ANNEX B

ANALYSES REQUIRED BY WRDA 2000 AND FLORIDA STATE LAW

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B ANNEX B ANALYSES REQUIRED BY WRDA 2000 AND FLORIDA STATE LAW

Federal law and regulation implementing the Comprehensive Everglades Restoration Plan (CERP) require Project Implementation Reports (PIRs) to address certain assurances as part of the project being recommended for approval and implementation. This section addresses provisions of Section 601(h) of the Water Resources Development Act of 2000 (WRDA 2000), the Programmatic Regulations for the CERP (33 CFR Part 385) for Savings Clause requirements and Project-Specific Assurances.

The following sections describe the specific requirements from WRDA 2000 and the CERP Programmatic Regulations and present the methods, results, and conclusions of the analyses necessary to meet those requirements.

B.1 Water Resources Development Act (WRDA 2000)

Congress enacted the WRDA 2000, Section 601, Comprehensive Everglades Restoration Plan, which approved CERP "as a framework for modifications and operational changes to the Central and Southern Florida (C&SF) Project that are needed to restore, preserve, and protect the South Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection." Section 601(h) of WRDA 2000, entitled, “Assurance of Project Benefits,” establishes project-specific assurances to be addressed as part of CERP implementation.

Section 601 (h) (1) of WRDA 2000 provides the following:

> IN GENERAL - The overarching objective of the Plan is the restoration, preservation, and protection of the South Florida Ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The Plan shall be implemented to ensure the protection of water quality in, the reduction of the loss of fresh water from, the improvement of the environment of the South Florida Ecosystem and to achieve and maintain the benefits to the natural system and human environment described in the Plan, and required pursuant to this section, for as long as the project is authorized.

The Savings Clause analysis is listed in WRDA 2000 as a means to protect users of legal sources of water supply and to protect the levels of service for flood protection that were in place at the time of enactment. Specifically, Section 601(h)(5) of WRDA 2000, entitled “Savings Clause,” requires an analysis of each project’s effects on legal sources of water that were in existence on the date of enactment of WRDA 2000 (i.e., December 2000), effects on levels of service of flood protection in existence on the date of enactment of WRDA 2000, and effects on the Seminole Tribe of Florida Water Supply Compact with the State of Florida and South Florida Water Management District (SFWMD). Section 601(h) (5) of WRDA 2000 states the following:

> *(A) NO ELIMINATION OR TRANSFER. – Until a new source of water supply of comparable quantity and quality as that available on the date of enactment of this Act is available to replace the water to be lost as a result of implementation of the Plan, the Secretary and the non-Federal sponsor shall not eliminate or transfer existing legal sources of water, including those for –*
>
> *(i) an agricultural or urban water supply;*

(ii) allocation or entitlement to the Seminole Indian Tribe of Florida under section 7 of the Seminole Indian Land Claims Settlement Act of 1987 (25 U.S.C. 1772e);
(iii) the Miccosukee Tribe of Indians of Florida;
(iv) water supply for Everglades National Park; or
(v) water supply for fish and wildlife.

(B) MAINTENANCE OF FLOOD PROTECTION. – Implementation of the Plan shall not reduce levels of service for flood protection that are –

(i) in existence on the date of enactment of this Act; and
(ii) in accordance with applicable law.

(C) NO EFFECT ON TRIBAL COMPACT. – Nothing in this section amends, alters, prevents, or otherwise abrogates rights of the Seminole Indian Tribe of Florida under the compact among the Seminole Tribe of Florida, the State, and the South Florida Water Management District, defining the scope and use of water rights of the Seminole Tribe of Florida, as codified in section 7 of the Seminole Indian Land Claims Act of 1987 (25 U.S.C. 1772e).

The analysis of project-specific assurances is listed in WRDA 2000 as a means to assure that CERP project benefits are realized by establishing the appropriate quantity, timing, and distribution of water to be dedicated and managed for the natural system. Section 601(h) (4) of WRDA 2000, entitled "Project-Specific Assurances," contains the following requirements for PIRs:

(A) PROJECT IMPLEMENTATION REPORTS. –

(i) IN GENERAL. – The Secretary (of the Army) and the non-Federal sponsor shall develop project implementation reports in accordance with Section 10.3.1 of the Plan.
(ii) COORDINATION. – In developing a project implementation report, the Secretary and the non-Federal sponsor shall coordinate with appropriate Federal, State, tribal, and local governments.
(iii) REQUIREMENTS. – A project implementation report shall –

...(IV) identify the appropriate quantity, timing, and distribution of water dedicated and managed for the natural system;
(V) identify the amount of water to be reserved or allocated for the natural system necessary to implement under State law;

WRDA 2000 excerpts cited above are intended to provide a concise summary of the Savings Clause and Project-specific Assurances analyses required under WRDA 2000. Refer to WRDA 2000 for complete text.

B.2 Programmatic Regulations (33 CFR Part 385)

Section 601(h)(3) of WRDA 2000 required the Secretary of the Army, with the concurrence of the Governor and the Secretary of the Interior, to promulgate Programmatic Regulations to ensure that the goals and objectives of the CERP are achieved. See the main report for a summary of compliance with the provisions of the Programmatic Regulations. The Final Programmatic Regulations for the CERP, which were published in 33 CFR Part 385 in 2003, establish the processes and procedures to guide the U.S. Army

Corps of Engineers (USACE) in the implementation of the CERP. This section summarizes the requirements of the Programmatic Regulations that provide supplemental information to WRDA 2000.

B.2.1 Pre-CERP Baseline

Section 385.35(a) of the Programmatic Regulations requires the development of a pre-CERP baseline to aid the USACE and the SFWMD when implementing the Savings Clause to determine if existing legal sources of water will be eliminated or transferred and to demonstrate that the levels of service of flood protection in existence on the date of enactment of WRDA 2000, and in accordance with applicable law, will not be reduced by implementation of a project.

B.2.2 Savings Clause - Elimination or Transfer of Existing Legal Sources of Water

Section 385.36 of the Programmatic Regulations requires that PIRs include a determination of existing legal sources of water that are to be eliminated or transferred as a result of project implementation. If a project is expected to result in an elimination or transfer of an existing legal source of water, the PIR shall include an implementation plan that ensures a new source of water of comparable quantity and quality is available to replace the source that is being transferred or eliminated.

B.2.3 Savings Clause - Flood Protection

Section 385.37 of the Programmatic Regulations requires that PIRs include an analysis of the project's impacts on levels of service for flood protection that existed on the date of enactment of WRDA 2000 (December 2000) and are in accordance with applicable law to demonstrate that the levels of service for flood protection will not be reduced by implementation of the project. Where appropriate and consistent with restoration of the natural system, opportunities to provide additional flood protection shall be considered. The conditions that existed on the date of enactment of WRDA 2000 are included in the Pre-CERP Baseline.

B.2.4 Project Assurances - Identification of Water for the Natural System

Section 385.35(b) of the Programmatic Regulations requires that each PIR identify the quantity, timing, and distribution of water to be dedicated and managed for the natural system necessary to meet TSP projected benefits.

