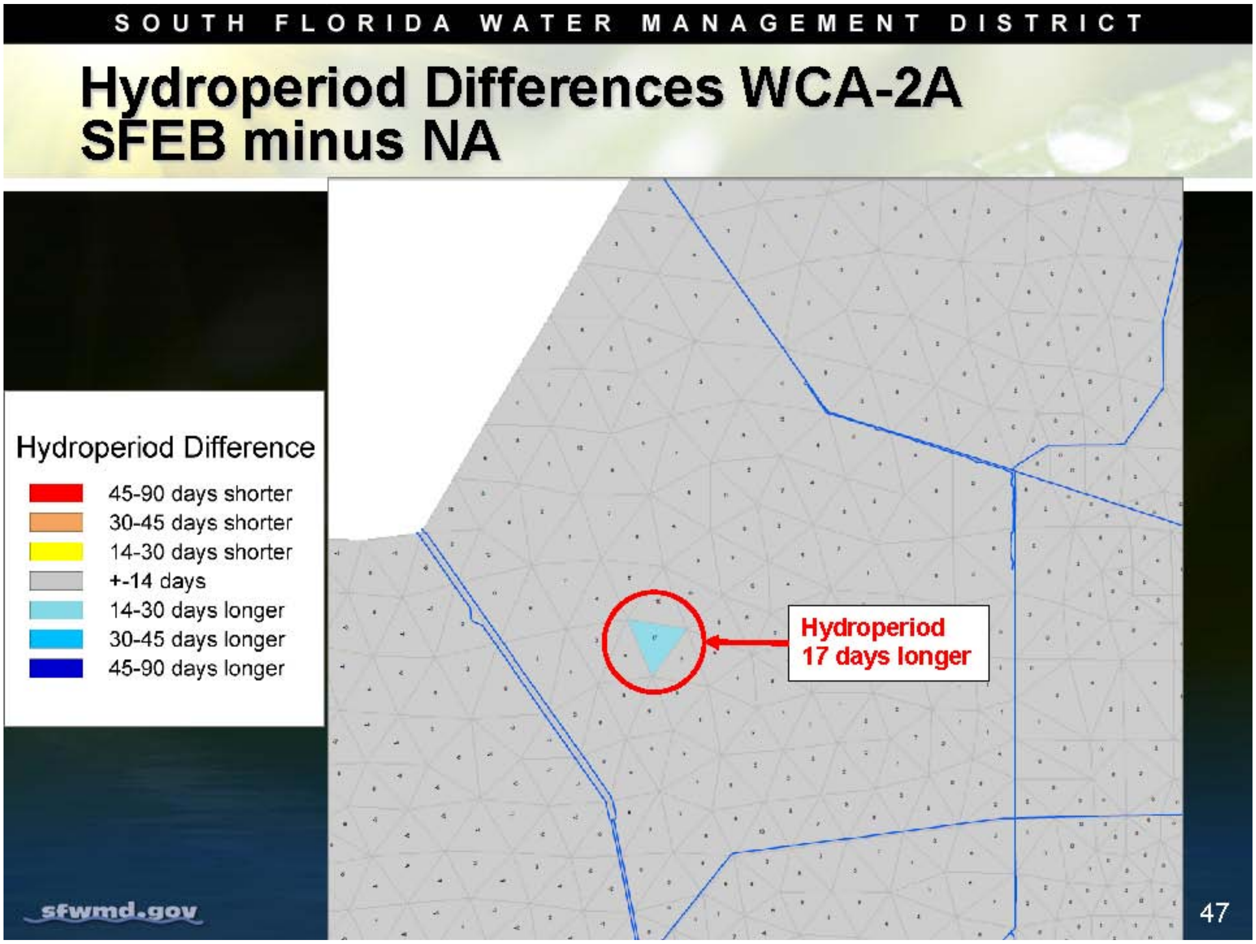


**Figure 4-43** Changes in Hydroperiod in WCA 2A – Alternative 2 (Shallow FEB)




**Alternative 3:**

For Alternative 3, there is an increase in the total outflows including diversions (70,000 acre-feet more per year) from STA 2 as compared to the No Action Alternative, while there is a decrease in total outflows from STA 3/4 (109,000 acre-feet less per year), including diversions. This change is seen in the downstream areas as Alternative 3 (Deep FEB) delivers approximately 14,000 acre-feet per year less flow via the L-6 Canal and S-7 pump station to WCA 2A, producing very slightly deeper ponding and slightly longer hydroperiods in areas in northwest WCA 2A compared to the No Action Alternative. Alternative 3 results in 3,000 acres of WCA 2A (3.1 percent) experiencing hydroperiods 15 to 18 days per year longer than the No Action Alternative (**Figure 4-46**).

**Figure 4-44** Average Annual Ponding Depth for WCA 2A and WCA 3A – Alternative 3 (Deep FEB)

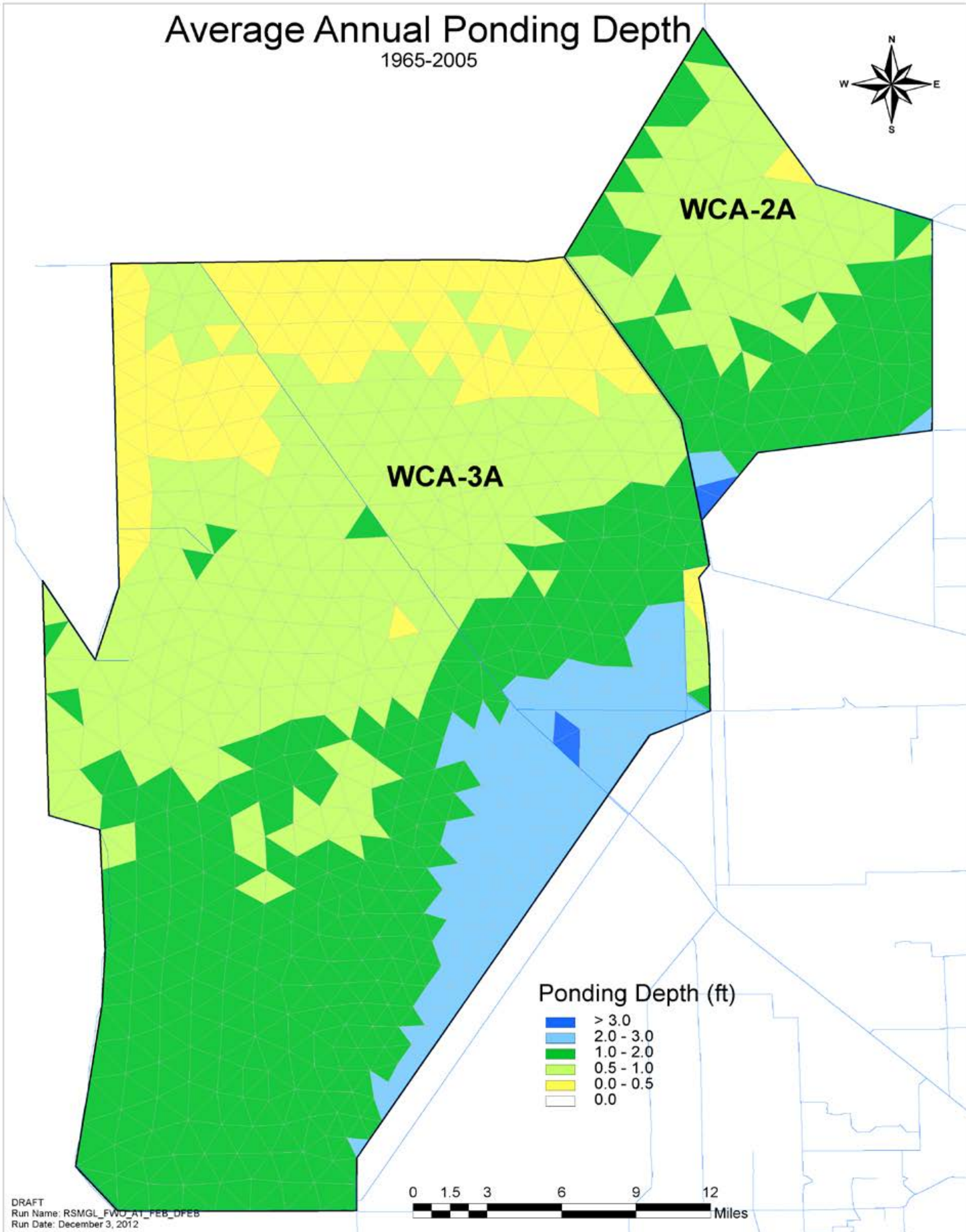


**Figure 4-45** Average Annual Hydroperiod for WCA 2A and WCA 3A – Alternative 3 (Deep FEB)

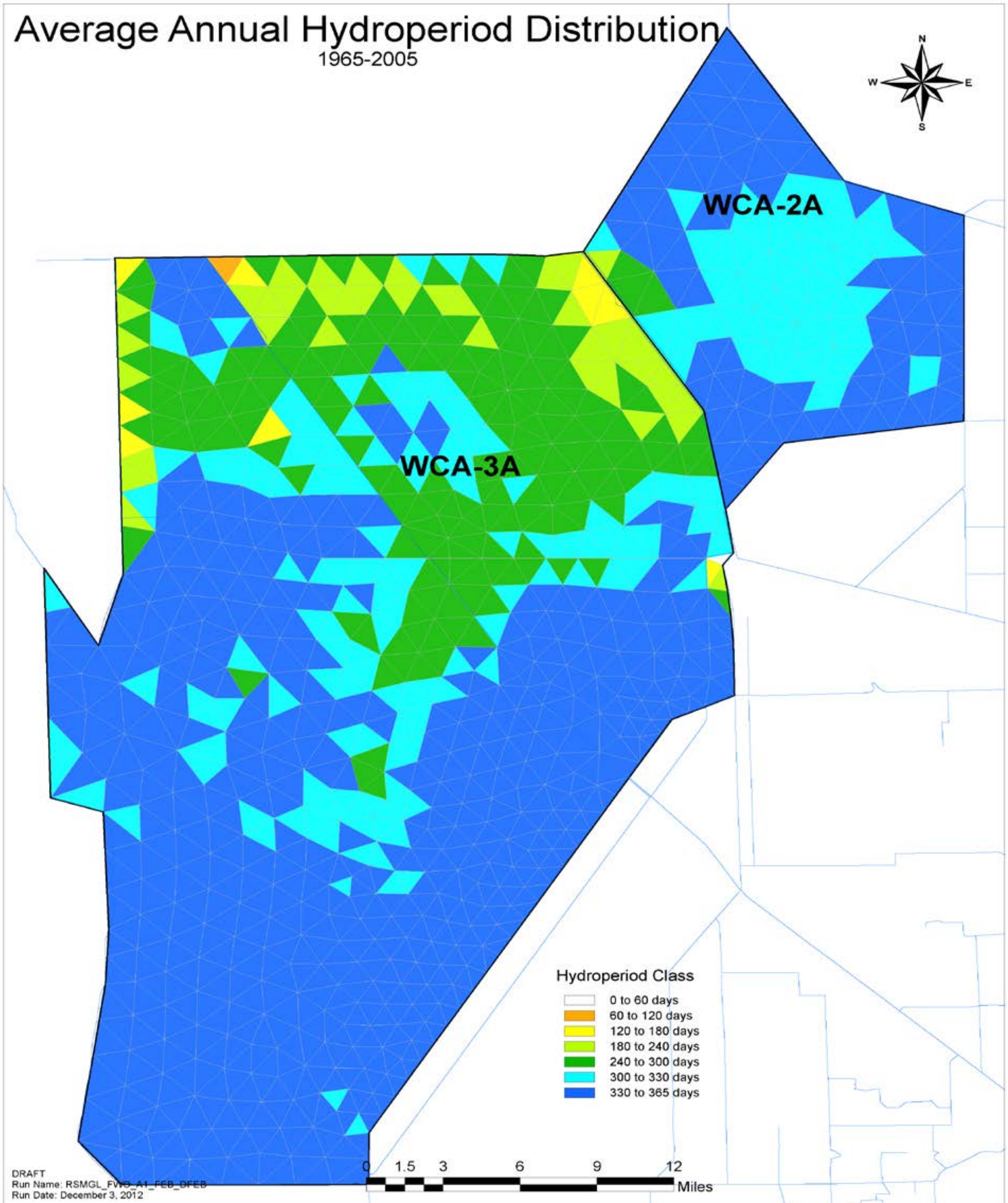
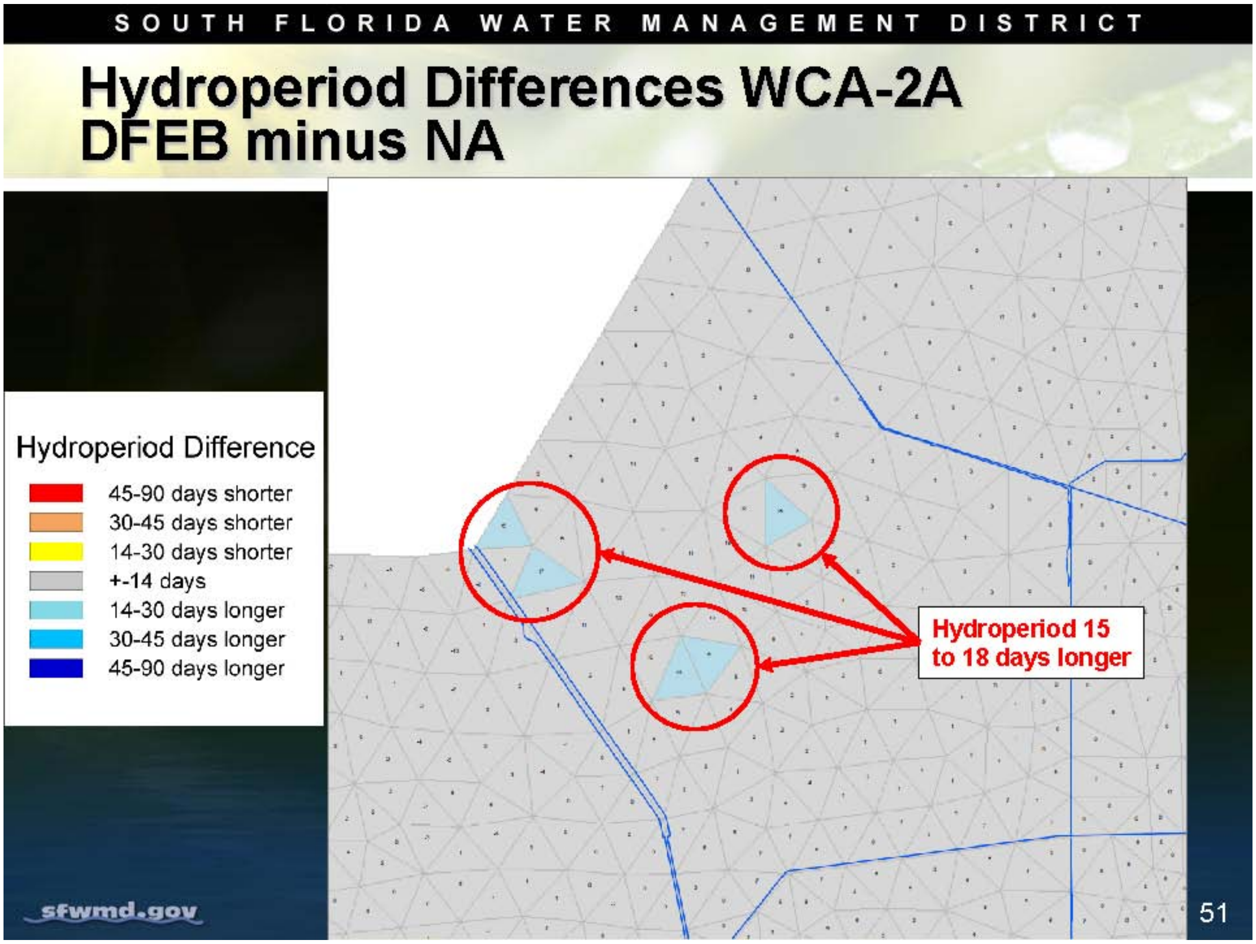


**Figure 4-46** Changes in Hydroperiod in WCA 2A – Alternative 3 (Deep FEB)




**Alternative 4:**

For Alternative 4, there is a decrease in the total outflows including diversions (60,000 acre-feet less per year) from STA 2 as compared to the No Action Alternative, while there is also a decrease in total outflows including diversions from STA 3/4 (233,000 acre-feet less per year) (**Table 4-4**). The A-1 STA would accept 252,000 acre-feet per year of inflows while outflows and diversions are 250,000 acre-feet per year. This change is reflected in the downstream water deliveries as Alternative 4 (STA) delivers approximately 13,000 acre-feet per year less flow via the L-6 Canal from STA 2 to WCA 2A, with no change in ponding or hydroperiods as compared to the No Action Alternative (**Figure 4-49**).