B.2.5 Project Assurances - Identification of Water for Other Water-Related Needs

Section 385.35(b) of the Programmatic Regulations also requires that each PIR identify the quantity, timing, and distribution of water made available for other water-related needs of the region.

B.2.6 Draft Guidance Memoranda

The Programmatic Regulations require the development of six guidance memoranda jointly by the Corps and SFWMD in consultation with others. The Draft Guidance Memoranda dated July 2007 provided additional information to complete the analyses initially described in WRDA 2000; however, since the guidance memoranda exist in draft form only, the PIRs completed prior to their approval can use appropriate methods deemed reasonable at the time. The July 2007 Draft Guidance Memoranda are available for review at the following link:

http://141.232.10.32/pm/progr_regs_guidance_memoranda.aspx

Section 385.35(b)(3)(iii) of the Programmatic Regulations specifically states that "PIRs approved before... the development of the guidance memorandum may use whatever method the Corps of Engineers and the non-Federal sponsor deem is reasonable and consistent with the provisions of Section 601 of WRDA 2000." During the preliminary planning phases of the LRWRP project, the Corps and SFWMD advocated using efficiencies learned from the processes of developing prior PIRs, including prior CERP project methodologies for the technical analyses described in Draft Guidance Memoranda 3 (Savings Clause Requirements) and Draft Guidance Memoranda 4 (Identifying Water Made Available for the Natural System and for Other Water-Related Needs). The two draft memoranda provide additional background information and describe the analyses and tools to address the Savings Clause and project assurances requirements of the Programmatic Regulations. The analyses completed for the LRWRP is documented in **Section B.3, Section B.4,** and **Section B.5** within this Annex and meets the intent of the draft memoranda while fulfilling the requirements of Section 601 of WRDA 2000 and the Programmatic Regulations.

Section B.3.1 of this report contains the key assumptions common to Savings Clause and project assurance analyses including an overview of the modeling tools available, the scenario assumptions, and the regional project effects resulting from achieving the LRWRP PIR objectives.

Section B.3.2 of this report contains a description of the assumptions, concepts, and methodologies applied for the LRWRP PIR evaluation of Savings Clause requirements.

Section B.3.3 contains a description of the assumptions, concepts, and methodologies applied for the LRWRP PIR evaluations to identify water made available by the project for the natural system and for other water-related needs of the region.

Section B.4 describes the results of these analyses, while **Section B.5** provides conclusions and identifies the amount of water made available by the project for the natural system to be reserved or allocated by the State of Florida and the amount of water made available for other water-related needs.

B.3 Methods

The same hydrologic models used for plan formulation are typically applied to the Savings Clause and project assurance analyses. This ensures consistency when representing the project effects in the analyses subsequent to plan selection. The Lower East Coast Subregional Model – North Palm (LECSR-NP) hydrologic model was used to simulate and evaluate the environmental effects of the LRWRP PIR array of alternatives through comparison with future without project base condition simulated with the same model. The LECSR-NP boundary includes the area between Lake Okeechobee and the coast, bounded on the south by the C-51 and L-10/12 Canals and on the north by the C-44 Canal. LECSR-NP is a MODFLOW-groundwater model with integrated surface water packages. Tidal conditions were modeled using historical conditions. Canal stages for Lake Okeechobee and the L-8, C-44, and C-51 canals were obtained from the South Florida Water Management Model (SFWMM), which also provided flows from the Control 2 structure along the M-Canal to the City of West Palm Beach (Giddings and Obeysekera 2018). The LECSR-NP model uses a 41-year period of hydrologic record (1965 through 2005) which includes sufficient climatological variability (including natural fluctuations of water) to represent the full range of hydrologic conditions experienced within the south Florida region over a long-term period. No one modeling tool or representation of model results can definitively predict with-project hydrologic conditions across the project area given the large regional scope of the project, model tool limitations and assumptions, and future uncertainties regarding the effects of other projects. However, each snapshot of model results can

form the basis for applying best professional judgment to determine whether the potential effects of TSP would reduce the availability of an existing source of water or reduce the level of service for flood protection, and to quantify the water necessary to achieve the benefits of the plan. The Engineering Appendix A provides additional information from other modeling efforts that reaffirms that the LRWRP TSP does not reduce the level of service for flood protection.

The plan formulation process applied during LRWRP analyzed the environmental effects and benefits of the project alternatives through qualitative and quantitative comparisons between the future without (FWO) project condition and the future with-project condition. The FWO project condition describes what is assumed to be in place if none of the study's alternative plans are implemented. The FWO project condition for LRWRP assumes the construction and implementation of authorized CERP and non-CERP projects, and other Federal, State, or local projects constructed or approved under existing governmental authorities that occur in the LRWRP study area, as described in **Subsection 2.5** of the main report. The future with-project condition describes what is expected to occur as a result of implementing the TSP.

B.3.1 Project Objectives and Associated Baseline Model Assumptions

Viewed from a programmatic perspective, the identification of water for the natural system associated with the CERP involves an analysis of four different aspects of ecological responses to hydrologic changes: 1) responses to the change in the quantity of water received by the natural system; 2) responses to the timing of those deliveries; 3) responses to the distribution of water delivered to the natural system; and 4) responses to the quality of the water received by the natural system. In a project specific sense, however, the relative importance of each of these aspects (quantity, timing, distribution, and quality) will vary from project to project depending upon the specific objectives established for the project.

For example, some CERP projects may focus formulation efforts on simply changing the timing (i.e., seasonality) or distribution (i.e., inflow and outflow points or internal movement) of water delivered to the natural system. Other projects may focus primarily on increasing or decreasing the amount of water delivered to the natural system depending on its needs, while still other projects may focus on improving the quality of the water delivered to the natural system to maintain desirable ecological community structure. These aspects, depending upon their applicability to specific CERP projects, are addressed during plan formulation through performance measures and evaluation criteria used to evaluate alternative plans and ultimately select a plan. Hydrologic targets for the natural system applied during plan formulation help to identify the quantity of water required to meet restoration objectives, in contrast to water that exceeds the targets and may be harmful or otherwise not contribute to meeting the restoration targets.

The TSP achieves the project objectives by changing the timing, distribution, and volume of water conveyed, to the natural system. The regional scale of the TSP results in water moving between ecosystems and basins consistent with the project's objectives (**Table B-1**). The water made available for the natural system is the water required for the protection of fish and wildlife within natural systems, including water that contributes to meeting hydrologic, water quality, and ecologic targets for natural system restoration. The Savings Clause and project assurances analyses for this TSP will focus on whether these regional-scale changes meet the requirements of WRDA 2000 and the Programmatic Regulations.

Table B-1. Goals and objectives of CERP and LRWRP.