**Figure 4-47** Average Annual Ponding Depth for WCA 2A – Alternative 4 (STA)

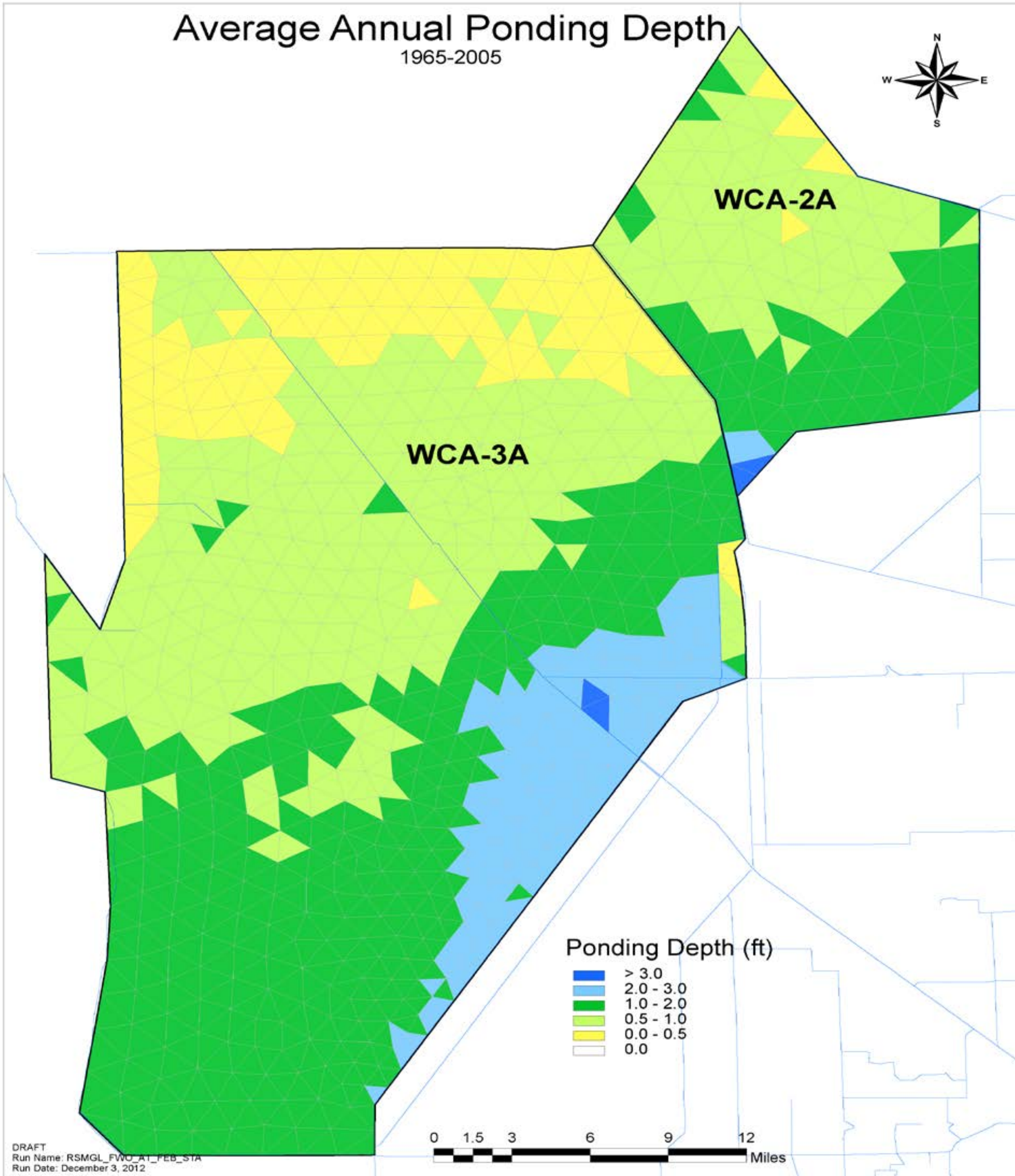


**Figure 4-48** Average Annual Hydroperiod for WCA 2A and WCA 3A – Alternative 4 (STA)

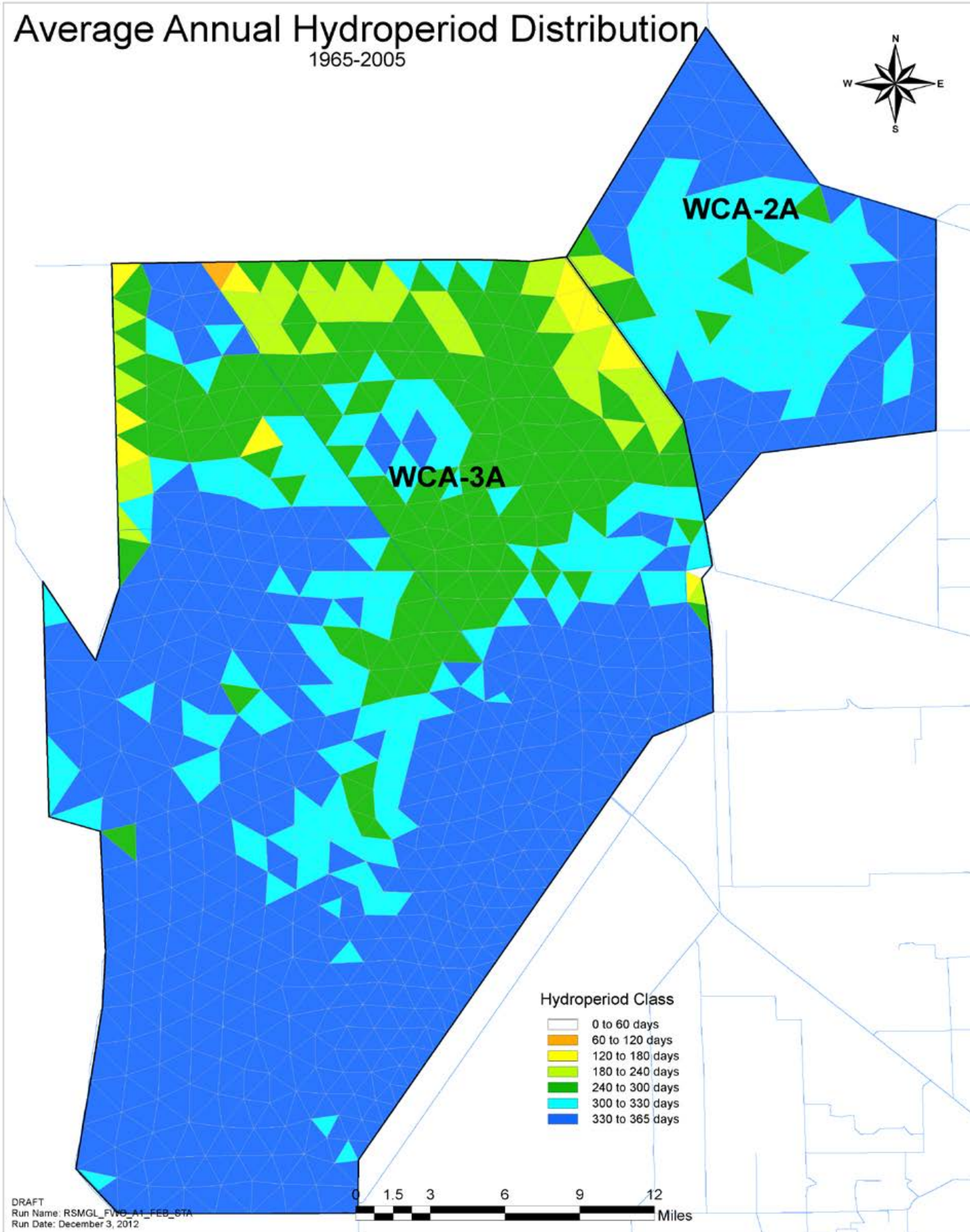
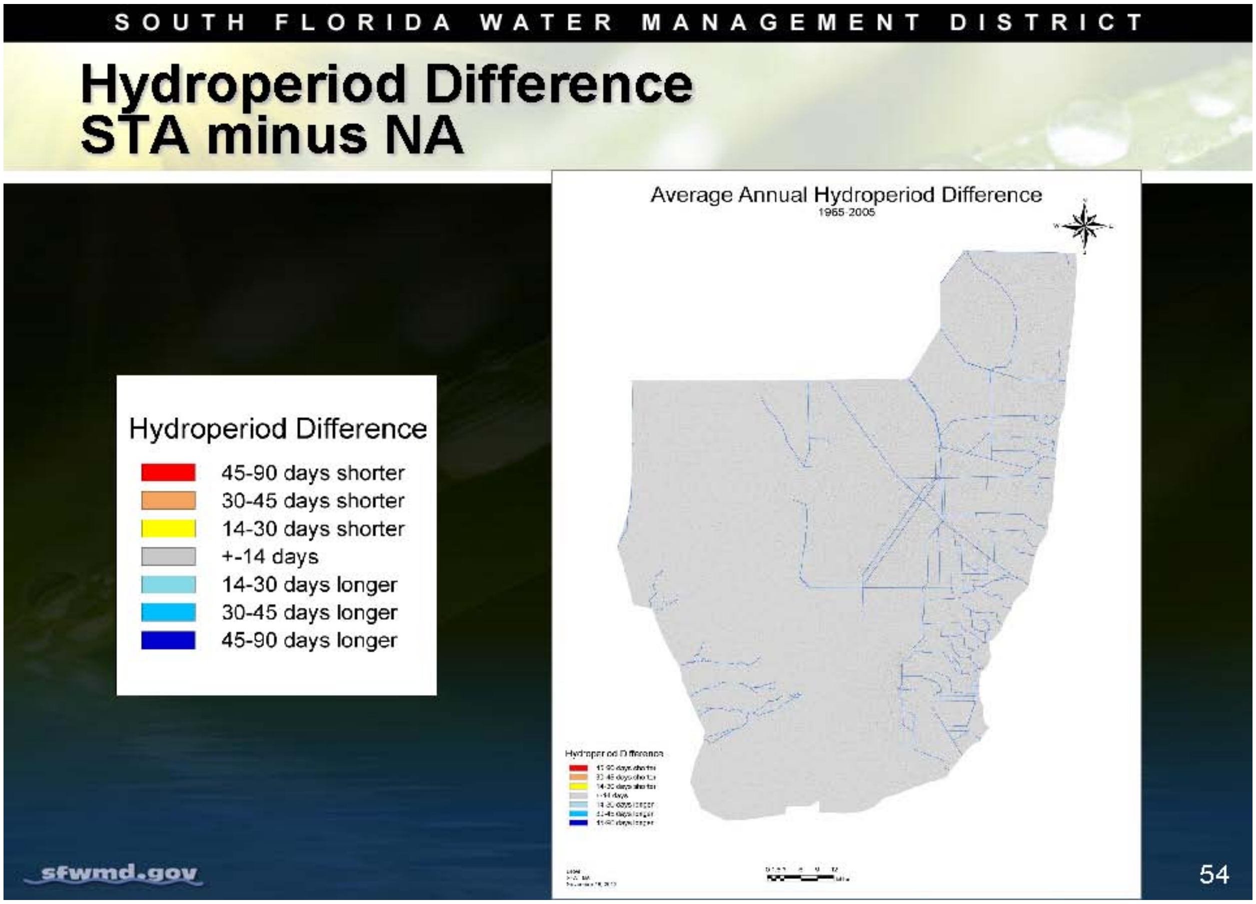


**Figure 4-49** Changes in Hydroperiod in WCA 2A and WCA 3A – Alternative 4 (STA)



#### 4.5.2.2.4 WCA 3A

WCA 3A inflows include treated flows from STA 3/4, STA 3/4 diversion flows and urban water supply flows. WCA-3A receives water from Lake Okeechobee, WCA 2 and the EAA via the North New River and Miami Canals with the majority of the inflows delivered from WCA 2A through the S-11 spillways. Another large source of water entering into WCA 3A is from STA 3/4 and STA 5, which enter through the S-8 and G-404 pump stations, and the S-150 and G-357 culverts, all of which are located at the northern boundary of WCA 3A.

Based on the results of the Glades LECSA RSM modeling, WCA 3A would receive approximately 401,000 acre-feet per year of inflows for the No Action Alternative, while Alternatives 2, 3, and 4 result in 25,000; 24,000; and 28,000 acre-feet per year less water than the No Action Alternative (**Table 4.6**). This reduction is mainly due to operating a 15,000 acre FEB or STA as compared to the No Action Alternative where the project site retains water without any discharge to the surrounding area. Performance measure graphics were generated for several gauge locations within WCA 3A and for the entire area.

**Table 4-6** Average Annual Inflows in WCA 3A

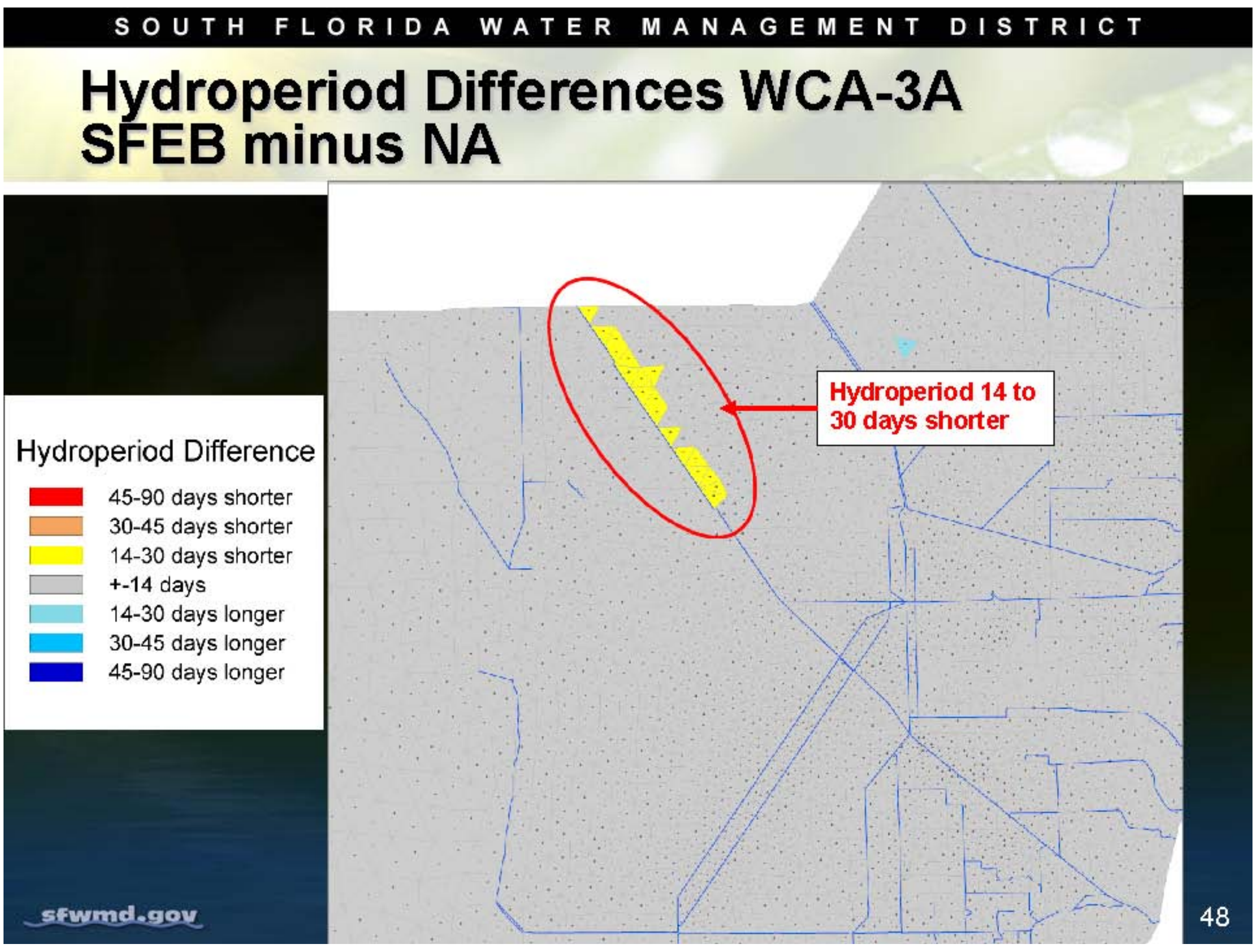
| | Parameter | Average Annual Volume (acre-feet per year) | | | |
|---|---|---|---|---|---|
| | | **Alternative 1: No Action** | **Alternative 2: Shallow FEB** | **Alternative 3: Deep FEB** | **Alternative 4: STA** |
| **WCA-3A** | **Inflows** | 401,000 | 376,000 | 377,000 | 373,000 |

A gauge location map is provided in **Figure 4-5**. Hydrographs of daily ponding depths and duration curves of ponding depths are provided for five WCA 3A gauge locations (3A-NW, 3A-NE, 3A-3, 3A-4, and 3A-28) in **Figures 4-12 through 4-21**. **Figures 4-41, 4-42 and 4-43** provide average annual ponding depths, hydroperiod distribution and the hydroperiod difference for Alternative 2 respectively for WCA 3A. **Figures 4-44** and **4-45** provide average annual ponding depths and hydroperiod distribution for Alternative 3 respectively for WCA 3A. **Figures 4-47** and **4-48** provide average annual ponding depths and hydroperiod distribution for Alternative 4, respectively, for WCA 3A.

**Alternative 2:**

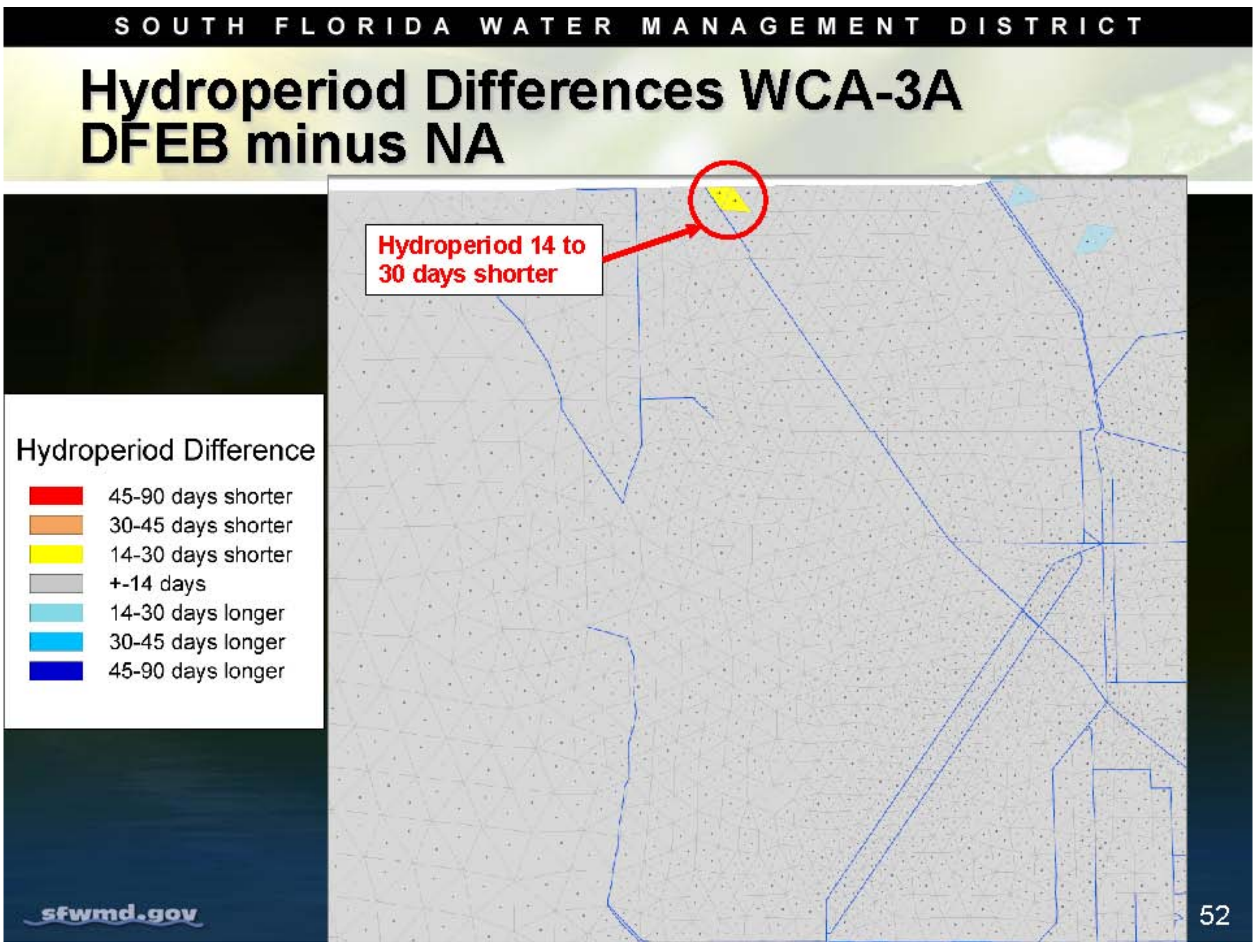
For Alternative 2, there is an increase in the total outflows including diversions (72,000 acre-feet per year) from STA 2 as compared to the No Action Alternative, while there is a decrease in total outflows from STA 3/4 (109,000 acre-feet less per year). WCA 3A receives 25,000 acre-feet per year less inflows than the No Action Alternative. This change is seen in the downstream areas as Alternative 2 (Shallow FEB) produces slightly shorter hydroperiods in an area in WCA 3A adjacent to the northern reach of the Miami Canal in comparison to the No Action Alternative. Approximately 11,000 acres of WCA 3A (2.2 percent) experience hydroperiods 14 – 30 days per year shorter than the No Action Alternative (**Figure 4-50**).

**Figure 4-50** Changes in Hydroperiod in WCA 3A – Alternative 2 (Shallow FEB)



**Alternative 3:**
For Alternative 3 (Deep FEB), there is an increase in the total outflows including diversions (70,000 acre-feet more per year) from STA 2 as compared to the No Action Alternative, while there is a decrease in total outflows including diversions from STA 3/4 (109,000 acre-feet less per year) (**Table 4—4**). WCA 3A receives 24,000 acre-feet per year less inflows than in the No Action Alternative. This change is seen in the downstream areas as approximately 1,000 acres of WCA 3A (0.2 percent) experience hydroperiods 14 to 30 days per year shorter than the No Action Alternative (**Figure 4-51**).

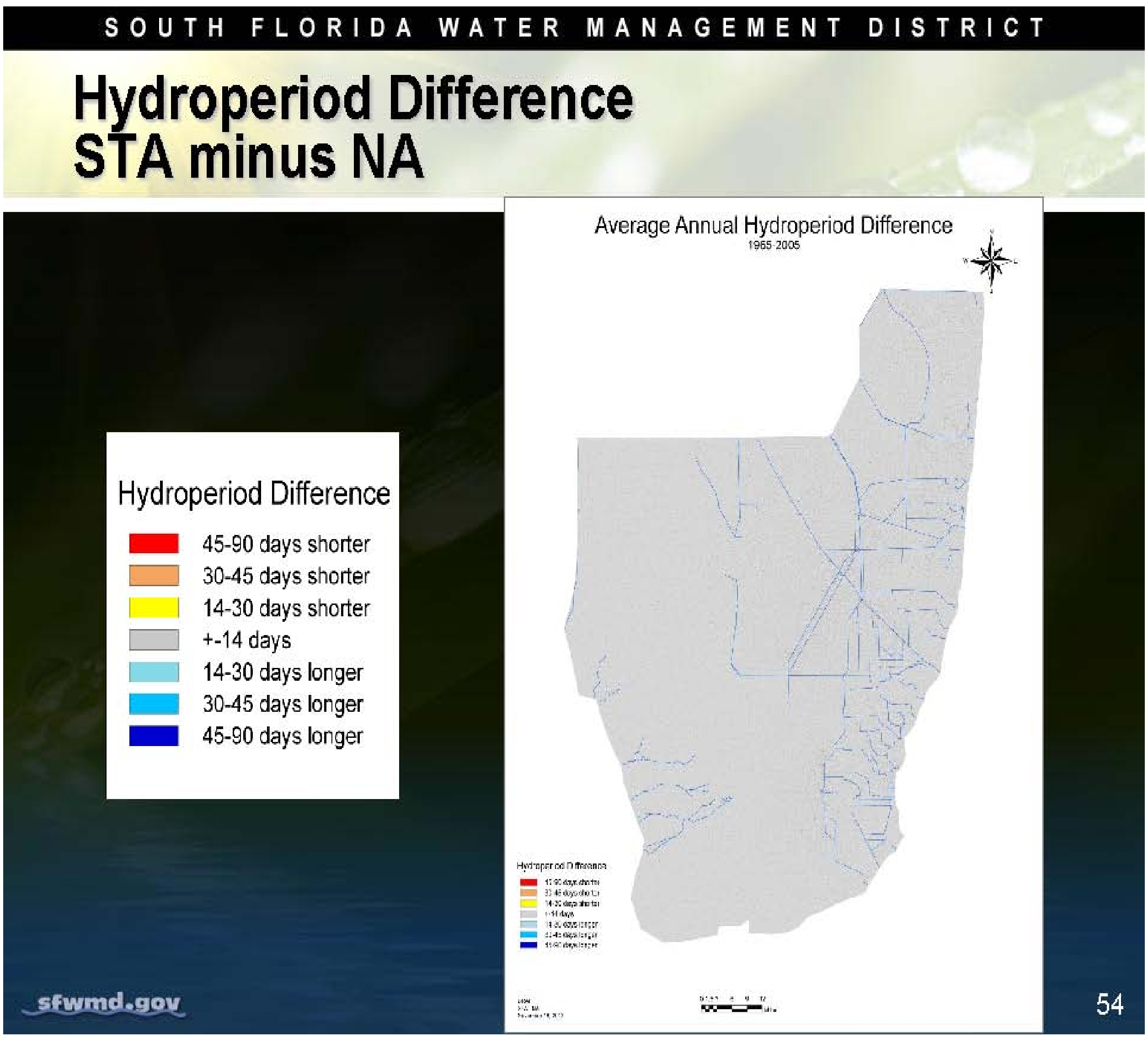
**Figure 4-51** Changes in Hydroperiod in WCA 3A – Alternative 3 (Deep FEB)



**Alternative 4:**

For Alternative 4, there is a decrease in the total outflows including diversions (60,000 acre-feet less per year) from STA 2 as compared to the No Action Alternative, and a decrease in total outflows including diversions from STA 3/4 (223,000 acre-feet less per year). This is because the A-1 STA would accept 252,000 acre-feet per year of inflows and 250,000 acre-feet per year of outflows. WCA 3A receives 28,000 acre-feet per year less inflows than No Action Alternative. Alternative 4 (STA) produces ponding and hydroperiods in WCA 3A that are very similar to the No Action Alternative as there are no observed differences (**Figure 4-52**).

**Figure 4-52** Changes in Hydroperiod in WCA 3A – Alternative 4 (STA)



#### 4.5.2.2.5 Holey Land Wildlife Management Area

No impacts to the surface water hydrology are anticipated to occur for the Action Alternatives since the action alternatives would not increase or decrease surface water in the Holey Land. As a result, no changes to Holey Land ponding depths are anticipated to occur.

## 4.5.3 GROUNDWATER HYDROLOGY

### 4.5.3.1 No Action Alternative

#### 4.5.3.1.1 Project Site

The two principal aquifers in and around the project site – the surficial aquifer system, and the Floridan aquifer system – would not be affected by the No Action Alternative. Under the No Action Alternative, the groundwater hydrology in and around the project site would remain as it is today, as described in Chapter 3. The groundwater hydrology of the STAs, the WCAs, and Holey Land would remain as it is currently.

### 4.5.3.2 Action Alternatives

The two principal aquifers in and around the project site – the surficial aquifer system, and the Floridan aquifer system – would be minimally, if at all, affected by the Action Alternatives. The Floridan aquifer system is divided into the Upper Floridan and Lower Floridan, by an intermediate confining unit, which restricts communication between these two layers. Therefore, the Lower Floridan would not be affected by any of the Action Alternatives. Alternatives 2, 3, and 4 would result in the construction and operation of a Shallow FEB, Deep FEB or STA that may inundate 15,000 acres with water depths ranging from approximately 1 to 12.5 feet. Under these conditions, water within the project site would be in direct contact with the groundwater through the surface soils and may be lost to the surficial aquifer system. However, due to the proposed seepage collection and return systems proposed for all of the Action Alternatives, the contribution of seepage that would occur would have a minimal effect on groundwater. Expected contributions to seepage from Alternative 2, 3 and 4 are expected to be equivalent.