CERP Objective	LRWRP Objective
CERP Goal: Enhance Ecological Values	**LRWRP Goal: Enhance Ecological Values**
Increase the total spatial extent of natural areas	Objective 3: Increase natural area extent of wetlands.
Improve habitat and functional quality	Objective 1: Restore wet and dry season flows of water to the National Wild and Scenic Northwest Fork of the Loxahatchee River and the river floodplain. Objective 2: Restore oysters, seagrass and other estuarine communities in the Loxahatchee River Estuary. Objective 4: Restore connections between Corbett WMA, Pal-Mar/Cypress Creek basin, Loxahatchee Slough, Grassy Waters Preserve and Loxahatchee River to improve hydrology, sheetflow, hydroperiods, natural storage, and vegetation communities.
Improve native plant and animal species abundance and diversity	Objective 5: Restore native plant and animal species abundance and diversity in Loxahatchee River watershed natural areas, river, and estuary.
CERP Goal: Enhance Economic Values and Social Well Being	**N/A**
Increase availability of fresh water (agricultural/municipal & industrial)	No corresponding objective. Potential incidental benefit to increase availability of water supply.
Reduce flood damages (agricultural/urban)	No corresponding objective. Potential incidental benefit.
Provide recreational and navigation opportunities	No corresponding objective, but project will provide recreational opportunities consistent with ecosystem restoration.
Protect cultural and archeological resources and values	No corresponding objective, but project will protect cultural and archeological resources and values.

The analyses of the Saving Clause and Project Assurance requirements includes considerations of three different sets of assumptions at two different points in time or conditions; 1) The Existing Condition Baseline (ECB) and 2) the Future Without Project baseline (FWO) and 3) future with the project (TSP). The model assumption tables for all base conditions are provided in Giddings and Obeysekera (2018).

The LRWRP PIR documentation and complete sets of LECSR-NP hydrologic model performance measure output are posted on the USACE and SFWMD public web sites for the LRWRP:

https://www.sfwmd.gov/our-work/cerp-project-planning/lrwrp-performance-measures

http://www.saj.usace.army.mil/Missions/Environmental/Ecosystem-Restoration/Loxahatchee-River-Watershed-Restoration-Project/

The assumptions for the ECB and the FWO are essentially identical (**Table B-2**) and no demonstrable differences between the ECB and FWO model results are evident. As a result, only the FWO was used in

the comparison of the TSP. The Alt 5 model run results are used for the TSP analysis, as Alt 5R was not modeled. Alt 5 and Alt 5R features are very similar and using Alt 5 is appropriate for the savings clause and project assurances analysis.

Table B-2. Modeling Scenarios for Savings Clause and Project Assurances.

Condition	Intent	Equivalent for LRWRP	Model Scenario
Existing Condition	Actual conditions at the time of the TSP is selected, including land use, operations, and demands. Demands can be either permitted or projected, whichever is greater.	2014 conditions with only the projects and operations approved and in effect. Permitted demands are included.	ECB
Initial Operating Regime Baseline	Future conditions at the time the TSP is operational, including land use, operations, and demands. Demands can be either permitted or projected, whichever is greater.	The future condition when the project will be initially operated, including non-CERP projects, CERP projects (with completed PIRs), and LRWRP features with associated operations. Permitted demands are included.	FWO

B.3.1.1 Volume Probability Curves and Stage Duration Curves

To identify the quantity, timing, and distribution of water for the natural system, a probabilistic approach was selected utilizing volume probability curves to depict the distribution of volumes of water that provide natural system benefits as a result of project features or to determine whether water is eliminated or transferred from natural systems. These volumes of water may include water that is available to meet natural system needs without project features and the water made available from TSP features to meet natural system needs through the entire range of historic climatologic conditions. For purposes of identifying the increase in the volume of water for the natural system, volume probability curves were produced depicting the range of the quantities of water delivered for natural system areas and coastal estuaries under all climatic conditions through the LECSR-NP period of simulation used to perform project evaluations.

The volume probability curve indicates the probability (percentage of time equaled or exceeded, on the x-axis) that a certain quantity of water (expressed as flow or volume on the y-axis) is made available as a function of historical rainfall distribution. The water quantities are aggregated for each water year within the period of simulation, defined as starting in May of year 1 and continuing through April of year 2 (40 total water years in the 1965-2005 LECSR-NP period of simulation). Once computed, the values are ranked from highest to lowest. Volume probability curves quantify the frequency of annual water volumes delivered to the natural system.

To identify whether the project reduces the level of service of flood protection, evaluations focus on changes to water stages and their frequency at representative monitoring gauge locations and model cell locations within residential and agricultural areas. The LECSR-NP model has no capability to directly measure flood control on individual fields or during relatively short events, but the LECSR-NP can be used as a coarse-scale tool to indicate a potential change in flood risk. Like volume probability curves, stage duration curves indicate the probability (percentage of time equaled or exceeded, on the x-axis) that a certain stage (expressed in National Geodetic Vertical Datum [NGVD] on the y-axis) is achieved as a function of historical rainfall distribution. Stages are aggregated for each day in the LECSR-NP period of simulation. Once sorted, the values are ranked from highest to lowest. A more localized analysis, with higher resolution hydrologic and/or hydraulic models, will be performed if there is an indication of significant increase in flood risk from the regional analysis.

The Engineering **Appendix A, Annex A-3** provides preliminary simulations using the Hydrologic Engineering Center River Analysis System (HEC-RAS) model for the C-18W Reservoir (flow-way 2) and the Cypress Creek Canal/Gulfstream West flow-through marsh. These simulations will provide storm event analysis over a more granular model mesh than that of the LECSR-NP model. HEC-RAS model results will inform the design and operation of proposed structures, leading to greater confidence that the TSP will not impact flood protection.

B.3.2 Analyses for Savings Clause including Intervening non-CERP and CERP Projects

The changes to quantity, timing, distribution, and quality of water proposed by the project, as described in **Section B.3.1,** focus on meeting hydrologic restoration targets for the NW Fork of the Loxahatchee River and watershed wetland communities. The potential effects of the LRWRP reservoirs, ASR's, and wetland restoration improvements can be assessed by comparing stage duration curves and other results from the LECSR-NP model simulations for the ECB, FWO, and TSP. If no reductions to existing legal sources of water or levels of service for flood protection are indicated during the comparison, then the Savings Clause requirements are determined to have been met. If there is an elimination or transfer of an existing legal source of water, then a new source of water supply to replace the water lost as a result of implementation of the TSP will be identified.

Consistent with the approach outlined in Draft Guidance Memoranda 3, which was developed to meet the intent of WRDA 2000 and the Programmatic Regulation, the following guidance will be applied by LRWRP to address the effects of intervening non-CERP activities, if relevant:

- Savings Clause analysis only applies to changes from date of enactment of WRDA 2000 that result from "Implementation of the Plan";
- Intervening non-CERP activities are changes wholly outside of CERP – e.g., Lake Okeechobee Regulation Schedule (LORS) 2008, C-111 South Dade, etc.;
- Savings Clause does not require CERP to make up for reductions in quantity or quality of existing legal sources or levels of service for flood protection caused by intervening non-CERP activities, but CERP cannot cause further reductions;
- Savings Clause does not prohibit CERP from reducing quantity or quality of existing legal sources or levels of service for flood protection increased by intervening non-CERP activities, but CERP cannot reduce those increases below those in place on the date of enactment of WRDA 2000.