No impacts to the groundwater hydrology of the STAs, WCAs, or Holey Land are anticipated to occur for the Action Alternatives as operational changes are not proposed and water levels within the STAs would remain approximately the same as described in Chapter 3.

## 4.5.4 STA PHOSPHORUS REMOVAL

### 4.5.4.1 No Action Alternative

Under the No Action Alternative, STA 2 and STA 3/4 would continue to experience dry-outs. Between Water Years 2002 and 2012, STA 2 (which became operational in WY2000) experienced dryout conditions in at least five (5) water years, with approximate durations ranging from 1 to 5 months. STA 3/4, which became operational in WY2004, experienced dryout conditions one time since Water Year 2005, with a duration of less than one month. If similar weather conditions occur, it is anticipated that similar frequency of dry outs would occur in the future.

### 4.5.4.2 Action Alternatives

The primary objective of the Action Alternatives is to attenuate and temporarily store peak stormwater flows to assist STA 2 and STA 3/4 with the achievement of the WQBEL. Minimizing the potential for STA dryout is an additional benefit. The ability of DMSTA to accurately predict the duration and severity of STA dryout is limited. One assumption in the DMSTA modeling and STA operation is that the treatment cell is not allowed to dryout. Therefore, the DMSTA results do not quantify the number of dryout events simulated to be eliminated. In general, as additional STA acreage is added (as in Alternative 4), the potential risk of STA dryout, and associated impacts to phosphorus removal performance within existing and new STAs, increases, whereas, when additional storage is added (as in Alternative 2 and 3), the potential for dryout within existing STAs decreases.

Additionally, the dryout within STA 3/4 that occurred in 2011 may not have been avoided with the Action Alternatives in place due to the hydrologic conditions that occurred during early 2011. However, the damaging conditions that resulted from the rapid re-filling of STA 3/4 would have likely been prevented, as this is the type of event that an FEB (Alternatives 2 and 3) is intended to address. The rapid re-filling of STA 3/4 resulted in peat pop-ups, rapid flux of phosphorus into the water column and overwhelming stress on the vegetative communities within the STA. With the FEB Alternatives (Alternative 2 and 3) in place, stormwater flows would have been directed first to the FEB for storage and attenuation, and then distributed to STA 3/4, ultimately providing short- and long-term performance benefit to the STA.

Florida's Everglades total phosphorus criterion rule specifies a definition of impacted as being where soil TP exceeds 500 milligrams TP per kilogram of soil; therefore, if the TP concentrations in the soils are below 500 milligrams per kilograms, these soils would be considered unimpacted. Lower phosphorus concentrations discharged from STA 2 and STA 3/4 would reduce the rate of soil phosphorus accumulation in the WCA soils. Over time, reductions in soil total phosphorus will help facilitate the restoration of impacted areas near the inflow points to WCA 2A and WCA 3A, creating conditions more conducive to historic Everglades vegetation communities.

## 4.6 WATER QUALITY

The water quality (phosphorus) modeling of EIS alternatives was conducted using DMSTA. Average annual flow volumes and TP loads and TP concentrations summarized by source basin are provided in **Table 4-7**. Water quality improvements (i.e. reductions in TP concentrations) are anticipated to occur such that both STA 3/4 and STA 2 are projected to discharge at the WQBEL with Alternatives 2, 3, and 4. These improvements in STA discharges would result in improvements at WCA 2A and WCA 3A inflows which would subsequently lead to improvements in water quality within WCA 2A and WCA 3A. Each STA is required to discharge at the WQBEL, which is based on a long-term discharge of 13 ppb flow-weighted (Section 1.3.1.2), after all the corrective actions identified in the consent orders associated with the NMDES and EFA permits have been completed in 2025. DMSTA projections of STA outflow concentration, such as those in **Table 4-8**, are interpreted in this context. Modeling uncertainty for DMSTA results is estimated at + or - 15% of the predicted long-term flow-weighted mean for each STA (USEPA 2010, Attachment H), without accounting for uncertainty in the assumed future flows and loads.

**Table 4-7** Source Basin Flow Volumes and Total Phosphorus Loads and Concentrations

| Source Basins | Average Annual Flow Volume (acre-feet per year) | Total Phosphorus Load (metric tons per year) | Total Phosphorus Concentration (ppb) |
|---|---|---|---|
| S-5A | 44,500 [1] | 11.7 | 213 |
| S-6 | 181,400 | 24.8 | 111 |
| S-7 | 263,900 [2] | 31.9 [3] | 98 |
| S-8 | 218,400 | 22.5 | 83 |
| East Shore Water Control District and 715 Farms (Closter Farms) | 22,700 | 3.7 | 132 |
| South Florida Conservancy District | 19,100 | 2.5 | 108 |
| South Shore Drainage District | 11,700 | 1.7 | 116 |
| C-139 (via C136) | 14,700 | 2.8 | 154 |
| Lake Okeechobee | 58,300 | 10.4 | 145 |

| | | | |
|---|---|---|---|
| (Regulatory Releases) | | | |
| Total | 834,700 | 112.0 | 109 |

Notes:

1. Assumes runoff reduction resulting from the future 6,500-acre STA-1W expansion in the S-5A Basin.
2. S-7 runoff is reduced to 231,000 acre-feet per year for Action Alternatives due to runoff no longer occurring from the project site.
3. S-7 total phosphorus load is reduced to 28.4 metric tons per year for the Action Alternatives due to runoff no longer occurring from the project site.

## 4.6.1 NO ACTION ALTERNATIVE

### 4.6.1.1 Project Site

Under the No Action Alternative, and if the area remains fallow, the water quality of the project site would likely remain as it is today as described in Section 3.6. The project site would continue to experience periods of dryout, which would lead to additional soil oxidation and release of nutrients upon rewetting. If the lands are converted back to active agriculture, it is expected that the stormwater runoff from the project site would likely contain relatively high levels of nutrients (mainly phosphorus and nitrogen from particulate matter and fertilizers) as with other agricultural lands in the EAA, though farming practices would follow best management practices in place for the area.

### 4.6.1.2 STA 3/4 and STA 2

Under the No Action Alternative, STA 2 and STA 3/4 would continue to receive peak stormwater flows and continue to experience dryout conditions that occur as a result of extreme hydrologic conditions that exist in south Florida. High flows resulting from storm events would likely continue to result in water depth durations that are longer and deeper than optimal, excessive hydraulic loading rates and phosphorus loading rates to the STAs, or diversion of untreated water around the STAs into the EPA. Extreme dry conditions would likely continue to result in periods of dryout causing additional soil oxidation and nutrient release. As a result, achievement of the WQBEL at discharges from both STAs would likely not occur. For the No Action Alternative, the outflow TP concentration for STA 2 (including Compartment B) is projected to be 13 ppb, based on the results of DMSTA modeling. This improvement, compared to the information provided in Section 3.6.2 (STA 2 historic outflow of 22 ppb, **Table 3-1**), is mainly due to the addition of 7,000 acres of treatment area (Compartment B) in 2012. The DMSTA-simulated outflow TP concentration of STA 3/4 is 18 ppb for the No Action Alternative, which is consistent with the information provided in Section 3.6.2. Under the No Action Alternative, the WQBEL would not be met at STA 3/4. **Table 4-8** provides DMSTA-simulated inflow and outflow volumes, inflow and outflow TP loads and inflow and outflow TP concentrations.

**Table 4-8** STA 3/4 and STA 2 Flows, TP Loads and TP Concentrations

| | Parameter | Alternative 1: No Action |
|---|---|---|
| STA 2 | Inflow Volume (acre-feet per year) | 301,000 |
| | Outflow Volume (acre-feet per year) | 307,000 |
| | Inflow TP Load (metric tons per year) | 46.2 |
| | Outflow TP Load (metric tons per year) | 4.6 |
| | Inflow TP Concentration (ppb) | 124 |
| | Outflow TP Concentration (ppb) [1] | 13 |
| STA 3/4 | Inflow Volume (acre-feet per year) | 504,000 |
| | Outflow Volume (acre-feet per year) | 495,000 |
| | Inflow TP Load (metric tons per year) | 62.0 |
| | Outflow TP Load (metric tons per year) | 11.2 |
| | Inflow TP Concentration (ppb) | 100 |
| | Outflow TP Concentration (ppb) [1] | 18 |

Notes:
1. Due to the uncertainty associated with DMSTA-simulated low level annual concentrations, annual values less than 12 ppb were replaced with a value of 12 ppb.

### 4.6.1.3 WCA 2A

Under the No Action Alternative, the water quality of WCA 2A would improve from the conditions described in Chapter 3, due to the phosphorus reductions that would occur with the additional 7,000 acres of treatment area at STA 2 (Compartment B). Compartment B construction was completed in December 2011 and was flow capable in April 2012. Water quality improvements at the STA 2 discharge may be seen as early as in Water Year (WY) 2012. **Table 4-9** provides the inflow volumes, inflow TP load and inflow TP concentrations for WCA 2A from STA 2 and STA 3/4 for the No Action Alternative.

**Table 4-9** WCA 2A Inflow Volumes, TP Loads and TP Concentrations from STA 2 and STA 3/4

| | Parameter | Alternative 1: No Action |
|---|---|---|
| WCA 2A | Inflow Volume (acre-feet per year) | 436,000 |
| | Inflow TP Load (metric tons per year) | 8.6 |
| | Inflow TP Concentration (ppb) | 16 |

### 4.6.1.4 WCA 3A

Failure to attain the WQBEL at the STA 3/4 discharge under the No Action Alternative is expected to result in the continued discharge of nutrient-laden waters and further degradation of water quality conditions in WCA 3A. **Table 4-10** provides inflow volumes, inflow TP load and inflow TP concentrations for WCA 3A from STA 3/4 for the No Action Alternative.

**Table 4-10** WCA 3A Inflow Volumes, TP Loads and TP Concentrations

| | Parameter | Alternative 1: No Action |
|---|---|---|
| WCA 3A | Inflow Volume (acre-feet per year) | 341,000 |
| | Inflow TP Load (metric tons per year) | 6.9 |
| | Inflow TP Concentration (ppb) | 17 |

### 4.6.1.5 Holey Land Wildlife Management Area

Under the No Action Alternative, the water quality of Holey Land would likely remain as it is today and as described in Chapter 3.

## 4.6.2 ACTION ALTERNATIVES

### 4.6.2.1 Project Site

Because the shallow FEB and the STA alternatives both operate by channeling water through shallow marshes, these two alternatives would reduce both TP loads and concentrations on the project site. The STA most efficiently removes the TP loads and concentrations as it would contain managed cells with both emergent and submerged wetland vegetation cells. The shallow FEB also provides benefits of phosphorus removal; however, its operation is not designed to optimize phosphorus removal on the project site. Therefore, the ability to remove phosphorus on the project site is limited for the Shallow FEB. The Deep FEB would not contain submerged or emergent wetland plant species that remove phosphorus and therefore, would not be expected to provide the reductions in phosphorus loads and concentrations that would be provided by the Shallow FEB and STA alternatives. A summary of DMSTA-simulated project site inflow and outflow volumes, inflow and outflow TP loads and inflow and outflow TP concentrations for all alternatives is provided in **Table 4-11**.

**Table 4-11** Project Site Flows, TP Loads and TP Concentrations

| Parameter | Alternative 1: No Action | Alternative 2: Shallow FEB | Alternative 3: Deep FEB | Alternative 4: STA |
|---|---|---|---|---|
| Inflow Volume (acre-feet per year) | NA | 274,000 | 336,000 | 252,000 |

| | | | | |
|---|---|---|---|---|
| Outflow Volume (acre-feet per year) | NA | 272,000 | 333,000 | 245,000 |
| Inflow TP Load (metric tons per year) | NA | 31.9 | 39.0 | 31.3 |
| Outflow TP Load (metric tons per year) | NA | 7.9 | 41.0 | 2.8 |
| Inflow TP Concentration (ppb) | NA | 94 | 94 | 100 |
| Outflow TP Concentration (ppb) [1] | NA | 44 | 100 | 12 |

Notes:
1. Due to the uncertainty associated with DMSTA-simulated low level annual concentrations, annual values less than 12 ppb were replaced with a value of 12 ppb.

#### 4.6.2.2 STA 2 and STA 3/4

A summary of STA 2 and STA 3/4 inflow and outflow volumes, inflow and outflow TP loads and inflow and outflow TP concentrations for all alternatives is shown in **Table 4-12**.

**Table 4-12**. STA 3/4 and STA 2 Flows, TP Loads and TP Concentrations

| | Parameter | Alternative 1: No Action | Alternative 2: Shallow FEB | Alternative 3: Deep FEB | Alternative 4: STA |
|---|---|---|---|---|---|
| STA 2 | Inflow Volume (acre-feet per year) | 301,000 | 387,000 | 386,000 | 253,000 |
| | Outflow Volume (acre-feet per year) | 307,000 | 391,000 | 389,000 | 259,000 |
| | Inflow TP Load (metric tons per year) | 46.2 | 53.2 | 57.1 | 40.6 |
| | Outflow TP Load (metric tons per year) | 4.6 | 6.0 | 5.5 | 3.4 |
| | Inflow TP Concentration (ppb) | 124 | 112 | 120 | 130 |
| | Outflow TP Concentration (ppb) [1] | 13 | 13 | 12 | 12 |
| STA 3/4 | Inflow Volume (acre-feet per year) | 504,000 | 401,000 | 407,000 | 275,000 |

| | | | | | |
|---|---|---|---|---|---|
| | Outflow Volume (acre-feet per year) | 495,000 | 392,000 | 397,000 | 269,000 |
| | Inflow TP Load (metric tons per year) | 62.0 | 29.4 | 52.1 | 34.1 |
| | Outflow TP Load (metric tons per year) | 11.2 | 5.6 | 5.6 | 3.5 |
| | Inflow TP Concentration (ppb) | 100 | 59 | 104 | 100 |
| | Outflow TP Concentration (ppb) [1] | 18 | 13 | 13 | 12 |

Notes:
1. Due to the uncertainty associated with DMSTA-simulated low level annual concentrations, annual values less than 12 ppb were replaced with a value of 12 ppb.

The project purpose is to meet the WQBEL in water at the STA 2 and STA 3/4 discharge points as it enters into the EPA. If the WQBEL is met at both STAs, and the STAs are able to adequately treat wet season flows, then future loading of excess phosphorus into the Everglades will be prevented. The WQBEL applied at the STA discharge is based on 13 ppb long-term as a flow weighted mean (which is equivalent to the 10 ppb long-term geometric mean criterion in the EPA marsh). The DMSTA modeling presented is interpreted against the objective of meeting the WQBEL: 13 ppb or below for STAs 2 and 3/4. With the addition of 7,000 acres of treatment area at STA 2 as a result of Compartment B, as modeled all four alternatives would meet the WQBEL at STA 2. However, the WQBEL is required to be met for both STA 2 and STA 3/4. All of the three Action Alternatives are projected to meet the WQBEL for both STAs.

#### 4.6.2.3 WCA 2A

A summary of WCA 2A inflow volumes, inflow and outflow TP loads and inflow and outflow TP concentrations for all Action Alternatives is shown in **Table 4-13**. For Alternative 2, the TP concentration of WCA 2A inflows decreases by 3 ppb and the TP load in WCA 2A inflows decreases by 1.4 metric tons per year (16 percent) when compared to the No Action Alternative. For Alternative 3, the TP concentration of WCA 2A inflows decreases by 4 ppb and the TP load of WCA 2A inflows decrease by 2.2 metric tons per year (26 percent) when compared to the No Action Alternative. For Alternative 4, the TP concentration of WCA 2A inflows also decreases by 4 ppb and the TP load of WCA 2A inflows decreases by 2.3 metric tons per year (27 percent) when compared to the No Action Alternative.

**Table 4-13**. WCA 2A Inflow Volumes, TP Loads and TP Concentrations

| | Parameter | Alternative 1: No Action | Alternative 2: Shallow FEB | Alternative 3: Deep FEB | Alternative 4: STA |
|---|---|---|---|---|---|
| WCA 2A | Inflow Volume (acre-feet per year) | 436,000 | 437,000 | 434,000 | 435,000 |
| | Inflow TP Load (metric tons per year) | 8.6 | 7.2 | 6.4 | 6.3 |
| | Inflow TP Concentration (ppb) | 16 | 13 | 12 | 12 |

**Notes:**
1. Due to the uncertainty associated with DMSTA-simulated low level annual concentrations, annual values less than 12 ppb were replaced with a value of 12 ppb.

### 4.6.2.4 WCA 3A

For all three Action Alternatives, the water quality of WCA 3A would improve as compared to the No Action Alternative, since the phosphorus concentration of WCA 3A inflows is reduced and STA 3/4 is projected to discharge at 13 ppb. **Table 4-14** provides a summary of WCA 3A inflow volumes, inflow and outflow TP loads and inflow and outflow TP concentrations from STA 3/4 for all alternatives. For Alternative 2, the TP concentration of WCA 3A inflows decreases by 5 ppb and the TP load of WCA 3A inflows decreases by 2.1 metric tons per year (30 percent) when compared to the No Action Alternative. For Alternative 3, the TP concentration of WCA 3A inflows also decreases by 5 ppb and the TP load of WCA 3A inflows decreases by 2.1 metric tons per year (30 percent) when compared to the No Action Alternative. For Alternative 4, the TP concentration of WCA 3A inflows also decreases by 5 ppb and the TP load of WCA 3A inflows decreases by 2.2 metric tons per year (32 percent) when compared to the No Action Alternative.

**Table 4-14**. WCA 3A Inflow Volumes, TP Loads and TP Concentrations from STA 3/4

| | Parameter | Alternative 1: No Action | Alternative 2: Shallow FEB | Alternative 3: Deep FEB | Alternative 4: STA |
|---|---|---|---|---|---|
| WCA 3A | Inflow Volume (acre-feet per year) | 341,000 | 321,000 | 327,000 | 318,000 |
| | Inflow TP Load (metric tons per year) | 6.9 | 4.8 | 4.8 | 4.7 |
| | Inflow TP Concentration (ppb) | 17 | 12 | 12 | 12 |

**Notes:**

1. Due to the uncertainty associated with DMSTA-simulated low level annual concentrations, annual values less than 12 ppb were replaced with a value of 12 ppb.

#### 4.6.2.5 Holey Land Wildlife Management Area

No water quality impacts to the Holey Land Wildlife Management Area are anticipated to occur for the Action Alternatives.

## 4.7 VEGETATION

### 4.7.1 GENERAL VEGETATION

#### 4.7.1.1 No Action Alternative

##### 4.7.1.1.1 Project Site

The vegetation at the site would continue to be dominated by weedy and invasive species. The 187 acres of higher quality depressional wetlands that were present in 2005 are now in a degraded condition with 90% nuisance and exotic species such as Elephant grass (*Pennisetum purpureum*) and castor bean. A continued expansion of these nuisance species and degradation of wetlands at the site would be expected if the site were to remain fallow. If agricultural activities would resume, the existing vegetation on the site would be replaced with agricultural plants (crop species such as sugar cane or sod farm).

##### 4.7.1.1.2 STA 2 and STA 3/4

Under the No Action Alternative, the vegetative community types in STA 2 and STA 3/4, which contains a mixture of EAV (*Typha* spp.) and SAV (*Chara* and *Najas*), would not change. Under the No Action alternative, impacts to vegetation resulting from increased hydraulic and nutrient loading rates and extended dry-out periods would occur as described in Section 3.7.2.

##### 4.7.1.1.3 WCA 2A and WCA 3A

It is anticipated the No Action Alternative would allow the nuisance cattail vegetation to continue to dominate and proliferate in the areas within the phosphorus enrichment gradients downstream of inflow points as described in Chapter 3. In WCA 2A, cattail coverage increased from 13,517 acres in 1991 to 23,010 acres in 1995 and to 29,178 acres in 2003 as determined by aerial imagery interpretation. In WCA 3, cattail coverage increased from 49,102 acres in 1995 to 79,936 acres in 2004. The aerial extent of cattail expansion may continue to increase; however with the recent expanded treatment area of STA 2, the rate of expansion in WCA 2A may be reduced. This is indicated by a prior vegetation mapping effort in which the average expansion was reduced from 2,375 acres per year during the first period to 771 acres per year for the second. In the vegetation transects of WCA 2A, for the past few water years, cattail has dominated the sites nearest the northern G-339 discharge point with a mixture of cattail and sawgrass at 0.6 miles (1 kilometer) downstream to sawgrass dominant sites 1.2 miles (2 kilometers) downstream or greater.

#### 4.7.1.1.4 Holey Land Wildlife Management Area

No change to the vegetation in community structure in the Holey Land is expected under the No Action Alternative.

### 4.7.1.2 Action Alternatives

#### 4.7.1.2.1 Project Site

**Alternative 2 (Shallow FEB)**

Hydrologic conditions at the site with the Shallow FEB, coupled with vegetation management, would favor the establishment of native marsh vegetation. The primary goal of vegetation management is to establish and maintain healthy EAV dominated communities, a community of plant species that have roots anchored to the bottom of the marsh and leaves that grow up through the water and emerge above the surface. The vegetative community structure that is anticipated within the A-1 Shallow FEB includes EAV with native plant species such as sawgrass (*Cladium jamaicense*), Carolina willow (*Salix caroliniana*), bulrush (*Scirpus californicus*), pickerel weed (*Pontederia cordata*), duck potato (*Sagittaria lancifollia*), muskgrass (*Chara* sp.), Illinois pondweed (*Potamogeton illinoensis*), coontail (*Ceratophyllum demersum*), and cattail (*Typha* spp.). The wetlands created would be protected from further development, managed to eliminate undesirable vegetation, and would provide improved functionality in perpetuity for the system. In addition, it is assumed in the DMSTA modeling that this EAV wetland vegetation would provide a greater phosphorus removal benefit than a Deep FEB.

**Alternative 3 (Deep FEB)**

Due to the variable hydrology of the Deep FEB (approximately 1 foot to 12 feet) and anticipated water depth above 4 feet for 30 percent of the time, it is not anticipated that this feature would support stable vegetative communities. The Deep FEB would act more like a reservoir due to the inability for a stable plant community to develop.

**Alternative 4 (STA)**

Under the STA alternative the project site would support vegetation similar to what is found in the existing STAs 2 and 3/4 with both EAV and SAV. The dominant SAV species include *Chara*, which is commonly called muskgrass, and *Najas*, which is water-nymph. The dominant EAV is cattail. Existing undesirable vegetation at the site would be replaced with vegetation similar to what is found in existing STAs as per the SFWMD planting guidelines for STAs.

## 4.7.1.2.2 STA 2 and STA 3/4

**Alternative 2 (Shallow FEB) and Alternative 3 (Deep FEB)**

With the Shallow and Deep FEB alternatives, the impacts to vegetation from heavy hydraulic loading rates and extended dry-out periods would be reduced. The FEB would attenuate stormwater runoff from the basins and deliver it in a more advantegous manner to STA 2 and STA 3/4. This steadier flow would help optimize the performance of the existing STAs.

**Alternative 4 (STA)**

The STA alternative would lessen impacts from heavy hydraulic loading rates, although to a lesser extent than either the proposed FEB alternatives. Extended dry-out periods with STAs 2 and 3/4 are anticipated to remain as described in Chapter 3 and the phosphorus removal efficiency of these STAs reduced as a result.

## 4.7.1.2.3 WCA 2A and WCA 3A

**Alternative 2 (Shallow FEB)**

The Shallow FEB showed reductions in phosphorus concentrations in inflows entering WCA 2A and WCA 3A from the EAA. The expected result is a reduction in cattail proliferation and expansion within the areas downstream of inflow point S-7 in WCA 2A, and inflow points from the S-11 spillways and S-8 and G-404 pump structures in WCA 3A. Also, open water areas may increase, providing habitat for the periphyton communities that are essential to the Everglades. These reductions represent an incremental step towards achieving the overall EPA marsh criterion of 10 ppb, which would help to restore the natural balance of native Everglades flora and fauna.

Changes to vegetation from the slightly altered hydroperiods in isolated areas of WCA 2A and WCA 3A are not anticipated. In WCA 2A, the RSM model predicted slightly greater hydroperiods (17 days longer) in sparse areas in northwest WCA 2A. In WCA 3A the RSM model predicted slightly shorter hydroperiods (14-30 days less) in already disturbed areas along a narrow stretch north of the Miami Canal in WCA 3A. Despite this slight decrease in hydroperiod, there is no difference in hydroperiod classes in this area between the no action and the shallow FEB.

Hydroperiod classes in the affected area range primarily from 240 to 300 days (8 to 10 months), followed by a few cells at 180 to 240 days (6 to 8 months), and two shorter hydroperiod cells at the very northeast portion of the affected area. An edge effect from the Miami Canal in this area is apparent and the majority of this area is already heavily impacted by cattails with shrubs.

**Alternative 3 (Deep FEB)**

Anticipated vegetative responses from reductions in phosphorus are equivalent to those described for the Shallow FEB alternative above. The RSM model predicted very minor changes in hydroperiod within WCA 3A and WCA 2A with the Deep FEB alternative. These slight decreases in hydroperiod (14 to 30 days) are located in the very northeast of the Miami Canal, an area that experiences an edge effect from the Miami Canal and the majority of which is already heavily impacted by cattails with shrubs. The very localized hydroperiod increases (15 to 18 days longer) in WCA 2A are not considered significant enough to shift vegetation in the area since this WCA is almost entirely already innundated for 300 or more days per year.

**Alternative 4 (STA)**

Anticipated vegetative responses from reductions in phosphorus are equivalent to those described for the Shallow FEB alternative above. There were no RSM modeled changes to hydroperiod or ponding depth with the STA alternative. There would however be a new upstream water demand to keep the STA hydrated which is not considered in the modeling effort or quantified.

### 4.7.1.2.4 Holey Land Wildlife Management Area

No impacts to vegetation within Holey Land would occur with Alternative 2 (Shallow FEB) and Alternative 3 (Deep FEB) since no changes to the vegetation community is proposed. Alternative 4 (STA) would cause direct impacts to vegetation in Holey Land to construct a conveyance discharge canal located within the Holey Land boundary adjacent to the project site along the northern portion of the east border of Holey Land. Alternative 4 would impact approximately 250 acres of wetlands withn Holey Land to construct the new discharge canal, which would allow treated discharges from the A-1 STA to be conveyed to the L-5 Canal. According to the 2005 Florida Natural Areas Inventory survey, this area is primarily a cattail monoculture wetland (SFWMD 2012- 2012 SFER Volume III Appendix 5-4).

## 4.7.2 WETLANDS

### 4.7.2.1 No Action Alternative

#### 4.7.2.1.1 Project site

Under the No Action Alternative there would be no additional discharges to waters of the United States, including wetlands; however, the wetlands would experience other effects. The A-1 project site would either remain in its existing condition or be utilized for agricultural purposes. If the site were to remain undisturbed, the vegetation at the site would continue to be dominated by weedy and invasive species. The 187 acres of true depressional wetlands that were present in 2005 are now in a degraded condition with 90% nuisance and exotic species such as Elephant grass (*Pennisetum purpureum)* and castor bean. A continued expansion of these undesirable species and degradation of wetlands at the site would be expected. If the agricultural activities would resume on the project site, the wetlands would be cleared of vegetation, and pumping would drain the water off of the lands. The existing wetland vegetation would be replaced with agricultural plants, such as sugar cane or sod.

#### 4.7.2.1.2 STA 2, STA 3/4, WCA 2A, WCA 3A, Holey Land

STA 2 and STA 3/4 would continue to be managed for either EAV or SAV and open water areas. Therefore, there no changes anticipated in the wetland vegetation within the STAs. Although the existing STAs provide phosphorus treatment to the WCAs, there would be a continued degradation to downstream wetlands and dense cattail areas expansion with the no action alternative due to the WQBEL not being met. Cattail is considered a high nutrient status species that is opportunistic and highly competitive, relative to sawgrass, in nutrient-enriched situations (Toth, 1988; Davis, 1991). This is demonstrated by Figure 3-15 in Section 3.7.3, which shows that cattail coverage increased 38% within WCA 3 from 1995 to 2004. Similar effects are anticipated for WCA 2. Several studies conducted within WCA 2A show that cattail out-compete sawgrass in their ability to absorb excess nutrients with increased cattail production during years of high nutrient inflows (Toth, 1988; Davis, 1991). Davis (1991) concluded that both sawgrass and cattail increased annual production in response to elevated nutrient concentrations, but that cattail differed in its ability to increase plant production during years of high nutrient supply. Therefore, continued input of phosphorus into the WCAs above the WQBEL is anticipated to continue to degrade wetland vegetation and increase cattail expansion.

### 4.7.2.2 Action Alternatives

### 4.7.2.2.1 Project site

**Alternative 2 (Shallow FEB)**

Construction of the Shallow FEB would fill and excavate 435.9 acres of wetlands and surface waters. Of the 435.9 acres of impacts, 280.1 acres of wetlands would be filled to construct the levee, 112.8 acres of waters of the U.S. would be filled to raise the elevation of canals and ditches to the adjacent wetland elevation, and 75.8 acres of canal would be excavated. The Shallow FEB would be operated at an average depth of 1.5 feet and the maximum depth is 4 feet. Emergent aquatic wetland vegetation is expected to be maintained or grow within the Shallow FEB. Therefore, approximately 10, 820.3 acres of wetlands will be inundated with water up, with maximum levels of four feet in depth after a severe storm event such as a hurricane or tropical storm.

The construction features causing permanent wetland impacts include interior and exterior perimeter levees, a collection canal and inflow and out flow structures. Wetland conditions would occur within the Shallow FEB after construction is complete and operation of the FEB begins.

**Alternative 3 (Deep FEB)**

Construction of a Deep FEB would result in 576.6 acres of unavoidable adverse impacts to wetlands and waters of the U.S. as a result of levee and canal fill, canal excavation, and excavation of freshwater wetlands. Of the 576.6 acres of impacts, 533.6 acres of wetlands would be filled to construct the levee and 43.0 acres of canal would be excavated. Alternative 3 would not require fill in canals or ditches. The Deep FEB would be operated at an average depth of six feet and the maximum depth is 12 feet. During times of deeper water depths, no rooted wetland vegetation is expected to be maintained or grow within the Deep FEB. During times when the inundation would be greater than four feet during parts of the year, emergent marsh habitat at the site would have a less optimal hydrology during those times when the water levels are greater than four feet. The remainder of time when water levels are below four feet, it is anticipated that either submerged aquatic or emergent marsh vegetation would be present. There would be about 10,820 acres of wetlands that would be flooded as a result of this alternative.

**Alternative 4 (STA)**

Construction of an STA would result in impacts to 986.4 acres of wetlands and waters of the United States to include 353.6 acres of fill to construct the levee, 112.8 acres of fill to raise the elevation of canals and ditches, 270 acres of canal excavation, and 250 acres of excavation and fill within Holey Land Wildlife Management Area. Wetland impacts within the Holey Land Wildlife Management Area are required to construct a new discharge canal to allow treated discharges from the A-1 STA to be conveyed to the L-5 Canal. Therefore, 125 acres of wetlands would be excavated to create the canal and 125 acres of wetlands would be filled to create the berms on either side of the canal. The STA would be operated at an average depth of 1.25 to 1.5 feet and the maximum depth is 4 feet. The impacts would be due to construction of interior and exterior levees, interior cell/flowway earthwork to bring areas to appropriate elevations and construction of internal and external water control structures. Emergent and submerged aquatic vegetation is expected to be maintained or grow within the STA. Similar to the shallow FEB, approximately 10,820 acres of wetlands will be inundated with water up to four feet.

##### 4.7.2.2.2 STA 2, STA 3/4, WCA 2A, WCA 3A, Holey Land

There are no impacts to downstream wetlands with any of the action alternatives. Improved water quality resulting from the action alternatives would slow the spread of nuisance cattail within these areas (especially the WCAs) causing an overall improvement in wetland conditions.

## 4.8 FISH AND WILDLIFE

### 4.8.1 OVERALL FISH AND WILDLIFE

#### 4.8.1.1 No action

##### 4.8.1.1.1 Project site

Under the No Action Alternative, no significant change would likely result to fish and wildlife populations on the project site if the site were to remain fallow. The project site would continue to provide habitat to wildlife utilizing the property. However, it is anticipated that exotic plant species would continue to encroach on the site. The increase in exotic plant species may reduce the wildlife utilization in the future as the dominance of exotic plant species as elephant grass and castor bean lowers the function and value of the wetlands. If the site were to return to agricultural use, the fish and wildlife populations on the site are expected to be reduced as the agricultural activities may disturb nesting and foraging.

##### 4.8.1.1.2 STA 2 and STA 3/4

Currently, the STAs provide high quality habitat for fish and wildlife species as described in Chapter 3. Under the No Action Alternative, the fish and wildlife habitat is expected to continue to support a wide variety of wading birds and other wildlife in the STAs.

#### 4.8.1.1.3 WCA 2A and WCA 3A

Colonial wading birds utilize the WCAs as both feeding and breeding habitat. The most common species utilizing the WCAs include the white ibis, great egrets, snowy egrets, cattle egrets, great blue herons, tricolored herons, little blue herons, green herons, black-crowned night herons, yellow-crowned night herons, wood storks, and glossy ibis, with populations varying widely in relationship to seasonal water level fluctuations. Current trends in water quality within the WCAs impact fish and other aquatic wildlife populations directly and indirectly by altering the vegetation, which affects foraging habitat of wetland dependent species. As nutrient loadings to surface water within the WCAs decrease, water quality should continue to improve. Under the No Action Alternative it is expected that STA discharges would not meet the WQBEL and water quality and the aquatic habitat within the WCAs would continue to decline.

#### 4.8.1.1.4 Holey Land Wildlife Management Area

Similar to WCAs, Holey Land provides aquatic habitat to a wide variety of fish and wildlife species. Under the No Action Alternative, the wildlife species use is not expected to change in the Holey Land.

### 4.8.1.2 Action Alternatives

#### 4.8.1.2.1 Project Site

Construction of a Shallow FEB and an STA would improve the fish and wildlife usage on the project site. The site conditions would change from low quality wetlands with several areas containing a dominance of exotic plant species to a wetland containing native plant species and depths of water up to four feet. Exotic plant species would be removed and the site maintained in perpetuity. Existing STAs are evidence that water depth up to four feet in the impoundment provides abundant habitat for a diverse array of wildlife species.

Although the Deep FEB would provide more aquatic habitat than the existing site conditions, the Deep FEB would provide less functional aquatic habitat than the Shallow FEB or STA. Many of the wading birds require shallow water depths to capture prey fish that utilize emergent vegetation. The deeper water depths of the Deep FEB would preclude emergent vegetation from establishing and foraging habitat for the shallow water dependent species, which include several State-listed birds, such as the Florida sandhill crane, limpkin, snowy egret, little blue heron, tricolored heron, white ibis, and roseate spoonbill.

#### 4.8.1.2.2 STA 2 and STA 3/4

The Shallow and Seep FEB alternatives would improve fish and wildlife habitat as the FEBs would operate in a manner as to avoid dryout in the STAs. The STAs would maintain a more steady state of water depths as the FEBs would provide water when the STAs require. In addition, there would be less impact to nesting birds in the STAs with the two FEB alternatives. As described in Section 3.8.3.1, the STAs contain habitat for several State-listed birds, such as the Florida sandhill crane, limpkin, snowy egret, little blue heron, tricolored heron, white ibis, and roseate spoonbill. In addition, the Florida burrowing owl, the least tern, and black necked stilts are known to nest within or near the STAs. Per email from Florida Department of Environmental Protection (FDEP) on April 23, 2013, the reddish egret is not expected to utilize the STAs. Currently, if the STAs dry out, these birds could nest in the dry lands. As the areas are re-flooded, there is the potential for the sudden increases in water depths to flood the nesting birds. The FEB alternatives would assist the STA and avoid dryouts.

There would be no change to wildlife usage in STA 2 and STA 3/4 if the STA Alternative were constructed.

#### 4.8.1.2.3 WCA 2A and WCA 3A

Overall wildlife habitat benefits are expected to occur in WCA 2A and WCA 3A with the construction of the Action Alternatives. Specifically, improved water quality within STA 2 and STA 3/4 would decrease the phosphorus loading entering into the WCAs, which would help to restore the vegetation communities within the WCAs over the long-term. Currently, annual average flow-weighted TP concentrations in WCA 2A and WCA 3A for water year 2011 are 18 and 20 ppb, respectively (SFWMD, 2011, Chapter 3A.). As seen in WCA 2A, increased TP loads entering the WCA have contributed to dense monotypic stands of cattail vegetation at the areas where water enters the WCA. The monotypic and dense growth patterns of invasive vegetation support less diverse fish and wildlife than native vegetation. Less dense vegetation can establish more ideal foraging habitat for many predatory bird and fish species by providing greater access to prey. This in turn can make WCAs more ideal nesting locations. Therefore, a reduction in TP entering the WCAs would likely improve foraging and nesting habitat for fish and wildlife species.

#### 4.8.1.2.4 Holey Land Wildlife Management Area

The construction of the Shallow FEB or the Deep FEB is not expected to affect wildlife usage in the Holey Land since the FEB Alternatives would have no effect on the water entering the Holey Land. With the STA Alternative, a conveyance discharge canal would be constructed within the

Northern portion of the eastern boundary of the Holey Land. The area is currently cattail, but would be converted to a canal. Therefore, the construction of the STA would convert a portion of cattail wetlands to a canal with floating aquatic vegetation, which would impact the species currently utilizing the cattail marsh.

### 4.8.2 FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES

The following sections document potential impacts to federally-listed threatened and endangered species, species of special concern (SSC), and designated critical habitat that could occur from the No Action Alternative and Action Alternatives 2, 3, and 4. The impact analysis includes listed species that have the potential to occur within the project footprint, the STAs directly affected by the proposed project (STA 2 and STA 3/4), and the downstream secondary project-affected regions (WCA 2A and WCA 3A).

Direct impacts are defined as impacts that occur within the footprints of the proposed project site during or as a direct result of construction and operation activities. Indirect impacts are defined as impacts that occur outside of the footprints of the proposed project but are still within the affected regions, or that occur within the footprints of the downstream STAs and WCAs. Due to the potential for adverse impacts to fish and wildlife, in particular threatened or endangered species and their habitat, the operational and monitoring plans for the proposed project are of particular importance to USFWS.

The Action Alternatives provide the opportunity for minor to major changes in the hydropatterns of the WCAs dependent upon the ability to provide improved treatment capacity of STA 2 and STA 3/4. With the No Action Alternative, a regional trend towards improvements in water quality, quantity, and timing may occur from planned restoration projects in the Everglades. Overall, this is anticipated to improve habitat within the project primary and secondary affected regions as defined in Chapter 3. The Proposed Action (Alternative 2, Shallow FEB) is expected to further increase these improvements. The extent of the enhancements with the No Action and Action Alternatives would depend on the manner in, and extent to which, the treatment capacity provided by existing and anticipated features is used in the context of other regional water management infrastructure and system operations made possible by the presence of any additional treatment or storage capacity.

The Proposed Action is not intended to propose, direct, or otherwise mandate specific changes in Central and Southern Florida (C&SF) System project operations identified in existing operations manuals (i.e., Lake Okeechobee Regulation Schedule or WCA Regulation Schedule), as determined in the future for restoration-related purposes. The effects on listed species discussed below are based on wildlife surveys, field observations, literature, reasonable scientific judgment, SFWMM, DMSTA, and SSDM results.

The USACE is currently preparing a separate biological assessment (BA) in accordance with Section 7(c) of the Endangered Species Act comparing the construction and operation of the A-1 Shallow FEB as described in the applicant's preferred alternative (Alternative 2) to the existing conditions in the affected regions. This BA also provides the USACE's final effects determination for listed species and critical habitat, and will be included as an Appendix in the final EIS. The BA evaluated the effects by comparing the Applicant's Preferred Alternative (Alternative 2) to the No Action Alternative (Alternative 1).

#### 4.8.2.1 American alligator

The American alligator is found within freshwater and brackish aquatic habitats in south Florida. American alligators were not observed on the A-1 project site during the field visits to the site, but are commonly found in and on canal banks within the EAA. Although the American alligator is not actually threatened or endangered it is listed due to the similarity in appearance to the threatened American crocodile. No consultation is required for the alligator.

#### 4.8.2.2 Eastern indigo snake

Upland and dry habitats (flatwoods, dry prairies, tropical hardwood hammocks, and coastal dunes) are the preferred habitats of eastern indigo snakes (USFWS 1999). While drier, upland habitat is limited in the project-affected regions, these species may also forage along the edges of freshwater marshes and in agricultural fields and along their banks within the EAA. This species also utilizes gopher tortoise burrows, so potential gopher tortoise habitat was considered in determining potential effects of the Action Alternatives on the eastern indigo snake. In addition to gopher tortoise burrows, the eastern indigo snakes use natural and man-made holes and burrows for refugia. Eastern indigo snakes were found on the project site during construction activities for the A-1 Reservoir.

##### 4.8.2.2.1 No Action

No direct impact on the eastern indigo snake is expected with the No Action Alternative. The site would either remain undisturbed or agricultural activities could resume. If agricultural activities continue on the site, approximately 10,820.3 acres of wetlands within the A-1 project site would remain undisturbed or be utilized for agriculture. The Eastern indigo snakes use agricultural fields as habitat and depending on the particular type of agricultural use, these areas may provide habitat that support a higher density of snakes found in natural upland habitat.

Indirect impacts could be attributed to soil subsidence. Wetter conditions are expected in the EAA by 2050 because of soil subsistence. Subsidence could therefore cause conditions in the EAA to be less favorable for the eastern indigo snake, which prefers drier, upland habitats. However, eastern indigo snakes may still utilize these areas as habitat.

## 4.8.2.2.2 Action Alternatives

Action Alternatives 2, 3, and 4 are anticipated to have a direct impact on the eastern indigo snake. Construction of the Action Alternatives would result in the conversion of 10,820.3 acres of wetlands to an above ground impoundment containing either 4 feet of water or 12 feet of water. Disturbed wetlands may be used by eastern indigo snakes, but are not preferred habitat. The eastern indigo snakes may forage along the edges of the FEBs or the STA during drier periods, but conditions within the impoundments would generally not be suitable because these areas would be permanently inundated.

Construction activities may also result in eastern indigo snakes leaving the area, abandoning den sites, and possibly losing foraging and mating opportunities. In addition, construction activities associated with the earth-moving equipment may increase the likelihood of Eastern indigo snakes being adversely impacted. Heavy machinery, which would be re-contouring ground levels, removing and relocating berms, and constructing roads, may unearth eastern indigo snakes and cause inadvertent impacts to occur. The applicant would require the construction workers to be aware of the eastern indigo snake and its habitat, and be informed how to identify the snake if found. The eastern Indigo Snake Construction Precautions would be required to be adhered during all construction activities.

Indirect impacts from the Action Alternatives to the eastern indigo snake could occur with all Action Alternatives from increased traffic and post construction activities. Increased traffic could increase the likelihood of direct mortality along roads in the area. The post-construction activities associated with the proposed FEBs and the STA that may cause impacts to the eastern indigo snake include maintenance of the roads, levees, pump stations, and cells (including vegetation management methods such as mowing, herbicide application, and physical removal). In addition, indirect impacts may occur to the eastern indigo snake due to the potential inundation of snake habitat during rehydration of the cells in the event the cells become dry after initial flooding. Protective measures alerting the contractor of the potential presence of this species and its protected status would also be used during the construction to avoid direct takes of the species. Indirect effects from changing the water elevations in downstream areas (STA 2, STA 3/4, WCA 2A, and WCA 3A) are not anticipated to cause an unacceptable adverse effect to the eastern indigo snake as.

#### 4.8.2.3 Audubon's crested caracara

The Audubon's crested caracara nests primarily in cabbage palm trees and forages in vegetated areas less than one-foot in height. The USFWS Standard Local Operating Procedures for Endangered Species (SLOPES) defines the primary protection zone for this species as 985 feet outward from a nesting tree. The secondary zone is 6,600 feet outward from an active nesting tree. The project site is located within a USFWS consultation area for the crested caracara; however, no juvenile gathering areas are located within these areas. During field surveys, no Audubon's crested caracaras were observed on the project site. In addition, there are no cabbage palm trees located on the project site.

##### 4.8.2.3.1 No Action

No direct or indirect impacts to caracara are anticipated under the No Action Alternative. Caracaras prefer dry and wet prairies with scattered cabbage palms but have adapted well to improved pasture (USFWS 2004). Although the existing vegetative communities within the project site may provide some foraging habitat for caracara, it is primarily fallow cropland with taller, woody vegetation that is not preferred for foraging as the current vegetative coverage is greater than 1 foot in height. The vegetative communities would remain as is (no effect) or would return to active agriculture (moderately improved foraging habitat).

##### 4.8.2.3.2 Action Alternatives

No direct impacts to caracara are anticipated with construction of Alternatives 2, 3, and 4. The exotic vegetation in the wetlands is above 1 foot high and thereby does not provide suitable foraging habitat. The Audubon's crested caracara generally does not forage in vegetation greater than 1 foot in height.