The only model-based comparison that accurately demonstrates the effects of only the LRWRP TSP is the future with the project condition (TSP) compared to the future without the project (FWO). This comparison segregates the effects of the intervening CERP and non-CERP projects. Plus, the LRWRP is hydrologically separate from CERP and, as such, no intervening CERP projects affect the LRWRP project area. Therefore, the comparison for savings clause analysis is the future without project (FWO) to the future condition with the project (TSP).

B.3.2.1 Savings Clause – Elimination or Transfer of Existing Legal Sources of Water

To analyze the potential elimination or transfer of existing legal sources, affected basins or users are evaluated. The basins and users that may be affected by the project are displayed in **Table B-3,** classified according to the categories identified in WRDA 2000.

Table B-3. Existing legal sources evaluated for elimination and transfer.

WRDA 2000, Section 601(h)(5)	User or Natural System Evaluated in LRWRP
(i) an agricultural or urban water supply;	A portion of the Lake Okeechobee Service Area (LOSA). A portion of the Upper East Coast Service Area within the study area (WRA 1). The North Palm Beach Service Area within the study area (WRA 2).
(ii) allocation or entitlement to the Seminole Indian Tribe of Florida under section 7 of the Seminole Indian Land Claims Settlement Act of 1987 (25 U.S.C. 1772e);	Not applicable to this project.
(iii) the Miccosukee Tribe of Indians of Florida;	Not applicable to this project.
(iv)water supply for Everglades National Park; or	Not applicable to this project.
(v) water supply for fish and wildlife.	Loxahatchee River Northwest Fork and Estuary. Watershed wetlands (Loxahatchee Slough, Pal-Mar East, Loxahatchee Tributaries).

The primary LECSR-NP model results evaluated for effects to agricultural or urban water supply are the frequency, severity, and volume of water use cutbacks, which is applicable to Water Restriction Area 1 (WRA 1), which includes the Martin County portion of the study area), and Water Restriction Area 2 (WRA 2), which includes a portion of the North Palm Beach Service Area. Additional information available to evaluate agricultural and urban water supplies includes sub-regional groundwater differences maps, regional water supply deliveries, and groundwater stages near public water supply wellfields. The selected metrics provide more direct and higher resolution measures of potential water supply effects for the LRWRP Savings Clause assessment than would be provided through assessment of inflow volume probability curves for each user group or basin. Changes in the frequency, severity or volume of water use cutbacks must be evaluated to see if the water sources have been eliminated or transferred in the simulation of the with-project condition. The model results are described in **Sections B.4.1.1** and **B.4.1.2**.

B.3.2.2 Savings Clause - Flood Protection

Flood protection is evaluated by a combination of best professional judgment interpreting model results and engineering analyses. Consistent with the Draft Guidance Memoranda, the same models and results

used for plan formation were applied for the LRWRP Savings Clause assessment. This varies from typical storm event analyses by using a long period of record simulation and focusing on the wet events included within the 1965–2005 simulation period. Stage duration curves for various areas of interest compare the groundwater elevations of the TSP relative to the FWO and ground elevations to determine if the TSP may impact flood protection. **Figure B-9** in this Annex shows the of point locations for the stage duration curves relative to discussion of model results.

Flood protection within the study area were analyzed including:

- residential developments in Martin County (Ranch Colony, Old Trail and others),
- Hobe St. Lucie Conservancy District Unit 2 Agricultural Area,
- residential areas adjacent to Grassy Waters Preserve, upstream of Kitching Creek, and
- Jupiter Farms residential area.

Groundwater levels in the study area have been significantly impacted through the development of a secondary canal system with little or no control to manage canal flows and stages. Residential areas in Flow-way 3, the Unit 2 Agricultural Area, and the area of Pal-Mar to the west drain through this canal system, resulting in extremely variable discharges to tide. This also results in excessive discharges via the Cypress Creek Canal to the Cypress Creek Tributary in the wet season and little or no available water during the dry season. The alternatives, including the TSP result in more effective control of stormwater flows and an increase in groundwater levels, in some cases by greater than two (2) feet.

The Cypress Creek Canal provides drainage for areas to the west (Culpepper, Pal-mar) via a series of culverts that discharge into the canal. In the existing condition, all the drainage to Cypress Creek flows unimpeded, resulting in excessive storm water flows and excessively reduced area groundwater levels. Complaints of depleted groundwater stages, resulting in excessive interior lake drawdowns in the dry season, are common. Control elevations for the communities are variable, ranging from 14.5’ NGVD to 17.0’ NGVD.

B.3.3 Analyses for Project Assurances – Identifying Water Made Available by the Project for the Natural System and Other Water Related Needs

Identification of water for the natural system is based on the concept of water needed to achieve the benefits of the project and the overarching objective of restoration, preservation, and protection of the South Florida Ecosystem. The water made available for the natural system is the water required for the protection of fish and wildlife, including water that contributes to meeting hydrologic, water quality, and ecologic targets for restoration of natural systems. Hydrologic targets for the natural system applied during plan formulation help to identify water required to meet restoration objectives, in contrast to water that exceeds the targets and may be harmful or otherwise not contribute to meeting the restoration targets.

Water for project assurances is quantified where project benefits accrue, consistent with the habitat unit benefits quantified during TSP plan formulation resulting from water being made available by the project. The basins where the project may potentially supply water for the natural system or other water-related needs are listed below:

- Natural System

  - Loxahatchee River NW Fork (at and upstream of Lainhart Dam)
  - Watershed Wetlands (Loxahatchee Slough, Cypress Creek, Pal-Mar)
- Other Water Related Needs
  - Water Restriction Area 1
  - Water Restriction Area 2

Identification of the water made available by the project requires analyses of the LECSR-NP results for the TSP. The identification of water involves both 1) water that is available to the natural system and available for other water-related needs in the FWO scenario, and 2) water made available by the project to the natural system and for other water-related needs, as depicted in **Figure B-1**. The sum of these two categories is the total water that is expected to be available to the natural system and available for other water-related needs.