The project site is located within a USFWS consultation area for the crested caracara but outside known juvenile gathering areas. The Species Conservation Guidelines for Crested Caracara (USFWS 2004) state that no effect from the project is anticipated on the caracara if on-site surveys of suitable habitat within the consultation area do not detect caracara nests. The site does not contain palm trees; therefore, the site is not expected to provide suitable nesting activity. No known nest sites are located within 6,600 feet of the project site.

Indirect impacts from the Action Alternatives to the caracara include an increase in traffic volume and changes to downstream habitats. Caracaras frequently prey on wildlife struck by vehicles. An increase in traffic would likely increase road kills, thereby increasing the risk of caracaras being struck by vehicles while preying on dead animal carcasses. However, the increase in traffic is expected to be minimal.

There would be no effects to the Audubon's crested caracara within the STA 2 and STA 3/4 as the STAs so not provide suitable foraging habitat. Alternatives 2, 3, and 4 would improve water quality in WCA 2A and WCA-3A by reducing phosphorus loads and concentrations, thereby maintaining the existing crested caracara foraging habitat by decreasing the rate of cattail expansion and that of other invasive plants. The indirect effect on the caracara would be that native wet prairie vegetation used for foraging would remain for a greater period of time.

The increases in water levels within WCA 2A and WCA 3A are minor. For alternative 2, WCA 2A would experience hydroperiod to extend 17 days longer per year than the No Action Alternative, 15-18 day longer for Alternative 3, and no change in Alternative 4. For WCA 3A, the hydroperiod would be 14-30 days shorter per year for Alternatives 2 and 3, and no change to the hydroperiod for Alternative 4. Therefore, access to prey availability would not change in the WCAs.

No changes in the Holey Lands are expected to occur as a result of Alternatives 2 and 3; therefore, they would have no effect on the Audubon's crested caracara. Construction of Alternative 4 (STA) would convert cattail wetland to a canal. Since the wetlands are not foraging habitat, the construction of the STA would also have no effect on the caracara.

#### 4.8.2.4 Everglade snail kite

The project site, STA 2, STA 3/4, WCA-2A, WCA-3A, and the Holey Land are all within USFWS consultation area for the Everglade snail kite. In addition, WCA- 2A and WCA 3A are located within designated critical habitat for the Everglade snail kite. Everglade snail kite nesting or foraging was not observed on the project site.

In Florida, Everglade snail kites forage almost exclusively on apple snails that are found in freshwater marshes and shallow vegetated littoral zones of lakes. Therefore, this evaluation focuses on both potential impacts to the snail kite itself and the apple snail, its most important prey item.

### 4.8.2.4.1 No Action

No direct impacts to snail kites, apple snails, or designated snail kite critical habitat would be expected with the No Action Alternative. Marsh and scrub wetlands on the project site may be converted back to agricultural lands. Although apple snail populations may occur within remnant natural wetlands, ditches, and canals, no apple snail egg casings were observed in the surveys on the project site, which indicates it is unlikely that Everglade snail kite currently use this area for foraging.

### 4.8.2.4.2 Action Alternatives

The potential for direct impacts to snail kites exists from construction of Alternatives 2, 3, and 4. With these alternatives, approximately 10,820.3 acres of freshwater wetlands and waters of the United States would be converted to aquatic habitats containing a variety of EAV, SAV, and/or FAV plant species. Relatively clear and open marshes and littoral zones with low-profile marshes (10 feet or less in depth) are ideal foraging habitat for the Everglade snail kite (USFWS 1999). Therefore, the construction of the deep FEB would offer the least benefits to the snail kite. The wetland systems that would be created as a result of the shallow FEB and the STA would provide better habitat for apple snails and the Everglades snail kite. During normal operations, the SAV and EAV cells would be operated at target depths of less than 4 feet of water, which is suitable foraging habitat for the snail kite.

Indirect impacts from the Action Alternatives would likely vary by alternative and include increased traffic levels as well as changes in hydrology and vegetation in affected regions, primarily the WCAs. The three main parameters considered in the evaluation of potential indirect impacts with the Action Alternatives are traffic, the cycle and duration of dry-down events, and changes in vegetation, each of which are described below.

Traffic: Increased traffic could result in a higher risk of direct mortality. Even though snail kites do not typically forage along roadways, they have been often observed foraging along levees in stormwater treatment areas. Slower traffic would not be expected to cause an unacceptable adverse effect since snail kites can easily avoid slower moving vehicles. Snail kites have been known to nest near levee roads. These nests are typically easy to identify and traffic restriction can be applied to limit nest disturbance.

Dry Down Events: Apple snails need EAV to thrive. Both apple snail and snail kite population success are directly affected by depth and duration of marsh flooding (Johnson et al. 2007). The following are the hydrologic parameters/criteria that were considered in evaluating potential impacts to snail kites and apple snails:

• Dry-down periods with a 1- to 2-month period were considered optimal for apple snails, while greater than a 2-month dry-down was considered unfavorable;

• A dry-down period between March and April was considered unfavorable as this time period was documented by Darby (1997, 2003) to be a peak in apple snail egg cluster production;

• Dry-down events occurring in a 3- to 5-year cycle were considered optimum snail kite habitat; and

• Dry-down events occurring in a 2- to 3-year cycle (slightly drier than optimum) or occurring in a 5- to 6-year cycle (slightly wetter than optimum) were considered marginal snail kite habitat.

Alternatives 2 (Shallow FEB) and Alternative 3 (Deep FEB) are designed to minimize the dry-down events in the STAs (STA 2 and STA 3/4) so the FEBs would improve conditions for the Everglades snail kites utilizing the STAs. Alternative 3 (STA) offers the least amount of benefits within STA 2 and STA 3/4 since the intent of the proposed STA would not operate to prevent dry-downs events.

Changes in the water levels within WCA 2A and WCA 3A are minor. As compared to the No Action Alternative, the hydroperiod within WCA 2A would experience wet conditions 17 days longer per year with Alternative 2, 15-18 day longer for Alternative 3, and no change in Alternative 4. Alternatives 2 and 3 would benefit the Everglades snail kite, while Alternative 4 would not cause any additional impacts. For WCA 3A, the hydroperiod would be 14-30 days shorter per year for Alternatives 2 and 3, and no change to the hydroperiod for Alternative 4. Therefore, Alternatives 2 and 3 (the FEB alternatives) would reduce the available foraging areas slightly while Alternative 4 would have no change.

Vegetation: Because the Action Alternatives would decreases phosphorus loads and concentrations within the WCAs, all of the alternatives would not contribute to the cattail expansion within the WCAs. By meeting the water quality criteria for phosphorus in the EPA, improvements to the Everglades snail kite foraging habitat are anticipated. Everglade snail kites forage by either still-hunting from a perch or by flying above the water surface and visually locating prey. Relatively clear and open marshes and littoral zones with low profile marshes (3 meters or less in depth) and shallow open water are ideal foraging habitat for the Everglade snail kite (USFWS 1999). Increased levels of phosphorus in Lake Okeechobee and the Everglades have resulted in dense stands of emergent invasive vegetation that has replaced the foraging habitat for the Everglade snail kite. A decrease in cattail coverage is considered beneficial to the Everglade snail kite and its designated critical habitat.

#### 4.8.2.5 Wood Stork

Wood stork foraging and nesting habitat occurs on the project site, STAs 2 and 3/4, and WCAs 2A and 3A. Wood storks were observed on the project site.

##### 4.8.2.5.1 No Action

Direct impacts from the No Action Alternative include decreasing the amount of preferred aquatic foraging habitat for wood storks from the conversion of 10,820.3 acres of freshwater wetlands to active agriculture. Atypical sod and sugar cane fields would still provide foraging habitat, but would be of a lower quality than the freshwater marsh and wetland scrub habitat that exists there currently.

Indirect impacts are not anticipated under the No Action Alternative. STA 2 and 3/4 are intended to be operated under their current operational plans and discharges into WCA 2A and WCA 3A would continue.

##### 4.8.2.5.2 Action Alternatives

Anticipated direct impacts from construction of the Shallow FEB and STA would likely increase the preferred aquatic foraging habitat available to the wood stork from the conversion of 10,820.3 acres of low quality wetlands to flooded cells with EAV and SAV, which may include areas over open water and appropriate water depths for foraging. This conversion would result in beneficial effects for wood storks by replacing lower-quality foraging habitat with higher quality shallow, inundated wetlands. Existing agricultural canals and ponds within the project site would be filled to create wetland habitat, but deeper canals (conveyance and collector canals) would continue to be in use and available to the wood stork. The construction of the Deep FEB would not provide wood stork foraging habitat as the water depths are too deep to support foraging (over 18-inches of water depths).

Indirect impacts from the Action Alternatives would likely occur and would include impacts associated with changes to hydrology and vegetation in affected regions from altered hydroperiods and phosphorus levels. Overall regional improvements to foraging and nesting habitat, as a result of improved vegetative communities and fish and wildlife habitat are anticipated. However, effects within the STAs may vary for the Action Alternatives.

The FEB alternatives (Alternatives 2 and 3) would reduce the frequency of dry-downs within STA2 and STA 3/4. Therefore, the FEBs would improve wood stork foraging habitat within the STAs. Alternative 4 (STA) would not operate to reduce the potential for dry-downs within the existing STAs; therefore, Alternative 4 would have no effect on the wood stork foraging habitat within STAs 2 and 3/4.

An overall anticipated regional trend toward restored water quality is expected to improve vegetative communities, water quality, and fish and wildlife habitat in WCA 2A and WCA 3A. It is anticipated that this improvement would likewise enhance wood stork foraging habitat and access to prey items in these areas. Wood storks typically forage in water depths 18 inches or shallower. The Action Alternatives would not change the average high and low water levels during the wet or dry seasons to be either deeper or shallower than 18 inches compared to existing conditions.

### 4.8.2.6 Florida panther

Panther telemetry data from 1981 to 2005 show panthers in the EAA, including areas directly adjacent to the project site and in WCA 3A (USFWS 2006). Figure 3-14 describes Panther telemetry data from 1997 through 2006 (URS 2007c) while Figure 3-15 indicates recent occurrences in the area (FWS database). Panthers may hunt on the project site, but it is unlikely that they would use these areas for any extended length of time because of the lack of suitable long-term panther habitat (URS 2007). Panthers were not observed on the project site during the field surveys.

#### 4.8.2.6.1 No Action

No anticipated direct impacts in the form of mortality, injury, or loss of habitat to the Florida panther would occur with active agriculture resuming on the project site because the project site is not considered preferred habitat for the Florida panther. Although panthers may traverse through the project site, they are not expected to use these areas for an extended period because of a lack of suitable, long-term habitat. Conversion of wetlands to active agriculture would reduce suitable habitat for feral hogs and white-tailed deer, two prey items for the panther. Although this habitat is not ideal for panther foraging, this conversion would decrease the hunting ability of the panther within the A-1 project site and would result in an indirect effect through decreased prey availability.

#### 4.8.2.6.2 Action Alternatives

Direct impacts to panthers from the construction of Alternatives 2, 3, and 4 would likely occur from conversion of 10,820.3 acres of freshwater wetlands to deeper water wetland areas with EAV and SAV, thereby reducing potential ranging, resting, and foraging habitat on the A-1 project site. In addition to becoming permanently inundated, the build-out areas would not be as accessible to the Florida panther because of the network of canals and ditches, leading panthers to travel longer distances to cross these portions of the EAA. Nevertheless, panthers would still be able to traverse through these lands or use them for resting after they are converted to the Shallow FEB or STA, but would not be able to utilize the land if they are converted to the Deep FEB. All Action Alternatives would reduce potential habitat for feral hogs and white-tailed deer in on the project site, two prey items for the panther. Although this habitat is not ideal for panther foraging, the conversion could decrease the hunting ability of the panther, resulting in an indirect impact similar to the No Action Alternative. In addition, construction of the build-out areas would contribute to the cumulative effect of other Comprehensive Everglades Restoration Plan (CERP) and large-scale environmental restoration projects, causing panthers to travel longer distances through portions of the EAA.

Indirect impacts on panthers include increased traffic levels, increased noise disturbance and reduction in value of panther habitat adjacent to the project due to habitat fragmentation. In past years, several road kills have occurred on CR 835/833 as a result of vehicles entering in and off the project boundaries. However, the project construction would result in increased traffic consisting of heavy equipment and employee vehicles. All vehicles would be required to obey posted speed limits for off road and for improved road travel. Impacts associated with construction traffic would be localized due to construction occurring in phases such that panthers can avoid the areas that are under construction. Additionally, all entrances would be secured with gates to control access. Noise levels would also be localized as the different phases are under construction.

With Alternatives 2, 3, and 4, slight changes to the hydrological conditions in WCA 2A and WCA 3A are anticipated, but these changes are not anticipated to impact the Florida panther. The project site is not located within the primary or secondary zone of the Florida panther, but is located within the consultation areas. Indirect impacts are also not anticipated in the Holey Lands.

## 4.8.3 STATE LISTED THREATENED OR ENDANGERED SPECIES

### 4.8.3.1 No Action Alternative

The current site conditions do not support habitat for the Gopher tortoise (*Gopherus polyphemus*), Florida gopher frog (*Rana areolata aseopus*) or the Florida mouse (*Podomys floridanus*) as these species prefer a dry, xeric upland habitats. The agricultural fields may currently provide nesting and foraging habitat for the Florida burrowing owl (*Athene cunicularia floridana*) as they nest in agricultural areas. There would be no change to any state listed threatened or endangered species on the project site under the No Action Alternative.

### 4.8.3.2 Action Alternatives

The Shallow FEB and STA alternative would improve foraging and nesting habitat for the state listed wading birds. When water levels are greater than 4-feet in depth, the Deep FEB would not provide foraging or nesting habitat as water levels are too deep for even long-legged species of birds. All of the Action Alternatives would provide foraging habitat for the black skimmer (*Rynchops niger*); however the Shallow FEB and the STA alternatives may also provide areas of nesting. The levees in all of the Action Alternatives would provide nesting habitat for the burrowing owl as they nest in the ground in areas with little understory vegetation. Additionally, the levees would provide ground nesting habitat for least tern colonies. Each of the Action Alternatives would not provide habitat for the Gopher tortoise, gopher frog, and the Florida mouse, as site conditions would be too wet. Prior to and during construction activities, the SFWMD will conduct wildlife surveys to include both federal and state-listed species to document the wildlife utilizing the site. The SFWMD will notify the Florida Fish and Wildlife Conservation Commission if any burrowing owls are detected during construction activities.

## 4.8.4 MIGRATORY BIRDS

Migratory birds are expected to utilize the A-1 project site, in particular black-necked stilts (*Himantopus mexicanus*), least terns, killdeer (*Charadrius vociferus*), and burrowing owls . An Avian Protection Plan (APP) is a voluntary set of guidelines to reduce impacts to nesting migratory birds as a result of flooding. In the event that conditions become favorable for nesting, the Avian Protection Plan for Black-necked Stilts and Burrowing Owls Nesting in the Everglades Agricultural Area Stormwater Treatment Areas will be implemented for Alternative 4 (STA) (SFWMD 2008). For the STA alternative, an APP plan is appropriate as they are less dense and potentially open water areas within the SAV cells. These typical STA conditions are more conducive to ground nesters. This will not be the case for the shallow FEB alternative which is anticipated to remain more densely vegetated once the project is complete. Due to the uncertainty of whether ground nesters currently or in the future will utilize the A-1 project site for nesting, the SFWMD does not recommend implementing an APP at this time for the FEB Alternatives, as this will significantly impact operational intent and flexibility of the facility.

The SFWMD is proposing to conduct its standard Endangered Species Act and Migratory Bird Treaty Act training prior to construction and monitor for black-neck stilts, burrowing owls and other ground nesting birds during construction and the two-year period in which the facility will be undergoing operational testing and monitoring. During the two-year period when the facility is in operational testing, surveys will be conducted regularly to confirm presence or absence of black-neck stilts and burrowing owls. If ground nesting birds are detected the SFWMD will coordinate with USFWS.

## 4.9 CULTURAL, HISTORIC AND ARCHEOLOGICAL RESOURCES

Historic properties may be determined to be eligible to the National Register of Historic Places (NRHP) if it meets at least one of the four following criteria:

A) That are associated with events that have made a significant contribution to the broad patterns of our history; or
B) That are associated with the lives of a person significant in our past; or
C) That embody distinctive characteristics of a type, period, or method of construction, or that represents the work of a master, or that posses high artistic value, or represent a significant and distinguishable entry whose components may lack individual distinction; or
D) That has yielded, or may be likely to yield, information important in prehistory or history.

Historic properties may also be determined to be eligible based on "traditionally" cultural significance, or TCPs, which incorporates abstract believes and customs, and practices of a living community that have been passed down through generations,

Adverse effects to cultural resources include but not limited to altering, directly or indirectly, any of the characteristics that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the properties location, design, setting, materials, workmanship, feeling, or association. Examples of adverse effects are physical damage or destruction, modification to the setting, or alteration of the integrity and character of the physical or abstract features, and/or criteria that contribute to its historic significance.

### 4.9.1 NO ACTION ALTERNATIVE

#### 4.9.1.1 Project site

There would be no impacts to cultural, historic, and archeological resources with the No Action Alternative.

### 4.9.2 ACTION ALTERNATIVES

#### 4.9.2.1 Project site

Construction and operation of the action alterative (Shallow FEB, Deep FEB, and STA) would have no effect on cultural resources on the A-1 project site. The property has been previously impacted by long term agricultural practices and road and canal construction, resulting in a highly disturbed landscape. The A-1 site has been the subject of multiple investigations to determine the presence of cultural, historical and archeological resources. In 2002, the SHPO concurred that the A-1 project site does not require any additional cultural resource investigations since no cultural resource sites were encountered and the site has been heavily affected by sugar cane and sod cultivation practices. The most recent Phase I Cultural Resource Assessment Survey (CRAS) was conducted in July 2012 by the State Bureau of Archaeological Research (BAR) on behalf of the SFWMD. No sites eligible or potentially eligible to the NRHP were found in the project area. The CRAS conclusions recommended no further archaeological work at the A-1 property at this time. (*A Cultural Resource Assessment Survey of the EAA A-1 Property*, Palm Beach County, Florida, Bureau of Archeological Research, Division of Historical Resources, Department of State, State of Florida, September 2012). By letter dated March 7, 2013, SHPO stated that it is unlikely that any historic or archaeological resources will be adversely impacted by the proposed project.

#### 4.9.2.2 Downstream areas

There are no known cultural resources within STA 2, STA 3/4, and WCA 2A. Therefore, there would be no effect on historic properties or cultural resources within these areas.

WCA 2B contains three (3) potential cultural resource sites, one of which is potentially eligible to be listed on the National Register of Historic Places, while WCA 3A and 3B contains 109 reported archaeological sites. Currently discussed in Chapter 3, these sites have not had extensive surveys and very little archaeological work has been done to understand how operational changes affect cultural resources within the WCAs. Until further analysis is completed on the effects of changing water levels within the WCAs, the USACE can only base our determination on the premise that if such impacts associated with changes to the hydrologic pattern have already impacted resources in the WCAs, then current proposed changes would have no effect on historic properties since the changes to inflows into the WCAs as a result of Alternatives 2, 3, and 4 are within the historical variation of water depths and durations for these areas. Therefore, none of the Action Alternatives would adversely affect cultural resources within WCA 2B, WCA 3A, and WCA 3B. In addition, the Action Alternatives would not diminish, modify, or alter the Everglades Restoration Transition Plan Human Remains Policy and Programmatic Agreement. However, until additional surveys are conducted within the WCAs, little will be known about the effects of changing water levels on the cultural resources in the area.

The creation of conveyance features associated with Alternative 4 (STA), which would convey STA outflows to the L-5 Canal for distribution to WCA 2A and 3A, would impact wetland areas within the Holey Land. There are no known cultural resource sites within Holey Land. Because earth disturbing activities would occur within Holey Land for Alternative 4 (STA), a CRAS would need to be conducted within the Holey Land to determine whether there are any eligible sites for inclusion in the NRHP.

## 4.10 TRIBAL RIGHTS

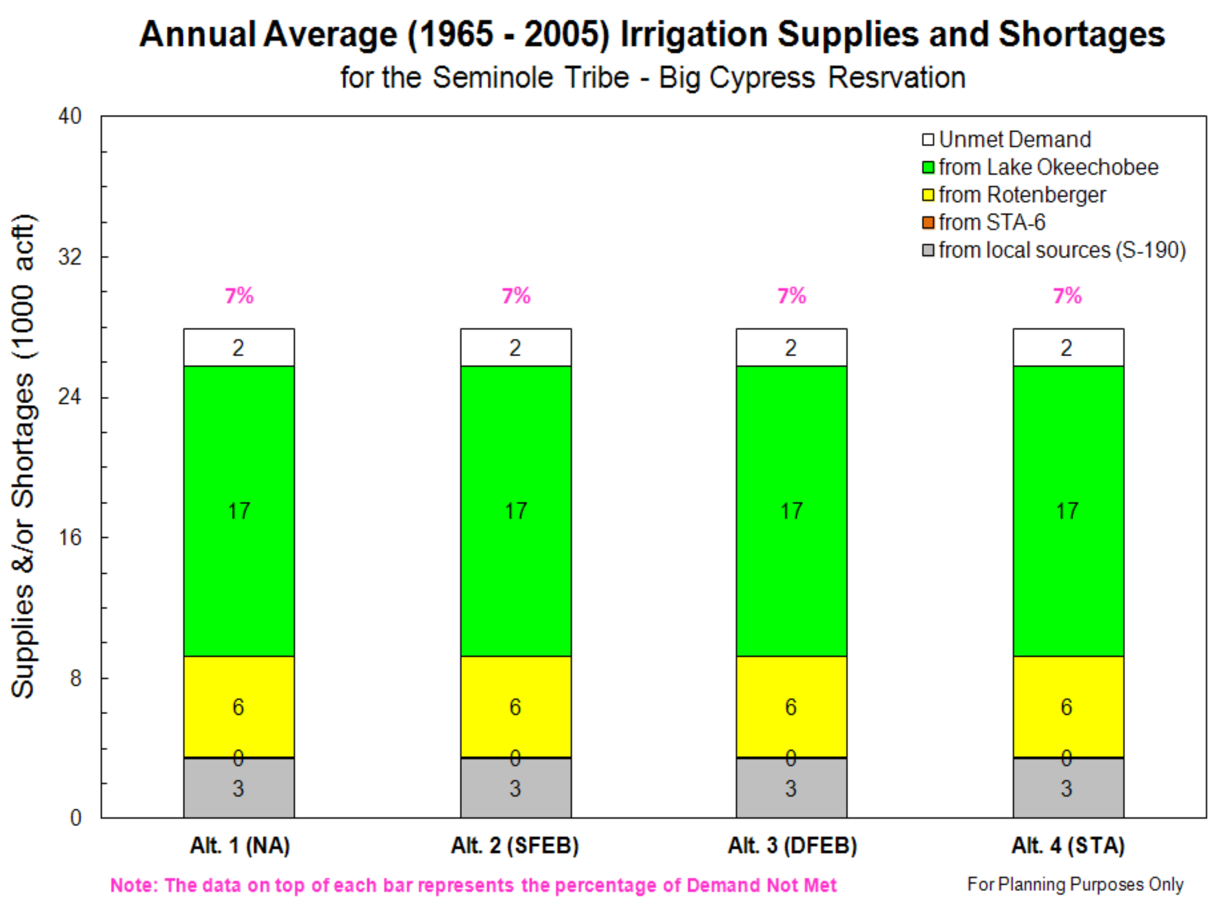
### 4.10.1 OVERVIEW OF THE SEMINOLE TRIBE WATER SUPPLY SOURCES

The Seminole Tribe has surface water entitlement rights pursuant to the 1987 Water Rights Compact (Compact) between the Seminole Tribe of Florida, the State of Florida, and the SFWMD (Pub. L. No. 100-228, 101 Stat. 1566 and Chapter 87-292 Laws of Florida as codified in Section 285.165, F.S.). According to the Compact, the surface water entitlement for the Big Cypress Reservation is based on the percentage of water available within the South Hendry County / L-28 Gap Water Use Basin as the lands of the Reservation are proportional to the total land acreage within the identified Basin.

The Entitlement Technical Report established a quantity of 47,000 acre-feet/year (65 cubic feet per second) as the surface water entitlement amount for the Seminole Tribe of Florida's Big Cypress Reservation. This quantity of water was required to be delivered in 12 equal monthly amounts of 3,917 acre-feet (Final Order 1998). The Seminole Tribe has requested that supplemental water supply be delivered to the Big Cypress Seminole Indian Reservation and the Big Cypress National Preserve and its Addition lands. Since the project purpose for this EIS is to achieve the WQBEL at the STA 2 and STA 3/4 discharge points in the Central Flowpath of the Everglades Protection Area utilizing existing water deliveries from Lake Okeechobee, additional supplemental water deliveries to the Seminole Tribe's land are not accomplished with the A-1 project. The entitlement volume is to be delivered primarily from the original entitlement source, the North and West Feeder Canal. When these volumes are insufficient, the Seminole Tribe relies on the secondary supply source, the G-409 pump station. Sources of water to G-409 include Lake Okeechobee, STA 3/4, STA 5/6, and Rotenberger Wildlife Management Area. The Action Alternatives will not change the existing operational plan for the G-409 pump station, and therefore, the Action Alternatives will have no impact on water supply for the Seminole Tribe of Florida's Big Cypress Reservation.

During the regional modeling for this EIS, SFWMD incorporated the delivery of surface water entitlement volumes that are consistent with the most current Work Plans. As shown in the **Figure 4-53** below, the annual average irrigation supplies (and sources) and shortages for the Seminole Tribe's Big Cypress Reservation are equivalent for all Alternatives (i.e. there is no change from the No Action Alternative). For all Alternatives, approximately 17,000 acre-feet of water is provided by Lake Okeechobee, 6,000 acre-feet is from Rotenberger Wildlife Management Area, and 3,000 acre-feet originates from local sources (e.g. East/West Feeder Canal S-190). All Alternatives, including the No Action Alternative, are not able to deliver approximately 7 percent (2,000 acre-feet) of the total entitlement volume for supplemental irrigation water in addition to falling short of the Tribe's request for supplemental water. The inability to deliver this approximately 7 percent of the Tribe's total entitlement volume for supplemental irrigation water is not attributable to any effect of construction of any A-1 Alternative. However, as stated above, when the volume of water is insufficient to provide water from the primary supply sources, real-time operations ensures that the Seminole Tribe receives their water entitlements through secondary supply sources.

**Figure 4-53** Average Annual Irrigation Supplies for Big Cypress Reservation

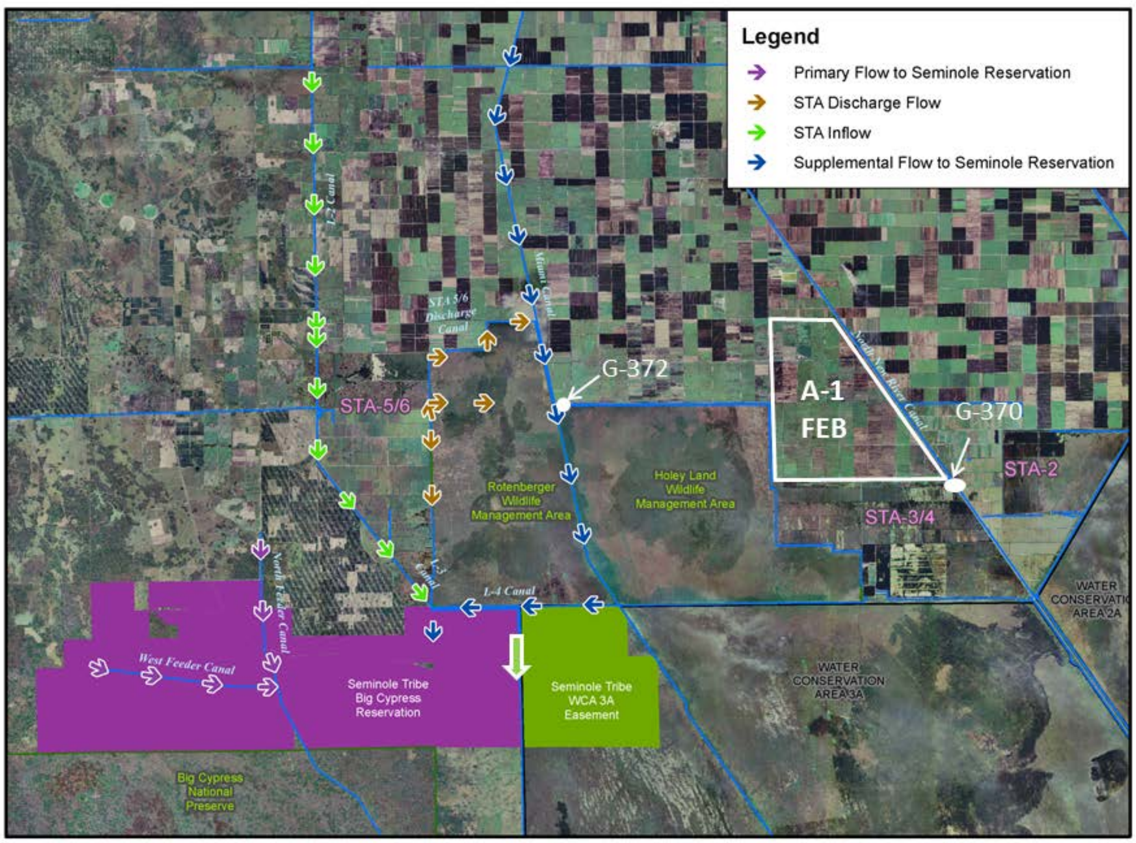


## 4.10.2 PROPOSED WATER FLOW

The A-1 FEB is located to the east of the Big Cypress Seminole Indian Reservation and is projected to receive inflows from Lake Okeechobee and basin runoff via G-370 on the North New River Canal and via G-372 on the Miami Canal as STA-3/4 receives those flows today. There would be no changes in the timing, magnitude and nature of water flows into the Big Cypress Seminole Indian Reservation.

The map depicted below shows surface water entitlement flows going into Big Cypress Seminole Indian Reservation (**Figure 4-54**). The Seminole Tribe's current entitlement deliveries will not be changed when the A-1 FEB is operational. A-1 FEB operations will have no effect on how water currently flows into Big Cypress Indian Reservation.

**Figure 4-54** Water Flows into Big Cypress Seminole Indian Reservation



### 4.10.3 WCA TRIBAL RIGHTS

Both the Seminole Tribe and the Miccosukee Tribe have full rights to access lands within WCA 3A to continue their TCP usage and occupancy of Federal or Federally acquired lands and waters within WCA 3A, which include hunting, fishing, trapping on a subsistence basis and Traditional Cultural Practices. Religious activities traditionally include the planting and harvesting of corn and the ceremonial Green Corn Dance conducted on tree islands. Subsistence activities include gathering of medicinal plants and natural building materials, hunting, and fishing; while commercial activities include frogging, conducting airboat and other guided tours, and providing recreational and tourism facilities within the Everglades.

The Action Alternatives would not alter, modify, or effect the Seminole Tribe or the Miccosukee Tribe's rights within WCA 3A. Alternative 2 (Shallow FEB) would result 14-30 days per year shorter hydroperiod in 11,000 acres of WCA 3A, Alternative 3 (Deep FEB) results in 14-30 days per year shorter hydroperiod in 1,000 acres, while Alternative 4 (STA) results in no change in ponding and hydroperiod in WCA 3A. The areas simulated to experience the effects are adjacent to the northern reach of the Miami Canal along the east side of the canal, while the Seminole Tribe's WCA 3A Easement is located west of the Miami Canal. The reduction in high water levels within WCA 3A is anticipated to improve environmental conditions for many of the tree islands, plants, and animals that the Tribes rely on to practice traditional and commercial activities.

## 4.11 RECREATIONAL RESOURCES

### 4.11.1 NO ACTION ALTERNATIVE

There would be no changes to recreational resources as a result of the No Action Alternative. Currently there is no authorized recreational use occurring on the A-1 site. It is possible that the SFWMD could issue new leases for agricultural use of these lands, which would result in future active production of sugar cane and other crops, limiting any recreational use on the site.

### 4.11.2 ACTION ALTERNATIVES

An FEB is a unique feature with a specific project purpose and function as described in Chapter 2. To date the South Florida Water Management District has not constructed nor operated a Shallow or Deep FEB. As a result, immediately following completion of construction, the project would enter an initial flooding and optimization period. During this period, various operation and management approaches would be evaluated in an attempt to maximize the project's ability to achieve its intended purposes. Until the initial flooding and optimization period is completed, explicit recreation for each of the action alternatives has not been defined and may be limited. Ultimately, the recreational opportunities afforded would need to be consistent with the project purpose and the project's operational plan; however, the intent is to offer the maximum amount of recreational opportunities that are determined to be consistent with the project purpose.

Once the initial flooding and optimization period is complete, the recreational plan for the project will be developed to maximize recreational opportunities compatible with the project purpose. Typical recreational activities considered are hiking, biking, wildlife viewing, hunting, and fishing. If applicable, public use activities will be incorporated using a phased approach and public access points will be configured with facilities to support recreational activities. When deciding which activities the SFWMD may allow, the project purpose is primary; considerations include how recreational activities affect water quality and the health and function of the vegetation community structure, as well as how water depths vary over time.

### 4.11.2.1 Project site

**Alternative 2 (Shallow FEB) and Alternative 3 (Deep FEB)**

As discussed above, once the Shallow or Deep FEB is constructed there would be a flooding and optimization period. In this time period passive recreational activities would be allowed. Once the flooding and optimization phase is complete, a recreational plan for the project would be developed to maximize recreational opportunities compatible with the project purpose.

**Alternative 4 (STA)**

Under the STA alternative, recreational activities would be consistent with recreational opportunities allowed in the other existing STAs (e.g., hiking, biking, wildlife viewing, hunting, and fishing). Opportunities for all these typical activities would generally increase, in comparison to the no action alternative, if the STA alternative were implemented. Many waterfowl and wading birds take advantage of other STAs in the region for nesting and foraging.

### 4.11.2.2 STA 2, STA 3/4, WCA 2A and WCA 3A

None of the action alternatives would have direct effects on existing recreational opportunities within STA 2, STA 3/4, and WCA-2A and WCA-3A.

Indirect effects associated with the Action Alternatives include the potential for temporary disturbance to recreational users in STA 2 and STA 3/4 while the construction of the project is ongoing. These disturbance effects would be limited to the adjacent portions of the STA and the WMAs, and would cease when construction is completed. In addition, modeling results establish that changes in flows and stages within WCA 2A and WCA 3A are very limited, and it is unlikely that these changes are of a sufficient magnitude or duration to adversely influence water related recreation in those areas.

#### 4.11.2.3 Holey Land Wildlife Management Area

Effects to the Holy Land could occur due to construction of a discharge canal adjacent to the existing STA 3/4 Cells 3A and 3B from the STA alternative to the L-5 canal. These direct impacts to the Holy Land could cause temporary disturbance to recreational users while construction is ongoing.

## 4.12 AESTHETICS

### 4.12.1 NO ACTION ALTERNATIVE

The existing aesthetic character of the A-1 project site is similar to the EAA as a whole, as described in Section 3.12. The landscape is flat and has a predominantly uniform and organized appearance. The prior construction activities on the site have created differences in site conditions in various areas on the project site. Areas that have been scraped down exhibit natural aesthetics with functioning wetland systems, while areas that have stockpiles of rock, gravel, and much offer poor aesthetics for the area. Other low quality aesthetic areas of the site contain wetlands dominated by exotic plant species. Under the No Action Alternative (Alternative 1), the aesthetics would be converting those various areas to agricultural lands if the site would resume agricultural activities.

### 4.12.2 ACTION ALTERNATIVES

Action Alternatives 2, 3, and 4 would result in construction and operation of new impoundments that would cover approximately 15,000 acres that would be inundated on a permanent basis. This long-term operating condition would change the visual character of the landscape in the immediate vicinity of the proposed project. This direct effect at and near the project site would be the primary aesthetic impact of the proposed project.

Based on the nature of the sources of change, potential aesthetic effects from the Action Alternatives would be the same. Any of the Action Alternatives would involve an initial period when construction would be evident to people within viewing range of the project sites. Views of construction equipment, dust plumes, exposed excavations, and partially completed culverts and other structures would be visible to residents and workers who pass near the construction sites in the course of their regular activities, and to motorists traveling on roads adjacent to the project sites. These views would be temporary in nature.

Once the project is in operation, the long-term appearance of the project site for Alternatives 2 (Shallow FEB) would consists of expansive emergent vegetation and Alternative 4 (STA) would consist of expansive emergent and submerged vegetation. Alternative 2 (deep FEB) would consist of expansive open water areas. All of the alternatives would provide views of the aquatic systems bordered by a variety of constructed features, including levees; roads along the tops of the levees; and water control structures, culverts, and pump stations spaced at varying intervals. However, the constructed features (e.g., levees, roads, water control structures, etc.) will be noticeable by those passing by the site. The view of the aquatic habitats would be noticeable to those on the levee system. Although the future condition with the project would result in less overall visual diversity, the presence of additional water area would likely be perceived as a positive change or of more visual interest when compared with the current condition (Hettinger 2005, as cited in URS 2007a,b). On balance, the long-term aesthetic change resulting from the project would not be a significant adverse impact.

## 4.13 FLOOD PROTECTION

### 4.13.1 NO ACTION ALTERNATIVE

Under the No Action Alternative the existing level of flood protection would be maintained as it currently is today with no impacts to the project site, STA 2, STA 3/4, WCA 2A, WCA 3A or Holey Land.

### 4.13.2 ACTION ALTERNATIVES

#### 4.13.2.1 Project Site

None of the Action Alternatives are expected to impact the existing level of flood protection within the C&SF System.

Both the shallow FEB and the STA alternatives are a closed system with the only hydraulic inputs being water delivered by pumps or direct rainfall. Based on Design Criteria Memorandum one (DCM-1), and a Levee Breach Analysis conducted for the Shallow FEB, the Shallow FEB alternative has been designated a low hazard potential classification. Inundation mapping performed during the analysis has shown at maximum water level a levee breach would not reach the travel lanes of U.S. 27 or overtop the north STA 3/4 levee; therefore, there is no impact to the existing level of flood protection service. Since the levee height and maximum water depths for the STA alternative are similar to the shallow FEB, no flood protection impacts are anticipated with the STA alternative. In the event of a levee breach, a potential for damage exists for adjacent private property to the north and west of the project site.

The Deep FEB alternative is classified as a high hazard potential based on the criteria outlined in DCM-1. A seepage cutoff wall would be required within the perimeter embankment as well as a perimeter seepage canal to reduce and capture seepage from the Deep FEB. In the event of a levee breach additional conveyance would be required on the west side of U.S. 27 to allow for flood waters to get away and not impact the travel lanes or overtop STA 3/4. Adjacent private agriculture property would experience damage to the north and west of the project site if a breach or overtopping of the Deep FEB levees were to occur.

#### 4.13.2.2 STAs 2 and 3/4, WCAs 2A and 3A, and Holey Land Wildlife Management Area

No impacts to the existing level of flood protection in STAs 2 and 3/4, WCAs 2A and 3A, and Holey Land would be expected with the Action Alternatives.

## 4.14 HAZARDOUS AND TOXIC WASTE

### 4.14.1 NO ACTION ALTERNATIVE

The current land use within the A-1 project site is inactive agricultural lands. Under the No Action Alternative, the land use would remain primarily fallow agricultural lands; however, agricultural activities may become active. There would be the potential for release of petroleum or agricultural chemicals in these areas with active agricultural land use. Additionally, large areas of the property have been scraped of the soil and the soil has been stockpiled in berms and discrete stockpiles throughout the property. These stockpiles represent an increased potential for erosion into adjacent waterways.

### 4.14.2 ACTION ALTERNATIVES

Current areas of known contamination are described in Chapter 3 of this document. One area where the project may encounter contaminant concentrations exceeding ecological risk thresholds with Alternatives 2 (Shallow FEB), Alternative 3 (Deep FEB) and Alternative 4 (STA) is the southern portion of Tract #100-039 (Woerner Farm 3), where toxaphene impacted soils were previously identified. Tract #100-039 consists of approximately 966 acres of land; however, only approximately 330 acres of the property will be used within project footprint, plus a small area to the northwest of the project footprint that will be used for a construction yard. This southern portion of Tract #100-039 within the project footprint has been scraped of soil and part of the seepage ditch that was constructed for the EAA reservoir. Additional sampling is required on this tract to verify that toxaphene concentrations in the remaining soils are below ecological risk thresholds and to verify the disposition of the scraped soils. Therefore, this area will be sampled prior to project construction. Any contaminated soils exceeding the threshold will be removed and relocated outside the project footprint.

Tract #100-104 (Talisman South Ranch) contains areas with elevated levels of copper and arsenic. This area completed remediation of all of the point source areas. The known areas within Tract #100-029 (Talisman Mill) where contaminated soils have been consolidated and capped will be within the A-1 FEB footprint. These areas will not be disturbed during construction. Construction of a reservoir over these areas was previously evaluated by FDEP, which concluded that these areas would not impact the project and the capped areas prevent exposure to wildlife or people, as long as the cap remains in place above the contaminated soils.

The USFWS has provided concurrence that no significant ecological risks associated with residual agrochemicals are present on Tracts #100-105 and #100-020. The USFWS issued separate concurrence on the entire A-1 FEB project site by letter dated April 17, 2013 (Appendix J), pending confirmation on remediation of toxaphene impacted soils from the lower 1/3 of the Woerner Farm 3 property and with the understanding that the SFWMD will implement a USFWS-approved start-up monitoring plan for copper which includes surface water, periphyton, and apple snails should they occur onsite.

A Site Rehabilitation Completion Order was issued by FDEP on July 21, 2006 under FDEP Facility ID number 50/8514728.

Due to the ubiquitous nature of arsenic throughout the EAA, all Action Alternatives could result in the generation of excess soils which contain arsenic at concentrations exceeding the FDEP residential soil cleanup target levels (SCTLs), but below commercial SCTLs or ecological risk thresholds. As these levels are below the ecological risk threshold, use of these soils on-site will result in a low ecological impact. It is currently anticipated that all soils will remain on site and utilized in construction of the levees. If excess soils are disposed off-site, they will be utilized in compliance with state and federal requirements and regulations.

The Action Alternatives would include the use of heavy equipment for construction of the proposed project and associated structures. Operation of this equipment may result in the release of petroleum products, such as fuel and hydraulic fluid. Fueling areas may experience spills when equipment and tanks are filled or possible spills from fuel tank leaks. The use of equipment could result in the release of hazardous and toxic materials or waste into the project area. However, Best Management Practices (BMP) would be implemented during construction to reduce the risk of release of hazardous or toxic materials or waste.

## 4.15 CLIMATE

Implementation of the No Action and the Action Alternatives would have no measureable effect on the climate in south Florida.

## 4.16 COSTS

### No Action and Action Alternatives

For the purposes of this EIS, cost estimates for each alternative are a rough order of magnitude based on the primary components that comprise each alternative. Therefore costs are confined to the build alternatives themselves for the project footprint. Since no construction is anticipated downstream in STA 2 and STA 3/4 or in WCA 2A and WCA 3A with any of the alternatives, a cost analysis is not applicable in these areas.

The cost estimate for each alternative is based on the alternative description of major components as outlined in Chapter 2, Section 2.4 Description of Alternatives. There is a certain amount of sunk costs (costs already incurred) within each alternative associated with the previous construction from the EAA A-1 Reservoir. These are defined as sunk costs for the land and initial earthwork that was conducted. **Table 4-15** contains each of the Alternatives listing total cost, sunk costs and estimated new construction costs. Of the alternatives (2, 3 and 4) that are projected to meet the WQBEL at both STA 2 and STA 3/4), Alternative 2 is the least expensive.

The difference in construction cost between the Shallow and Deep FEBs results from the needed additional excavation for the Deep FEB for an inflow pump station and fill material for larger levees, as well as the seepage cutoff wall and additional protection features needed for flood protection (see also Section 4.13.2.1). The STA would require additional levees to separate the EAV and SAV cells; as well as a new discharge canal within Holey Land.