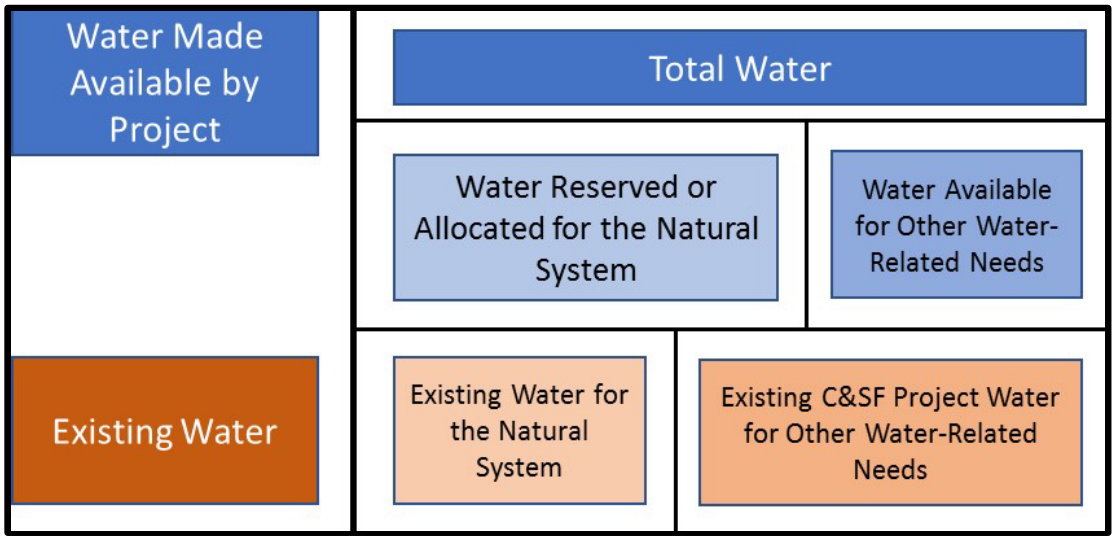

Figure B-1. Water needed to achieve the benefits of the plan.

The LRWRP captures and stores water that would otherwise be lost to tide and, therefore, unavailable for beneficial use. LRWRP is hydrologically separate from most of the CERP, with a connection only via the L-8 Canal to Lake Okeechobee. The total water made available by the project, by year, is estimated as the difference between the 2070 FWO and the with-project condition (TSP minus FWO) as depicted in **Table B-4**.

Table B-4. Summary of Analyses for the Identification of the Average Annual Water Made Available by the Project.

Analysis	Water for the Natural System
Existing pre-project water for the natural system	FWO
Total water for the natural system with the project	TSP
Identification of water made available by the project	Difference between TSP and FWO

Five locations were selected to quantify the water needed to achieve the benefits of the LRWRP TSP for the Loxahatchee River NW and northern tributaries. These locations represent the inflows to the downstream locations where benefits are expected to result from implementation of the TSP.

- Surface water inflows from the C-18 Impoundment correspond to water captured by the impoundment from Corbett, C-18W canal, and Indian Trail Improvement District Flood Waters as well as outflow from ASR that is delivered downstream to the C-18 Canal.
- Flows over the G-161 structure from Grassy Waters Preserve.
- Flows over Lainhart Dam to the Loxahatchee River NW Fork.
- Flows from ITID to the C-18 Impoundment.
- Flows from the M-1 Pump Station to the M-Canal.

Quantification of water made available for the natural system is displayed using volume probability curves. The 10th, 50th, and 90th percentiles are identified for the TSP and the FWO. The difference between these conditions is the water made available by the project for the natural system.

To evaluate whether additional water is made available by the project to meet other water related needs, specifically water supply in the Water Restriction Areas, the changes to the level of service were evaluated. For the project area, whether additional water has been made available by the project in the regional system is quantified as a reduction in demands not met in the TSP when compared to the demands not met in the pre-project public water supplies (FWO) in WRA 1 and WRA 2 that could be achieved without affecting the benefits accrued to the natural system. The public water supply demands identified in the LRWRP PIR are assumed the same in both the pre-project future without and the with-project condition.

B.4 Results

This section provides the results of analyses of the savings clauses for elimination or transfer of existing legal sources of water and for flood protection, and project assurances for water made available for the natural system and water for other water related needs.

B.4.1 Elimination or Transfer of Existing Legal Sources of Water

Consistent with the WRDA 2000 and the Programmatic Regulations, the Savings Clause analysis removes the effects of the intervening non-CERP projects and compares the with-project condition (TSP) to the without project condition (FWO) to determine if any existing legal source of water has been eliminated or transferred.

The project area has two Water Restriction Areas (WRA). WRA 1 is the Martin County portion of the study area; WRA 2 is the Palm Beach County portion of the study area, from the Martin County line south to the C-51 Canal. The general locations for WRA 1 and WRA 2 are shown in **Figure B-2**

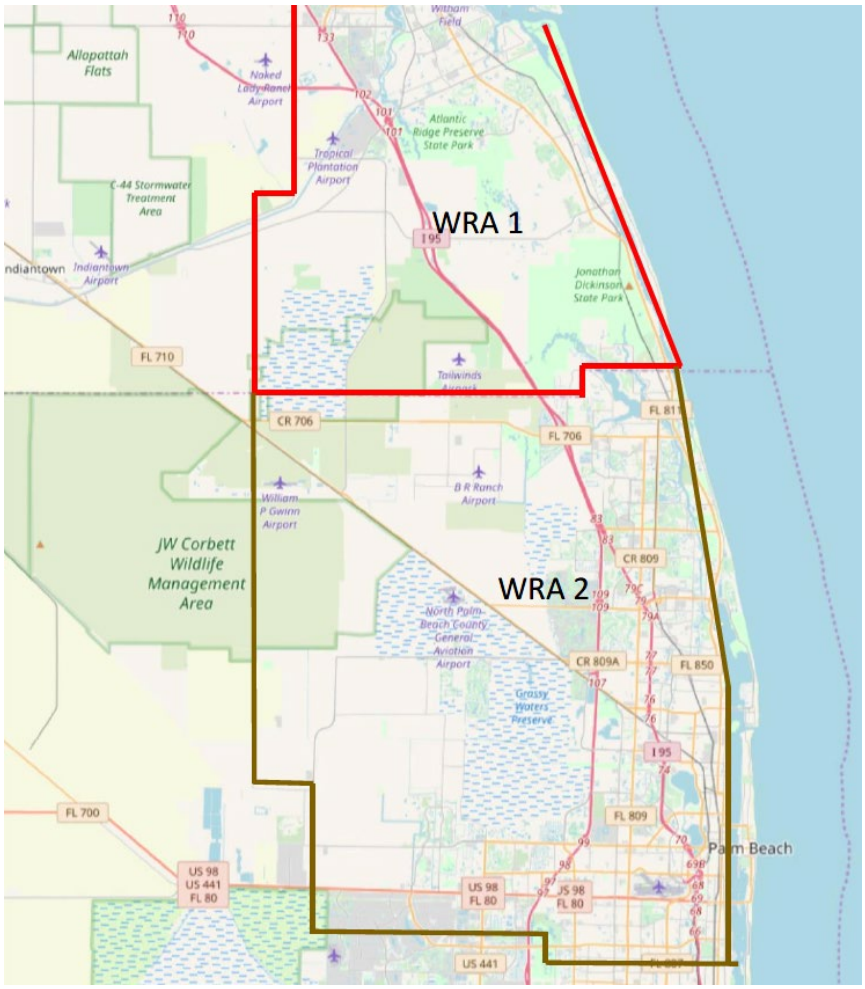

Figure B-2. General location of WRA 1 and WRA 2.