**Table 4-15** Estimated Costs of All Alternatives

| Alternative | Sunk Cost | Estimated Construction Costs | Total Cost |
|---|---|---|---|
| 1 - No Action | $180,000,000 | $0 | $180,000,000 |

| | | | |
|---|---|---|---|
| 2 - Shallow FEB | $180,000,000 | $60,000,000 | $240,000,000 |
| 3 - Deep FEB | $180,000,000 | $593,000,000 | $773,000,000 |
| 4 - STA | $180,000,000 | $288,000,000 | $468,000,000 |

## 4.17 ENVIRONMENTAL JUSTICE

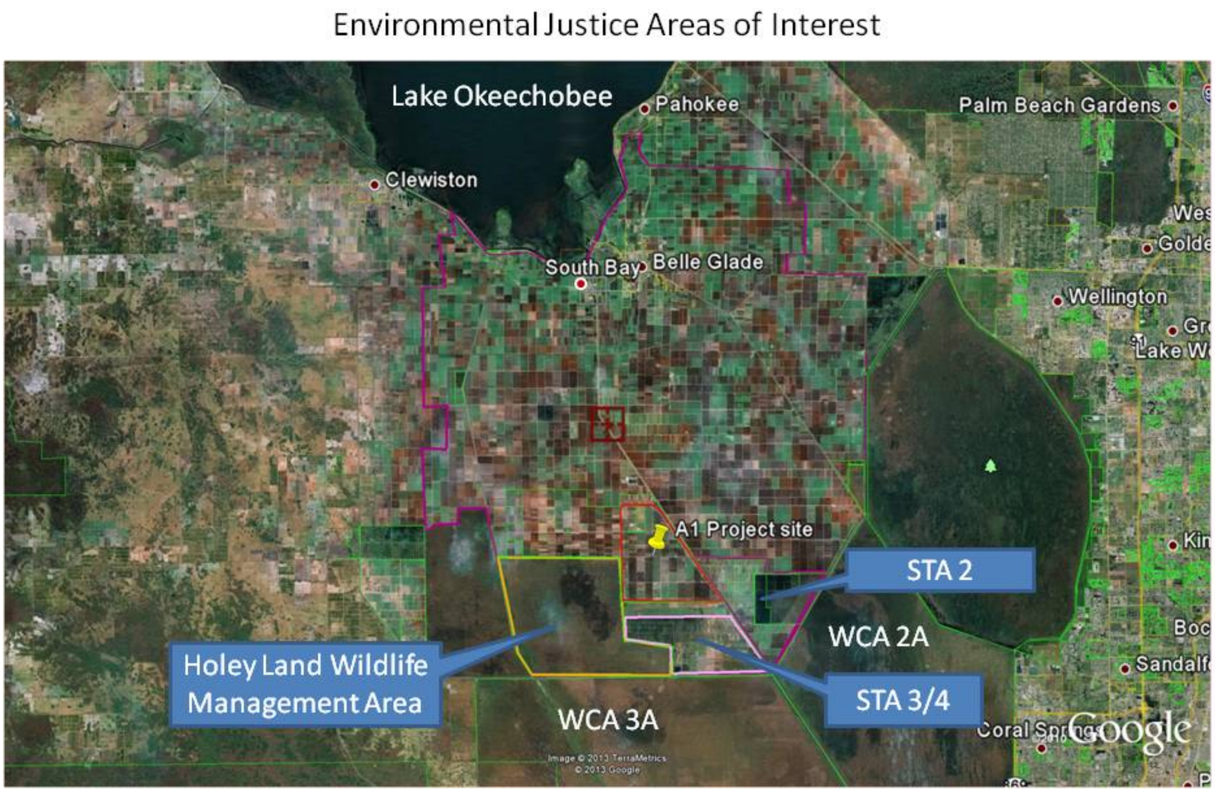
The Environmental Protection Agency (EPA) defines environmental justice, as fair treatment and meaningful involvement of all people regardless of race, color, national origin or income with respect to development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, or commercial operations, or the execution of federal, state, local, and tribal programs and policies. Meaningful involvement means that potentially affected community residents have an appropriate opportunity to participate in decision making about a proposed activity that will affect their environment and/or health (EPA website at www.epa.gov/region4/ej).

In accordance with Executive Order 12898, the Federal government reviews the effects of their programs and action on minorities and low income communities. This is accomplished by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. The following potential environmental justice issues have been identified for a water storage facility in the EAA:

- Displacement of minority or low income inhabitants of land within the footprints of land purchases required for each of the project alternatives.
- Flooding or related environmental issues that would impact minority groups or low income class groups as a result of change in conveyance of water.
- Loss of jobs for low income and minority workers as a result of implementing the project.

The scope of analysis for the A-1 project site includes the EAA, STA 2 and STA 3/4, WCA 2A and WCA 3A, and Holey Lands. These areas do not contain residential communities. The closest areas with minority or low income communities are north of the EAA, Belle Glade and South Bay, which are 14 and 13 miles north (upstream) of the project site, respectively (**Figure 4-55**).

**Figure 4-55** Environmental Justice Areas of Interest




According to the United States Census Bureau data of 2011, Belle Glade contains 21,815 people residing in the city. The racial makeup of Belle Glade is 4.7% White, 27.0% Hispanic or Latino origin, 62.7% African American, 0.3% Native American, 0.5% Asian, and 5.4% some other race. There are 6,324 households in Belle Glade with a median household income of $28,406 per year. About 38.4% of the population is below the poverty line, of which 47.4% are under the age of 18 and 28.8% are over the age of 65. The US Census data states the per capita income is $4,995, which is the lowest ranked city/town in the state of Florida (887 out of 887). The zip code in Belle Glades is 33430.

Also according to the United States Census Bureau data of 2011, South Bay contains 4,901 people residing in the city. The racial makeup of South Bay is 10.0% White, 23.3% Hispanic or Latino, 64.2% Black or African American, 0.4% Asian, 0.6% Native Hawaiian and other Pacific

Islander, and 3.3% from some other races. There are 779 households in South Bay with a median household income of $25,663 per year. About 42.9% of the population is below the poverty line, of which 54.9% are under the age of 18 and 36.5% are over the age of 65. The 2010 US Census data states the per capita income is $9,126, which is ranked (866 out of 887). The zip code in South Bay is 33493.

The Action Alternatives would not have a disproportionately high and adverse human health or environmental effects on minority or low income populations. Displacement of minority or low-income inhabitants will not occur with any Alternative as the lands do not support housing. In addition, land that has historically been used for agriculture would be used water quality purposes on the A-1 project site. Therefore, there would be a loss in agricultural lands and a loss of agricultural jobs. Recreational benefits are a potential use for each of the Action Alternatives. Socioeconomic development activities resulting from construction of the project include but are not limited to construction symposiums, contract opportunity assistance for small business involvement and job cross training for local residents. These all act to make the area more attractive to visitors and in turn, may provide jobs and subsistence for low income and minority populations of the area. Belle Glade and South Bay will not be affected by flooding or other environmental factors such as dust, offensive odors, or water pollution as the areas are located north of the project site. The project would discharge waters into an STA, which is designed to accept flood waters. The STA will in turn, discharge the treated water into WCAs. The SFWMD will implement measures to control dust during construction activities through the use of best management practices.

## 4.18 NATURAL OR DEPLETABLE RESOURCES

### 4.18.1 NO ACTION

The No Action Alternative is anticipated to have an increase in the generation of agricultural or mineral resources. The A-1 project site could be utilized for agricultural use or rock mining.

### 4.18.2 ACTION ALTERNATIVES

There are rock mining and/or agricultural resources that would be unavailable for exploitation as a result of construction of the Action Alternatives. Limestone and/or rock material is a common available resource in the region. The impact of the proposed project upon rock mining or agricultural resources is very minor. No other significant vegetable or mineral resource is known to exist.

## 4.19 CUMULATIVE IMPACTS

Evidence is increasing that the most severe environmental consequences do not result from the direct impacts of any particular action, but from the combination of impacts of multiple, independent actions over time. Section 1508.7 of the CEQ regulations defines a cumulative impact as:

> "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

Principles of cumulative effects analysis, as described in the CEQ guide *Considering Cumulative Effects under the National Environmental Policy Act*, are presented in **Table 4-16**.

| **Table 4-16. Principles of Cumulative Impacts Analysis** |
|---|
| Cumulative impacts are caused by the aggregate of past, present, and reasonably foreseeable future actions. |
| Cumulative impacts are the total impacts, including both direct and indirect impacts, on a given resource, ecosystem, and human community of all actions taken, no matter who (federal, nonfederal, or private) has taken the actions. |
| Cumulative impacts need to be analyzed in terms of the specific resource, ecosystem, and human community being affected. |
| It is not practical to analyze the cumulative impacts of an action on the universe; the list of environmental impacts must focus on those that are truly meaningful. |
| Cumulative impacts on a given resource, ecosystem, and human community are rarely aligned with political or administrative boundaries. |
| Cumulative impacts could result from the accumulation of similar impacts or the synergistic interaction of different impacts. |
| Cumulative impacts could last for many years beyond the life of the action that caused the impacts. |
| Each affected resource, ecosystem, and human community must be analyzed in terms of the capacity to accommodate additional impacts, based on its own time and space parameters. |
| Source: CEQ, 2013. |

### 4.19.1 SIGNIFICANCE

In accordance with CEQ regulations and implementing guidance, cumulative effects are evaluated in terms of their significance. The term *significant*, as defined in 40 CFR 1508.27, part of the CEQ regulations for implementing NEPA, requires considerations of both context and intensity. Context means that the significance of an action must be analyzed in several settings, such as society as a whole, the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend on the effects on the locale rather than on the world as a whole. Both short- and long-term effects are relevant to the consideration of the significance of an effect. Intensity refers to the severity, or degree, of effect. Factors that have been used to define the intensity of effects include the magnitude, geographic extent, duration, and frequency of the effects. The following terms are used to describe the degree of direct and indirect effects, whether they are adverse or beneficial:

- No Effect or Minor Effect - the effect is either non-detectable (no effect) or slight but detectable (minor)
- Moderate – the effect is readily apparent.
- Major – the effect is severely adverse or exceptionally beneficial.

Adverse effects can be reduced in intensity by mitigation. Mitigation in this context refers to measures taken to avoid, minimize, or offset adverse effects. For example, dust emissions generated during road building operations, whether directly caused by the movement of heavy equipment or indirectly caused by unvegetated soils exposed to wind, have the potential to cause a major effect that decreases as distance from the work increases. When BMPs are implemented, usually in response to local or county ordinances, the BMPs mitigate the effect of the dust by controlling fugitive dust emissions and reducing the intensity (magnitude, geographic extent, and frequency) of the effect to a moderate or minor level.

### 4.19.2 PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS AFFECTING RESOURCES WITHIN THE STUDY AREA

Prior to drainage and compartmentalization, the Everglades were a shallow wetland conveying water from Lake Okeechobee to the southern coast of Florida. The Everglades Drainage District, encompassing 7,150 square miles, was created in 1907 by Florida Governor Napoleon Bonaparte Broward for the purpose of drainage and reclamation of the Everglades (Light and Dineen 1994). In the early 1900s, the Everglades Drainage District constructed several canals that impacted Lake Okeechobee and the Greater Everglades. By 1917, the West Palm Beach, Hillsboro, North New River and Miami Canals had been constructed (Allison et al., 1948). By 1931, the outlet from Lake Okeechobee to the Caloosahatchee River was improved, and the completion of the St. Lucie Canal east to the Atlantic Ocean provided another way of controlling lake levels. The Bolles and Cross canals became connectors to the four major canals south of

Lake Okeechobee bringing the total miles of canal excavated to 440 (Light and Dineen 1994). The Everglades Drainage District also constructed 47 miles of levees around the southern rim of Lake Okeechobee during this time (Allison et al., 1948). Within a similar time frame (1915-1928) the construction of Tamiami Trail was completed which linked Miami with Naples on the west coast. Hurricanes in 1926 and 1928 shifted attention from Everglades drainage to controlling flooding around Lake Okeechobee. In 1930, the Corps became a major participant with the state (i.e., Okeechobee Flood Control District) in controlling flooding around Lake Okeechobee. Florida agreed to share a portion of the costs to increase discharges from the lake, improve canal works, and reconstruct and enlarge the levees around it (Light and Dineen 1994). The effect of levees on the agricultural area south of Lake Okeechobee was dramatic and sugarcane production was doubled in 10 years between 1931 and 1941 (Clarke, 1977). Drainage of the Everglades and the linkage of the east and west coast, promoted urban growth in south Florida and the population escalated from 22,961 in 1900 to 228,454 by 1930 (Dietrich 1978). During the 1930s and into the 1940s, construction was abandoned and maintenance ceased on Everglades Drainage District works (Light and Dineen 1994).

Although modifications to Lake Okeechobee and the Everglades began in the early 1900s, the greatest influence on the alteration of flow was the C&SF Flood Control Project, which was originally authorized by Congress in 1948. The C&SF project was designed to lower water levels east of the eastern protective levee by 4 to 5 feet. Increased flood protection coupled with lowering of the water table east of the levee had a dramatic effect on urbanization and development and acted as a catalyst for a population explosion in south Florida. Between 1952 and 1954 the eastern perimeter levee along the WCAs was constructed from Palm Beach to Dade County in order to stop sheet flow from the Everglades toward the urbanizing eastern coastal areas (Light and Dineen 1994). Between 1954 and 1959 additional levees (L-1, L-2, L-3, L-4, L-5, L-6, and L-7) were constructed to partition the EAA from the remainder of the Everglades and the old Everglades Drainage District Canals (West Palm Beach, Hillsboro, North New River, and Miami) were deepened within the EAA to provide better flood conveyance from the agricultural area into the WCAs (Light and Dineen 1994).

Between 1960 to 1963 substantial portions of the C&SF Flood Control project were completed. Construction of the levees surrounding WCA 3 was completed by 1963 with L-67A dividing WCA 3 into two compartments, WCA 3A and WCA 3B (Light and Dineen 1994). S-151 and S-31 were also constructed during this time period. These two structures improved the discharge capacity of the Miami Canal to coastal communities (Cooper and Roy, 1991), further exacerbating the unnatural drainage of northern 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, during wet periods, the natural capability of 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. Northern WCA 3A has become largely dominated by sawgrass, cattail and scattered shrubs and lacks the structural diversity of plant communities seen in central and western WCA 3A.

Completion of the L-29 levee in 1962 led to ponding in the southern portions of WCA 3A. Exacerbating this problem were the major canal systems (i.e. Miami Canal, L-67A) which accelerate the flow of water from north to south within WCA 3A, drying the north while further ponding the south (Zaffke 1983), especially along the L-67 A and L-29. As a result of this ponding, extended hydroperiods and increased water depths led to changes in vegetation communities in which wet prairies were displaced by aquatic slough communities (Zaffke 1983, Tanner et al. 1987). In addition, many tree islands within southern WCA 3A were lost due to increased water depths (Craighead 1971), with many of the remaining islands showing signs of stress. Wood and Tanner (1990) documented the trend in southern WCA 3A toward deep water lily dominated sloughs due to impoundment within the southern end of WCA 3A.

Four control structures located along the L-29 were constructed between 1960 and 1963 (S-12A, S-12B, S-12C, and S-12 D). These structures were used to regulate discharge from WCA 3A and effectively limited water releases to only the western part of Shark River Slough (Light and Dineen 1994). Construction of the L-67 C and the extension of L-67 south of Tamiami Trail were completed between 1965 and 1973 in order to facilitate water delivery from WCA 3A to ENP. Completion of the L-67 A and C canal and levee system intercepted water that would otherwise flow to WCA 3B. With its impoundment, WCA 3B became isolated from the rest of the Everglades with inflows and outflows limited to rainfall and levee seepage. Within WCA 3B, the ridge and slough landscape has become severely compromised by the virtual elimination of overland sheetflow 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. With the construction of WCA 3A, WCA3B and the extension of the L-67, flows to ENP became subject to water supply deficits during the dry season and excesses during the wet season, resulting in a decline in ecological quality. By 1973 the C&SF project in the Everglades was essentially complete.

Among the first Congressional actions to offset adverse impacts to ENP by improving the supply and distribution of water, was the Flood Control Act of 1968, which provided for modifications to the C&SF Project through the implementation of the ENP South Dade Conveyance System (SDCS). Additional Congressional actions ensued, including the ENP Protection and Expansion

Act of 1989, which expanded ENP to incorporate the Northeast Shark River Slough and the East Everglades into the Park's boundary for protection and restoration of the natural hydrologic conditions within ENP. This Act also provided authorization for development of the Modified Water Deliveries (MWD) to ENP project. The goal of the MWD Project was to improve water deliveries into ENP and, to the extent practicable, take steps to restore the natural hydrologic conditions within ENP. The Water Resources Development Act (WRDA) of 2000 established CERP to provide for the restoration, protection and preservation of the water resources of central and southern Florida, including the Everglades and Florida Bay (USACE 1999).

CERP contains 68 components that include approximately 217,000 acres of new reservoirs and wetlands-based water treatment areas. A number of operational components have also been identified in CERP and will, in most cases, occur in conjunction with related construction features. The operational features in CERP include: a modified Lake Okeechobee regulation schedule; environmental water supply deliveries to the Caloosahatchee and St. Lucie Estuaries' modifications to the regulation schedules for WCAs 2A, 2B, 3A, 3B, and the current rainfall delivery formula for ENP; modified Holey Land Wildlife Management Area Operation Plan; Modified Rotenberger Wildlife Management Area Operations Plan; a modification for coastal well field operations in the Lower East Coast (LEC); LEC utility water conservation; and operational modifications to the southern portion of L-31 and C-111. These features will result in significant environmental benefits to the CERP project area, improving the quantity, quality, timing and delivery of water to the natural system. Construction has begun on the first generation of CERP project modifications already authorized by Congress. Second generation of CERP projects is awaiting Congressional authorization. However, none of these projects will alter water flow or water quality within the study area.

Non-CERP projects that are considered reasonably foreseeable, which may affect resources within the study area, include projects under the Restoration Strategies Regional Water Quality Preliminary Plan (SFWMD 2012) for either the Western, Central or Eastern Flowpaths. The Restoration Strategies Regional Water Quality Preliminary Plan describes resulting projects developed to address water quality concerns associated with discharges from the STAs to the EPA to achieve water quality standards established for the Everglades. Overall, the SFWMD is implementing a technical plan to complete eight projects that will create more than 6,500 acres of new STAs, 110,000 acre feet of additional water storage through construction of FEBs, and 800 acres of earthwork within the existing STAs to maximize effective treatment area. Design and construction of the treatment and storage projects will be completed in three phases over a 12 year timeframe, with completion set for 2024.

The C&SF Project has numerous water management structures consisting of culverts, spillways, and pump stations that have specified operating criteria for managing or regulating water levels for Congressionally-authorized project purposes. Regulation schedules have been, and will continue to be, designed to balance multiple, and often competing, project purposes and objectives. Managing for better performance of one objective often lessens the effectiveness of performance of competing objectives. For example, for Lake Okeechobee, higher regulation schedules tend to benefit water supply, but may increase the risk to public health and safety, and can harm the ecology of the lake. Lower lake schedules may produce lake levels more desirable for the lake ecology and improved flood protection, but reduce water supply potential.

Since April 2008, Lake Okeechobee has been operated in accordance with the 2008 Lake Okeechobee Regulation Schedule (2008 LORS). Prior to the 2008 LORS, Lake Okeechobee operations were managed under the "Water Supply and Environment (WSE) Regulation Schedule" since July 2000. The 2008 LORS operational study was initiated to address high lake levels, high estuarine discharges, estuary ecosystem conditions, and lake ecology conditions that occurred during the 2003 to 2005 time period. The study considered the back-to-back historically significant 2004 and 2005 hurricane seasons' effects on the recognized structural integrity issues of HHD along with effects to other project purposes. The 2008 LORS was identified to be effective at decreasing the risk to public health and safety, reducing the number of high-volume discharges to the estuaries, and providing critical flexibility to perform water management operations. When it was approved, LORS 2008 was identified as an interim schedule. A subsequent schedule would be considered after the modifications to the Herbert Hoover Dike were completed.

In addition to CERP and non-CERP projects previously specified, another current project includes the Everglades Restoration Transition Plan (ERTP) for WCA 3A, ENP, and the SDCS, which has replaced the Interim Operational Plan (IOP) for protection of the Cape Sable seaside sparrow (CSSS). From July 2002 through October 2012, WCA 3A was regulated according to a seasonally varying 8.75 to 10.75 feet, NGVD regulation schedule and the Rainfall Plan (initiated in 1985), as per IOP. The primary objective in implementing IOP was to adhere to a 1999 USFWS Jeopardy Opinion to reduce damaging high water levels within CSSS habitat west of Shark River Slough (i.e. CSSS-A). The purpose of IOP was to provide an improved opportunity for CSSS nesting by maintaining water levels below ground level for a minimum of 60 consecutive days between March 1 and July 15, corresponding to the CSSS breeding season. In addition, a secondary purpose of IOP was to allow CSSS habitat to recover from prolonged flooding during the mid-1990s. The ERTP superseded the IOP in October 2012 and is intended to define water management operating criteria for the C&SF project features and constructed features of the

MWD and Canal-111 South Dade Projects until a Combined Operational Plan (COP) is implemented. ERTP objectives include improving conditions in WCA 3A for the endangered Everglade snail kite, wood stork and wading bird species while maintaining protection for the endangered CSSS and Congressionally-authorized purposes of the C&SF Project.

In November 2011, the USACE initiated an expedited planning process referred to as the Central Everglades Planning Project (CEPP). The goal of CEPP is to implement a suite of restoration projects in the central Everglades to prepare for congressional authorization, as part of the CERP. CEPP would evaluate and develop incremental project components that focus restoration on more natural flows into and through the central and southern Everglades. The project objectives include capturing water currently being discharged to northern estuaries and re-direct south to benefit the Everglades. This would be accomplished by re-establishing the hydroperiods and hydropatterns that characterize the River of Grass project by (1) increasing storage, treatment, and conveyance of water south of Lake Okeechobee, (2) removing and/or plugging canals and levees within the central Everglades, and (3) retaining water within ENP and protect urban and agricultural areas to the east from flooding, Implementation of CEPP would allow more water to be directed south to the central Everglades, Everglades National Park and Florida Bay while protecting coastal estuaries projects on land already in public ownership

**Relationship with Central Everglades Planning Project**

CEPP will be implemented by the USACE with the SFWMD as the non-federal sponsor. While implementation of CEPP would allow more water to be directed south to the central Everglades, the A-1 Shallow FEB would only accept water that is currently being discharged south from Lake Okeechobee and would not capture water that would is currently being discharged from Lake Okeechobee to tide. Furthermore, the A-1 Shallow FEB project is not a project component of CEPP as it is proposed to be constructed and operated solely by the SFWMD.