To determine if an elimination or transfer of existing legal sources of water occurred, an analysis was done using the frequency, duration, and severity of water use cutbacks during water shortages during periods of deficient rainfall. The trigger package for the LECSR-NP emulates the SFWMD water shortage policy by reducing water withdrawals when groundwater stages below designated levels in pre-identified trigger cells. There are four phases of cutbacks. The percentage of cutback is increased as the water levels decline further below the Phase 1 (15% cutback level). Although the LECSR-NP model predicts the absolute number of water supply cutback events and the corresponding frequency of occurrence have a high degree of uncertainty, relative comparisons between the ECB, FWO and TSP provide a meaningful comparison to quantify potential effects of the project.

Frequency is defined as the number of years when water use cutbacks occur for three consecutive months. Duration is measured by the total number of months of cutbacks. Severity is calculated in a similar fashion as duration except months with Phase 2 or Phase 3 cutbacks count as 2 or 3 months, respectively. No Phase 4 level of water supply restrictions were triggered in any of the LRWRP simulations.

B.4.1.1 Water Restriction Area 1 (southern Martin County)

Existing legal sources of water in WRA 1 include groundwater withdrawn by public utility wellfields, private wells, irrigation wells, and surface water withdrawals for landscape, recreation, and agricultural uses.

Water supply demand continues to be met by locally available water sources, primarily the surficial aquifer system. When Lake Okeechobee falls into the water shortage zone and water use cutbacks are imposed, only the public water suppliers and other users in WRA 1 that do rely on the regional system, including Lake Okeechobee, are included in the water shortage order. (Only HSLCD has some reliance on Lake Okeechobee and is subject to regional water use cutbacks.) The WRA 1 is placed under water shortage order when local groundwater levels decline below trigger levels. This function is represented in the LECSR-NP trigger package.

In WRA 1, the frequency, duration and severity of water restrictions (water use cutbacks) triggered by dry conditions including droughts are identical between the ECB, FWO and the TSP (**Table B-5**). Locally triggered events in WRA 1 are not influenced by the TSP. The same months and the same level of cutbacks were triggered in the ECB, FWO and the TSP. (**Figure B-3**, **Figure B-4** and **Figure B-5**). As shown in **Table B-6** the volumetric differences between the ECB, FWO and TSP are negligible. In part, this is due to the distance between major water users and the project features. The demands not met are categorized according to use: Aquifer Storage and Recovery (ASR), Public Water Supply (PWS), Golf Irrigation (GOL), Nursery Irrigation (NUR), Agricultural – Flood Irrigation (AG1-FL), Agricultural – Overhead Irrigation (AG1-OH), Agricultural- Low Volume Irrigation (AG2-LV) and Industrial (IND).

Table B-5. The frequency, duration and severity of water shortages in the pre-project and post-project simulations for WRA 1 (in months).

Scenario	Frequency (months)	Duration (months)	Severity (months)
ECB	5	22	27
FWO	5	22	27
TSP	5	22	27

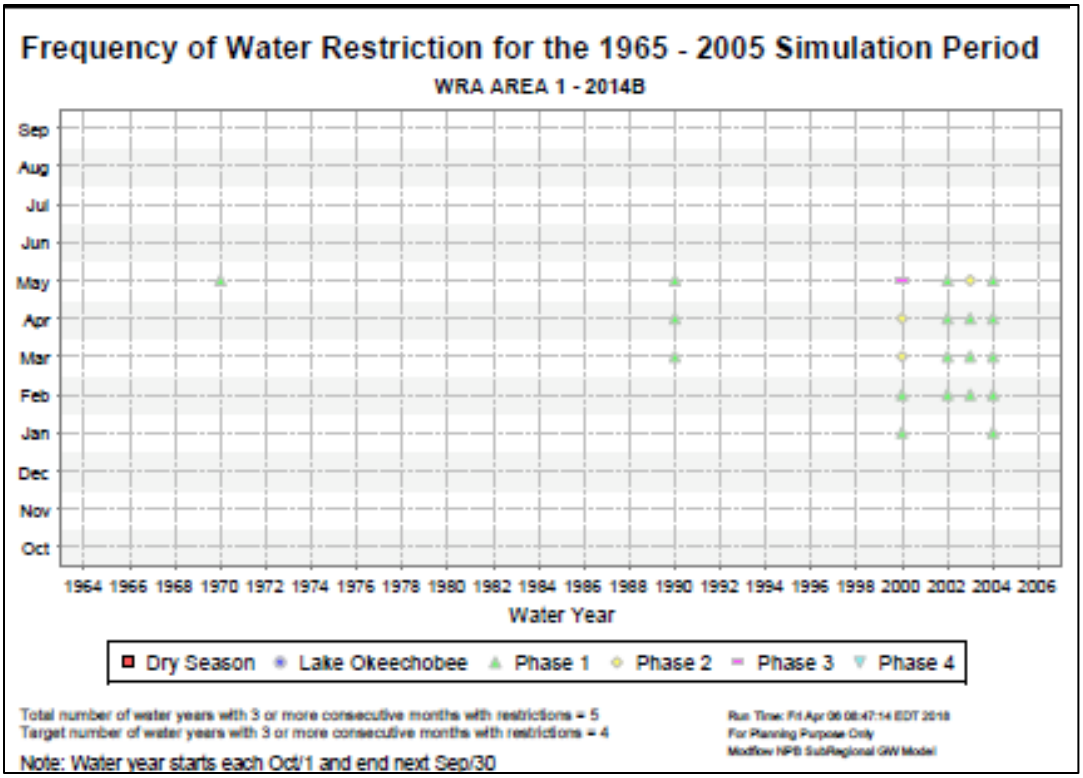

Figure B-3. Locally triggered water restrictions in WRA 1 during the ECB simulation.

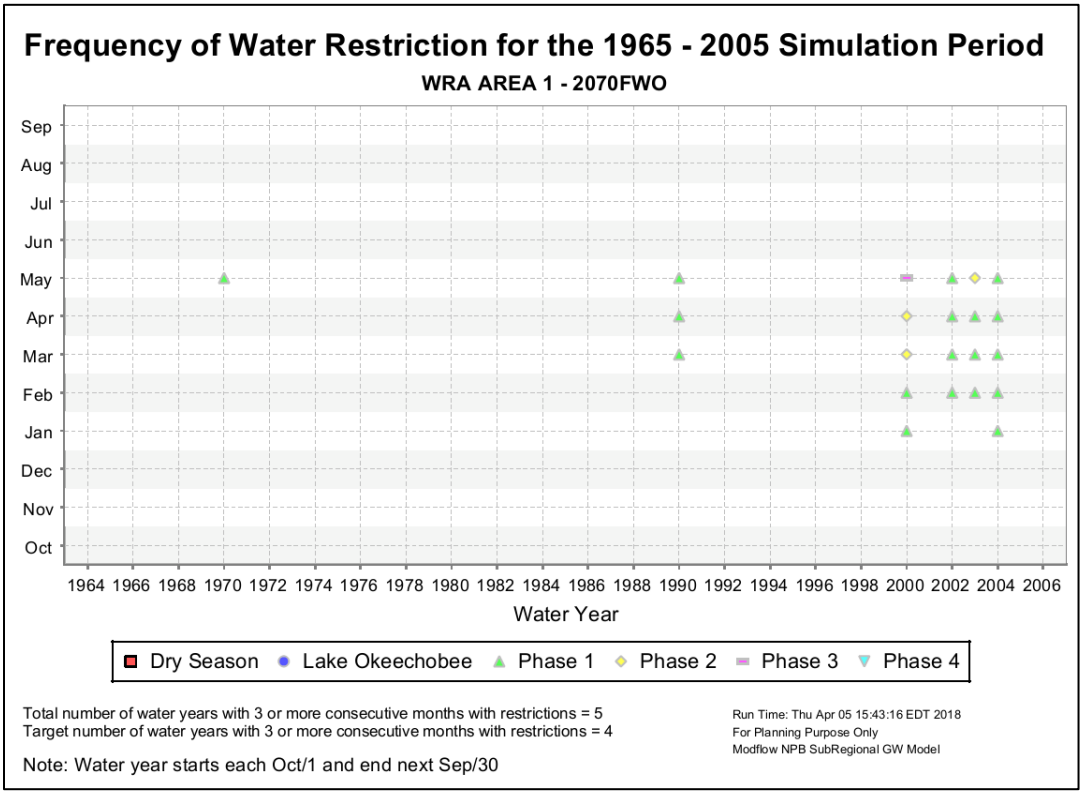

Figure B-4. Locally triggered water restrictions in WRA 1 during the FWO simulation.

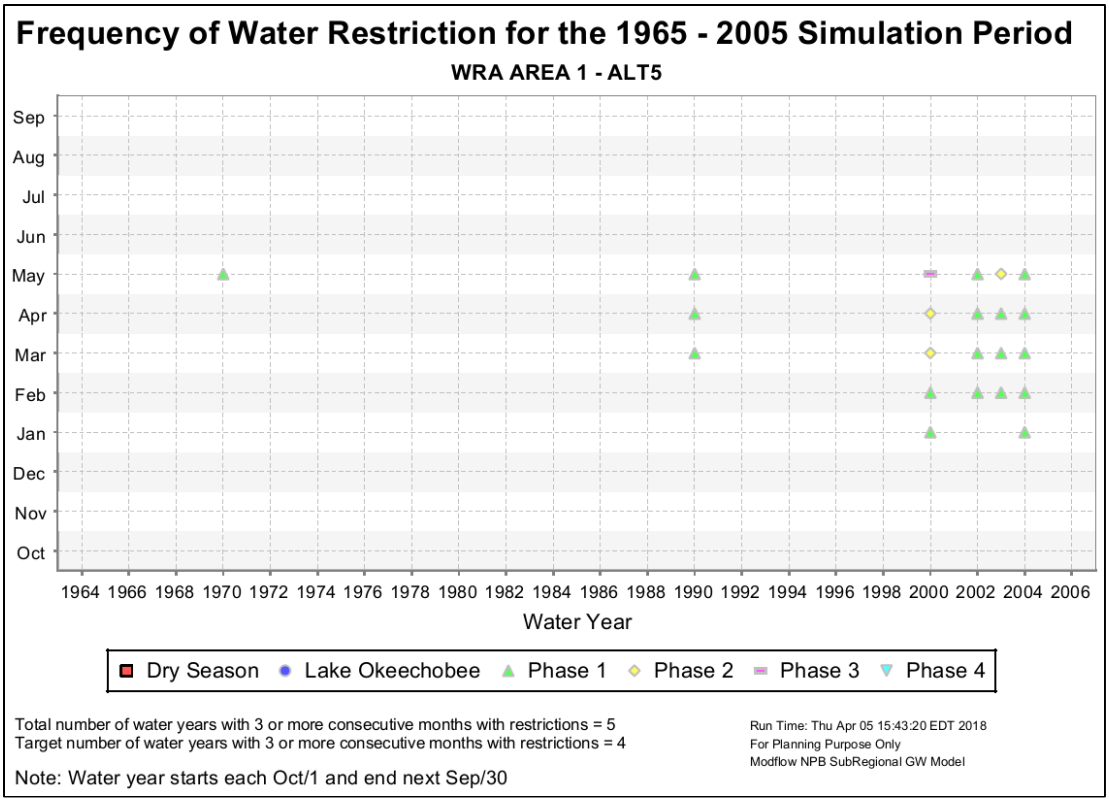

Figure B-5. Locally triggered water restrictions in WRA 1 during the TSP simulation.

Table B-6. Million gallons demand not met due to water restrictions for all use categories in WRA 1 for the ECB, FWO and TSP simulations for the period of record 1965-2005.

Alt/type	ASR	PWS	LAN	GOL	NUR	AG1-FL	AG1-OH	AG2-LV	IND
ECB	0	40	0	2	0	0	0	0	0
FWO	0	39	0	2	0	0	0	0	0
TSP	0	39	0	2	0	0	0	0	0

B.4.1.2 Water Restriction Area 2 (North Palm Beach County)

WRA 2 receives water supply from the regional system and water use cutbacks can be triggered by either Lake Okeechobee stages or by stages at local groundwater trigger sites in the service area. The TSP does not change either the frequency or severity water use cutbacks relative to the ECB and FWO (**Table B-7**).

Over the entire 41 years of simulation, 14 years showed water use cutbacks (**Figure B-6**, **Figure B-7** and **Figure B-8**). The TSP results in a slight reduction in demands not met for PWS (**Table B-8**). In the TSP, the total demand not met for PWS in WRA 2 in 14 years with water restrictions is 4,417 million gallons (MG). The FWO had a slightly larger demand not met, 4,419 MG. Thus, the TSP showed a 2 MG improvement in demands not met. Averaged over the 14 years of cutbacks, the difference is not significant, representing an improvement of less than 1 percent **(Table B-8**).

Table B-7. Frequency, duration and severity of locally triggered water use cutbacks in WRA 2 (months).