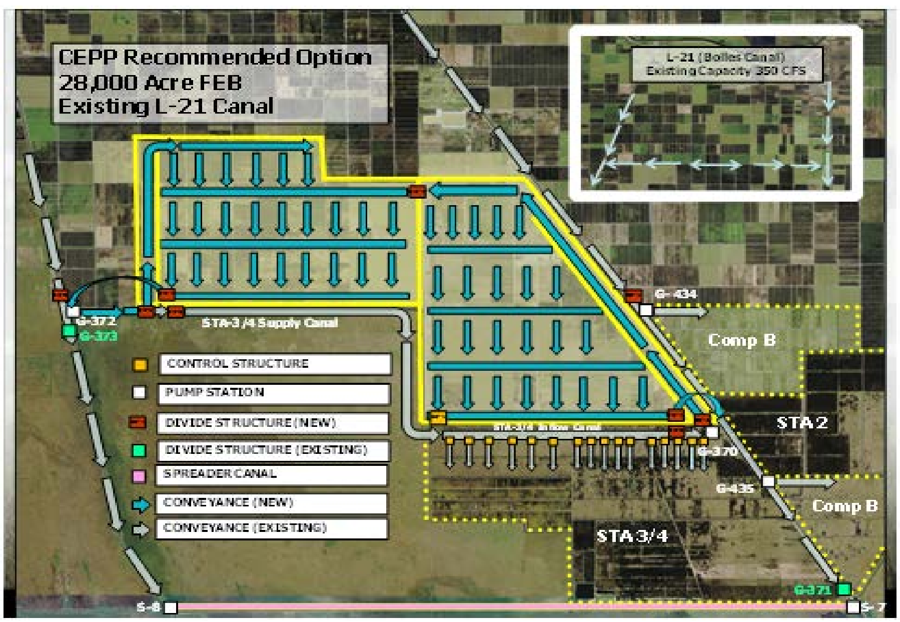
CEPP recognizes the SFWMD's plans on the A-1 parcel and considers the operation of the A-1 Shallow FEB in the planning process. CEPP assumes that the SFWMD's A-1 Shallow FEB will be constructed separately from the CEPP projects, will be constructed prior to the CEPP projects, and would be operated as an FEB regardless of whether the CEPP project received Congressional approval. Therefore, the SFWMD's A-1 Shallow FEB is included in the baseline condition of the alternatives analysis referred to as the CEPP Future Without Project.

**Integrated Operations of the FEB (parcels A-1 and A-2)**

The screening conducted for CEPP storage and treatment options, to deliver “new” water to the Everglades, resulted in the identification of a 28,000 acre FEB as the option that reasonably maximizes benefits while minimizing costs. This configuration proposes a shallow FEB on the A-2 footprint that would operate in conjunction with the SFWMD’s A-1 Shallow FEB project (See **Figure 4-56**). The maximum operating depth within the proposed CEPP FEB design is 4 feet. The Recommended Option is projected to provide approximately 200,000 ac-ft per year (average annual value) of additional flow (which is currently being discharged to tide via the St. Lucie Canal and Caloosahatchee River) to the Everglades.

The SFWMD’s A-1 Shallow FEB was designed to accept existing EAA runoff and current Lake Okeechobee releases in order to provide water to STA 2 and STA 3/4 in an optimized way. The SFWMD’s A-1 Shallow FEB is not proposed to be continually operated at four feet at all times, although this would normally occur during the wet season. Therefore, the A-1 FEB will have capacity to accept and treat additional water from Lake Okeechobee during off-peak times, such as the dry season. CEPP formulation considers potential benefits from using the available capacity in the A-1 FEB, STA 3/4 and STA 2 during the dry season for additional water storage.

**Figure 4-56** Conceptual Layout of CEPP Integrated FEB on A-1 and A-2 project site




For the A-2 FEB, a new divide structure would be proposed to be constructed at the northwest corner of the A-1 Shallow FEB. When in operation, the new divide structure could allow for a transfer of water between the A-1 and the A-2 FEBs enabling them to operate in conjunction with one another. The public will have the opportunity to review and comment on the CEPP project, including the A-2 FEB through a series of public workshops sponsored by the South Florida Ecosystem Restoration Task Force. Details of the public workshop can be found at: http://www.sfrestore.org/cepp/cepp.html Additional details of the CEPP project will be provided in the upcoming CEPP EIS. Information on CEPP can be found on the USACE's website at: http://evergladesplan.org/pm/projects/proj_51_cepp.aspx

### 4.19.3 DETAIL OF ANALYSES

As stated in the CEQ regulations (1501.1):

> "following scoping, the preparing agency should determine the scope (Sec. 1508.25) and the significant issues to be analyzed in depth in the environmental effect statement. Identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3), narrowing the discussion of these issues in the statement to a brief presentation of why they will not have a significant effect on the human environment or providing a reference to their coverage elsewhere."

As described in Chapter 1, following scoping, issues that were not believed to be significant were eliminated from detailed study. These topics include Essential Fish Habitat, Air Quality, Noise Pollution, Transportation, and Water Supply/Drinking Water. Issues, or resource categories, not eliminated from detailed study included: Land Use, Geology, Topography and Soils; Hydrology (Overall Water Management, Surface Water Hydrology; Groundwater Hydrology, STA Phosphorus Removal); Water Quality; Vegetation (General Vegetation and Wetlands); Fish and Wildlife (Overall Fish and Wildlife, Federally Listed Threatened or Endangered Species, State Listed Threatened or Endangered Species, Migratory Birds); Cultural, Historic, and Archaeological resources; Tribal Rights; Recreational Resources, Aesthetics; Flood Protections; Hazardous and Toxic Waste; Climate; Costs; Environmental Justice, and Natural or Depletable Resources.

In accordance with CEQ guidance (CEQ, 1997), this analysis of cumulative effects is focused on those resource categories determined to be significant. Identification of the resource categories for which there may be significant cumulative effects began with defining the direct and indirect effects of the current action on the resources categories (see Sections 4.3 through 4.18). The resource categories were then considered in terms of their importance nationally, regionally, and locally. After consideration of the direct and indirect impacts of the current project and the above described reasonably foreseeable projects and considering comments received during the scoping and draft EIS comment periods, the resource categories determined to have significant potential cumulative impacts are:

- Hydrology
- Threatened and Endangered Species;
- Fish and Wildlife Resources
- Surface Water Quality
- Ecological Resources (Vegetation and Wetlands)
- Cultural, Historic, and Archaeological resources;

Although geology, groundwater hydrology, fish and wildlife values, migratory birds, aesthetics; flood protection, hazardous and toxic waste, climate; costs, and environmental justice were considered in detail for direct and indirect effects, they are not part of the cumulative effects analysis in this section. This decision was based on the factors described above, including the degree and significance of the direct and indirect effects, the resources, ecosystems, and human communities that may be affected, and the relative importance of the issues. **Table 4-17** describes the potential cumulative effects as a result of past, present, proposed, and future actions.

**Table 4-17** Potential 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** | • No change in discharge from Lake Okeechobee to the Northern Estuaries.<br>• Significant beneficial hydrologic effects are anticipated to the hydrology of STA 2 and STA 3/4 produced by utilization of the Shallow FEB to attenuate flows during high storm events and to provide water to the STAs to ensure longer, more consistent hydroperiods.<br>• No significant change in hydrologic conditions due to changed depths or resulting hydroperiods in either WCA 2A or WCA 3A. |
| **Future Actions** | • Reductions in high discharge events from Lake Okeechobee to the Northern Estuaries.<br>• Significant beneficial hydrologic effects are anticipated within the Greater Everglades through restoration of southerly flow and rehydration of previously drained areas.<br>• Improved hydrologic conditions by increasing depths and resulting hydroperiods in WCA 3A, WCA 3B, and ENP. |
| **Cumulative Effect** | The cumulative effect upon enactment of the A-2 FEB would be equivalent to the effect of the A-2 FEB project itself. There is no synergistic or aggregated cumulative effect that would negatively impact hydrology as the A-1 FEB would be incorporated into the baseline effects of the A-2 project and all effects disclosed through the analysis of the A-2 project. Natural hydrologic conditions would not be fully restored to pre-drainage conditions. However, improved hydrology would occur with the A-1 and A-2 site operating more frequently at or near 4-feet of water, STA-2 and STA 3/4 having longer hydroperiods and few dry outs |

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| | periods, and the WCAs would have improved hydroperiods as well. |
| **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. Ongoing projects such as IOP have been implemented to maintain CSSS populations. ERTP implementation represents a paradigm shift from single species to multi-species management. The FWS recovery plan is used as a management tool. |
| **Proposed Action** | may affect, but is not likely to adversely affect the Audubon's crested caracara, the wood stork, the Florida panther, and the Everglades snail kite, and may affect the eastern indigo snake. The proposed project would not adversely modify the designated critical habitat for the Everglades snail kite. |
| **Future Actions** | Ongoing projects would be implemented to protect threatened and endangered species within the project area.<br>ERTP 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** | • There would be a moderate to major improvement to fish and wildlife resources within the A-1 site.<br>• No change in discharge events to the Northern Estuaries is anticipated, therefore, there would be no improvement for suitable habitat for key indicator species such as oysters in the estuary.<br>• There would be a minor beneficial effect on fish and wildlife values within the STAs as they remain hydrated for longer portions of the year.<br>• There would be a minor improvement of fish and wildlife values within the WCAs over time as improved water quality has a positive effect on the spatial extent of suitable habitat.<br>• Any increases in forage prey availability (crayfish, other invertebrates, and fish) would directly benefit amphibian, reptile, small mammal, and wading bird species.<br>• Nesting and foraging activities of resident bird species may be moderately improved on the A-1 site and on any of the areas where improved hydrology or water quality allows for growth of suitable habitat. |

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| **Future Actions** | • There would be a minor effect to fish and wildlife values within Lake Okeechobee.<br>• There would be a moderate to major improvement to fish and wildlife resources within the A-2 site.<br>• Reductions in the number of high discharge events to the Northern Estuaries are anticipated to moderately improve suitable habitat for key indicator species such as oysters.<br>• There would be a major improvement of fish and wildlife values within the WCA 3A, 3B, and ENP due to rehydration within previously dry areas that would increase the spatial extent of suitable habitat.<br>• Any increases in forage prey availability (crayfish, other invertebrates, and fish) would directly benefit amphibian, reptile, small mammal, and wading bird species.<br>• Nesting and foraging activities of resident bird species are anticipated to be significantly improved.<br>• 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. |
| **Cumulative Effect** | The cumulative effect upon enactment of the A-2 FEB would be equivalent to the effect of the A-2 FEB project itself. There is no synergistic or aggregated cumulative effect that would negatively impact fish and wildlife values as the A-1 FEB would be incorporated into the baseline effects of the A-2 project and the effects of the A2 become the cumulative effects disclosed through the analysis of the A-2 project. Habitat improvement efforts would be expected to have a moderate to major positive effect on fish and wildlife values. |
| **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** | • No effect on vegetation in Lake Okeechobee as there is no change in water flow from Lake Okeechobee that might affect the vegetation.<br>• There would be a moderate to major improvement to wetland function within the A-1 site.<br>• There would be a minor to moderate beneficial effect on wetland function within the STAs as they remain hydrated for longer portions of the year.<br>• There would be a minor improvement of wetland function within the WCAs over time as improved water quality has a positive effect on the spatial extent of suitable habitat. |
| **Future Actions** | • Minor effects to vegetation within Lake Okeechobee are anticipated due to implementation of the CEPP components.<br>• There would be a moderate to major improvement to wetland function within the A-2 site.<br>• Reductions in the number of high discharge events to the Northern Estuaries are anticipated to improve conditions for seagrass beds.<br>• There would be a moderate beneficial effect on wetland function within the STAs as they remain hydrated for longer portions of the year.<br>• There would be a moderate improvement of wetland function within the WCAs over time as improved water quality has a positive effect on the spatial extent of suitable habitat.<br>• Improved hydroperiods and sheetflow within WCA 3A, 3B and ENP would result in reduced soil oxidation, promoting peat accretion necessary to rebuild the complex |

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| | mosaic of habitats across the landscape.<br>• Increased freshwater flows to Florida Bay would aid to lower salinity levels, benefiting mangrove communities and seagrass beds.<br><br>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** | The cumulative effect upon enactment of the A-2 FEB would be equivalent to the effect of the A-2 FEB project itself. There is no synergistic or aggregated cumulative effect that would negatively impact wetland functions as the A-1 FEB would be incorporated into the baseline effects of the A-2 project and the effects of the A2 become the cumulative effects disclosed through the analysis of the A-2 project. While the spatial extent of natural plant communities in the combined FEB areas, STAs 2 and 3/4, and the WCAs would not be restored to historic proportions, the quality of vegetative communities would be improved and the quantity of wetland habitat would increase. |
| **Water Quality** | |
| **Past Actions** | Water quality has been degraded from development and agriculture. |
| **Present Actions** | Efforts to improve water quality from agricultural areas are ongoing. State and Federal projects would temporarily elevate localized levels of suspended solids and turbidity. |
| **Proposed Action** | Placing a Shallow FEB on the A-1 site would have a moderate improvement on the water quality as the discharges from STA 2 and STA 3/4 would be expected to meeting the WQBEL at discharges from the STAs into the Everglades Protection Area. |
| **Future Actions** | Placing a Shallow FEB on the A-2 site would have a moderate improvement on water quality as additional water could be routed south from Lake Okeechobee that would have otherwise been discharged to tide, which would have negatively affected the northern estuaries. Implementation of the A-2 Project would likely result in no additional exceedances of the Everglades Settlement Agreement as compared with the current operational plan. Water quality changes potentially affects fish and wildlife resources by altering vegetation composition or structure. Aggressive actions by the State of Florida would decrease pollutant concentration and loadings to the project area. If authorized in the next Water Resources Development Act (WRDA), the Broward County WPA Project, (report approved in 2007) would reduce storm runoff deliveries to WCA-3 and improve water quality coming across into the Trail. |
| **Cumulative Effect** | The cumulative effect upon enactment of the A-2 FEB would be equivalent to the effect of the A-2 FEB project itself. There is no synergistic or aggregated cumulative effect that would negatively impact water quality as the A-2 FEB would be operating in tandem with the A-1 project and the effects of the A2 become the cumulative effects disclosed through the analysis of the A-2 project. While additional water would be routed south and stored on the A-1 Site, the A-2 Site, and within STA 2 and STA 3/4, meeting water quality at the STA discharge points would be a requirement of existing permits. While anthropogenic effects on water quality are unlikely to be eliminated, water quality is expected to slowly improve over existing and recent past conditions. |
| **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. Investigations mandated in the Programmatic Agreement for ERTP are in the process of being completed. |
| **Proposed Action** | • There are no known cultural resources within the A-1 Site. Therefore, there are no impacts to cultural resources expected.<br>• The minor change in hydroperiod within the WCAs is expected to be so minor that no effect is expected by the proposed project's impacts on cultural resources sites eligible for listing with the NHPA. |
| **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 ERTP are in the process of being completed and will determine the effects of fluctuating water on subsurface historic properties.<br>• While the effects of CEPP, and specifically the A-2 project 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. |
| **Cumulative Effect** | Cumulative effects to historic properties and culturally significant sites will be potentially major long-term adverse effects. Mitigation measures for effects to historic properties could reduce the cumulative effect to be minor long-term adverse effects. |

## 4.20 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Under NEPA guidelines, the EIS analysis includes a discussion on irreversible and irretrievable commitment of resources as it pertains to the Action Alternatives. An irreversible commitment of resources refers to effects to the resources that cannot be reversed or that would not be reversed in a foreseeable amount of time. An example would be when a species becomes extinct. Irretrievable commitment of resources describes a resource that is lost for a period of time or as long as the action exists. For example, fishing productivity would be lost in an area closed to be converted to oil exploration for as long as the oil exploration remains.

Action Alternatives 2, 3, and 4 would result in the conversion of 10,820.3 acres of wetlands to manipulated wetlands. Existing wetlands that are located in areas where placement of fill would occur (construction of levees and filling canals) would be irreversibly lost; however, land, including wetlands within the impoundments, would be converted or would remain wetland or waters. Temporary, and possibly permanent, displacement would occur for some natural and human resources during construction operations.

## 4.21 IMPACT COMPARISON AND CONCLUSIONS

The environmental effects of the alternatives were evaluated and compared with the No Action Alternative. Many of the environmental effects were similar for each of the Action Alternatives, which are evaluated in detail in Chapter 4 and summarized in Section 4.21 (**Table 4-16**). However, changes to the affected environment are seen in land use, soils/total phosphorus removal, surface water, water quality, and wetland impacts as a result of the Alternatives. In this evaluation, a cost benefit analysis was recognized between the alternatives and is an aid in evaluating the environmental consequences. The differences in the affected environmental factors, including the cost benefit analysis, are summarized below.

### LAND USE

Alternatives 2, 3, and 4 would require the A-1 project site to be used primarily for water quality purposes. Because the lands are required to be used to conduct restoration activities in the Everglades ecosystem pursuant to the Farm Bill and the Cooperating Agreement, each of the action alternatives would require approval for an interim land use change from USFWS/DOI.

### SOILS/TP CONCENTRATIONS

Lower phosphorus concentrations discharged from the STA 2 and STA 3/4 would reduce the rate of soil phosphorus accumulation in WCA soils. Over time, reductions in soil total phosphorus will help facilitate the restoration of impacted areas near the inflow points to WCA 2A and WCA 3A creating conditions more conducive to historic Everglades vegetative communities. The FEBs proposed in Alternatives 2 and 3 have the potential to benefit soils within STA 2 and STA 3/4 by maintaining minimum water levels and reducing the frequency of dryout conditions. The probability of experiencing dryout conditions in STA 2 and STA 3/4 is greatest under Alternative 4 (STA). In general, as additional STA acreage is added (as in Alternative 4), the potential risk of STA dryout, and associated impacts to phosphorus removal performance within existing and new STAs, increases, whereas, when additional storage is added (as in Alternative 2 and 3), the potential for dryout within existing STAs decreases.

### HYDROPERIOD ANALYSIS

Alternative 2 has the least change in hydroperiod in WCA 2A, while Alternative 3 has the least change in hydroperiod in WCA 3A. Alternative 4 has no change in the hydroperiod in either WCA. The hydroperiod changes that are simulated to occur are for all the Action Alternatives are limited to a small percentage of area within WCA-2A (0.6 – 3.1%) and WCA-3A (0.2 – 2.2%). The minor differences in WCA-2A hydroperiods for Alternatives 2 and 3 occur mainly due to a shift in the location of WCA-2A inflows from S-7 to the L-6 Canal, however the total inflow volumes to WCA-2A are approximately equivalent. The hydroperiod changes that occur in WCA-3A are most likely due to the different structural and operational characteristics related to the facilities (Shallow FEB, Deep FEB, STA) evaluated within the project site.

**WATER QUALITY**

The purpose of the project is to assist STA 2 and STA 3/4 in meeting the WQBEL at discharges from the STAs into the Everglades Protection Area. The No Action Alternative does not meet the project purpose since STA 3/4 would not meet the WQBEL at the STA outflow. Alternatives 2, 3, and 4 are projected to meet the WQBEL at outflows from both STAs.

The WQBEL requires that 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.

**Table 4-18** Summary of Water Quality Analysis

| Alternatives | STA 2 Outflows (ppb) | STA 3/4 Outflows (ppb) | WCA 2A Inflows (ppb) | WCA 3A Inflows (ppb) |
|---|---|---|---|---|
| Alternative 1: No Action | 13 | 18 | 16 | 17 |
| Alternative 2: Shallow FEB | 13 | 13 | 13 | 12 |
| Alternative 3: Deep FEB | 12 | 13 | 12 | 12 |
| Alternative 4: STA | 12 | 12 | 12 | 12 |

**WETLANDS**

Natural wetlands will be permanently altered within the boundaries of the project site as unavoidable adverse wetland and surface water impacts would occur due to placement of fill and excavation. Jurisdictional wetland impacts for levee fill vary between each alternative since each project would require specific width, heights, and location of levees. Jurisdictional wetland impacts for levee fill are greatest with Alternative 3 because the taller levees require a wider base. Jurisdictional wetland impacts for Alternative 4 require external and internal levees. Alternative 4 also requires excavation and fill in Holey Lands to construct a canal and with berms/levees. The Shallow FEB has the lowest wetland impacts of the Action Alternatives.

Jurisdictional wetland impacts are least for the No Action Alternative. Below is a table summarizing the wetland impacts for each alternative.

**Table 4-19** Summary of Wetland Impacts (acres)

| Impact Type/Area | Proposed Levee Fill | Proposed Canal Fill | Proposed Canal Excavation | Holey Land Wildlife Management Area | | Total |
|---|---|---|---|---|---|---|
| Alternative 1: No Action | 0 | 0 | 0 | 0 | | 0 |
| Alternative 2: Shallow FEB | 280.1 | 112.8 | 43.0 | 0 | | 435.9 |
| Alternative 3: Deep FEB | 533.6 | 0 | 43.0 | 0 | | 576.6 |
| Alternative 4: STA | 353.6 | 112.8 | 270 | 250 | | 986.4 |

**COST**

Each of the alternatives would require approval for a land use change. The No Action Alternative does not meet the project purpose since STA 3/4 would not meet the WQBEL at the STA outflow. However, Alternatives 2, 3, and 4 would meet the WQBEL for STAs 2 and 3/4. Although meeting the WQBEL, the probability of experiencing dryout conditions in STA 2 and STA 3/4 is greatest under Alternative 4 (STA) while Alternatives 2 and 3 offer the greatest benefit to reducing dryout conditions. Alternative 2 would result in the least amount of wetland impacts. In weighing the merits and drawbacks of the various alternatives, a cost benefit analysis was also considered in this evaluation since the project is funded with tax-payer dollars and the impacts to the public could assist in determining an important qualitative consideration.

Of the Alternatives that are projected to meet the WQBEL at the outflow from both STA 2 and STA 3/4, Alternative 2 is the least expensive. Alternative 3 required additional excavation for the Deep FEB for an inflow pump station and fill material for larger levees, as well as the seepage cutoff wall and additional protection features needed for flood protection. This alternative would utilize more excavated rock that is already on site. Alternative 4 (STA) would require additional levees to separate the EAV and SAV cells, as well as a new discharge canal within Holey Land.

**Table 4-20** Summary of Cost

| Alternative | Sunk Cost | Estimated Construction Costs | Total Cost |
|---|---|---|---|
| 1 - No Action | $180,000,000 | $0 | $180,000,000 |
| 2 - Shallow FEB | $180,000,000 | $60,000,000 | $240,000,000 |
| 3 - Deep FEB | $180,000,000 | $593,000,000 | $773,000,000 |
| 4 - STA | $180,000,000 | $288,000,000 | $468,000,000 |

The current and reasonably foreseeable actions’ direct and indirect effects on most of these resource categories were predicted to have no effect or to have a minor degree of effect, or at most a moderate degree of effect. The only major degree of effect was associated with listed species. None of these effects were significant. Most were relatively limited in extent, with the categories’ effects confined within the boundaries of the action. The primary exception to this was environmental justice, and for that resource category the current and reasonably foreseeable actions were expected to have a minor, beneficial, and non-disproportionate effect. Finally, although all of these resource categories generated interest during scoping and comments on the Draft AEIS, this factor alone was not sufficient to elevate any of the categories to the level of the significant cumulative impact issues.