Scenario	Frequency (months)	Duration (months)	Severity (months)
ECB	2	16	16
FWO	2	16	16
TSP	2	16	16

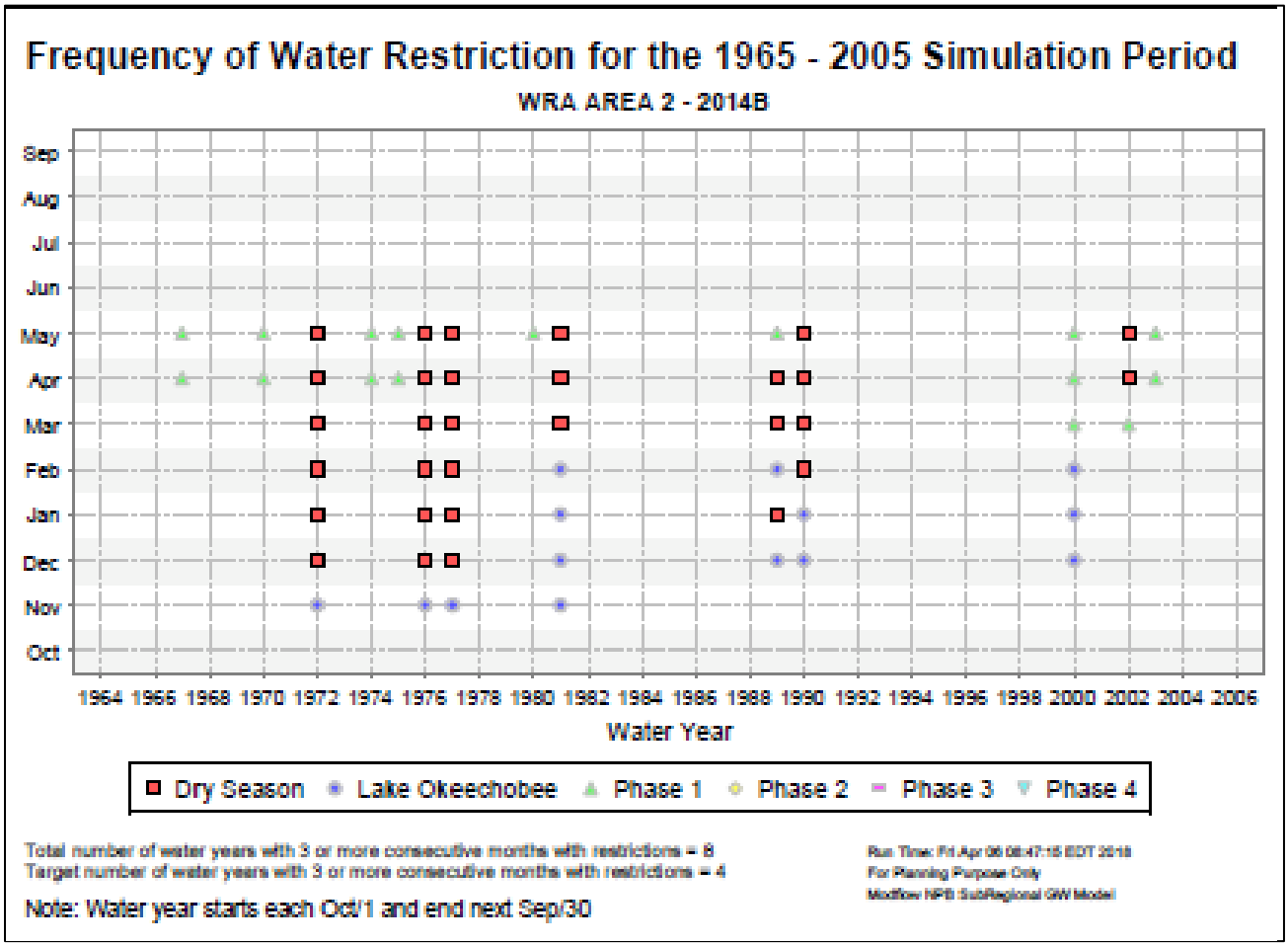

Figure B-6. Locally triggered water restrictions in WRA 2 during the ECB simulation.

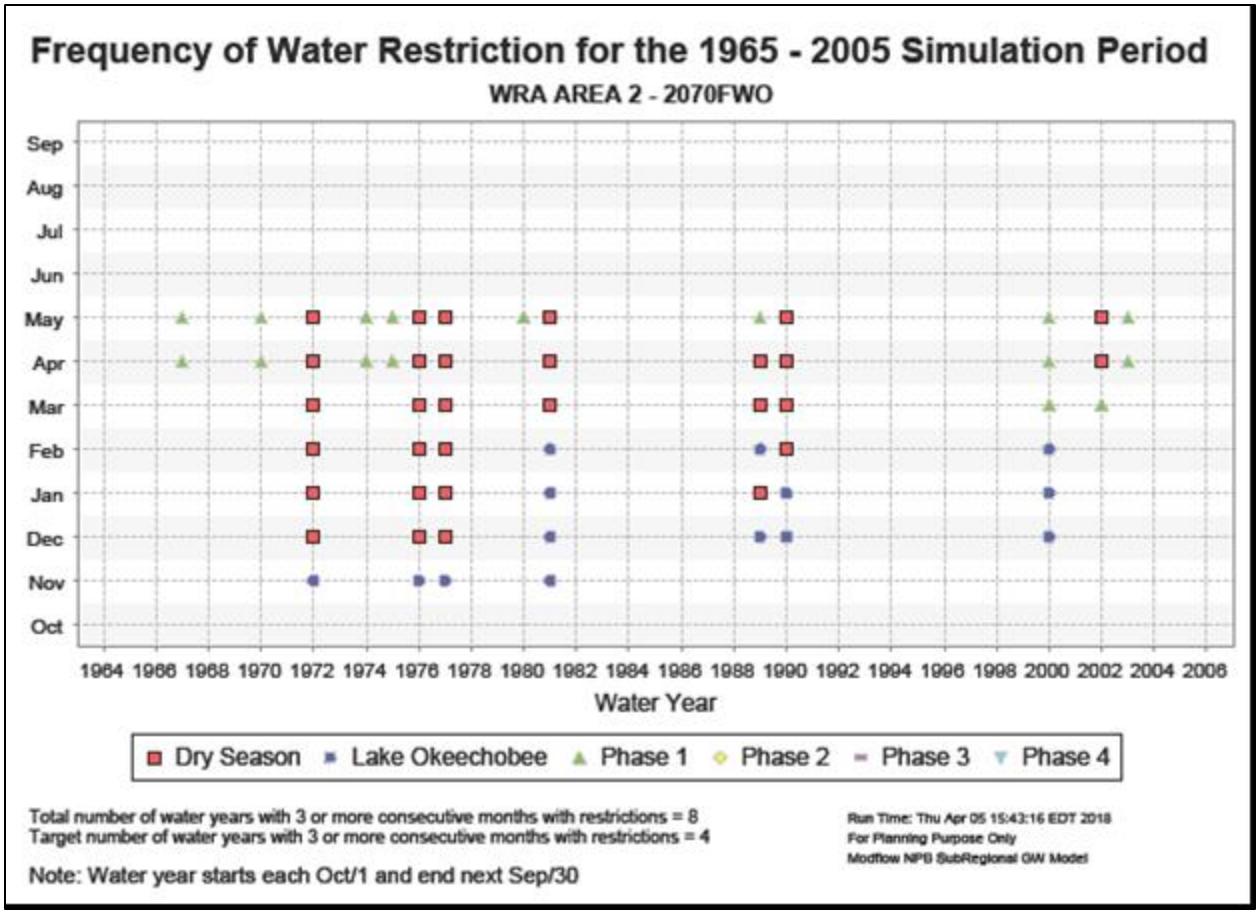

Figure B-7. Locally triggered water restrictions in WRA 2 during the FWO simulation.

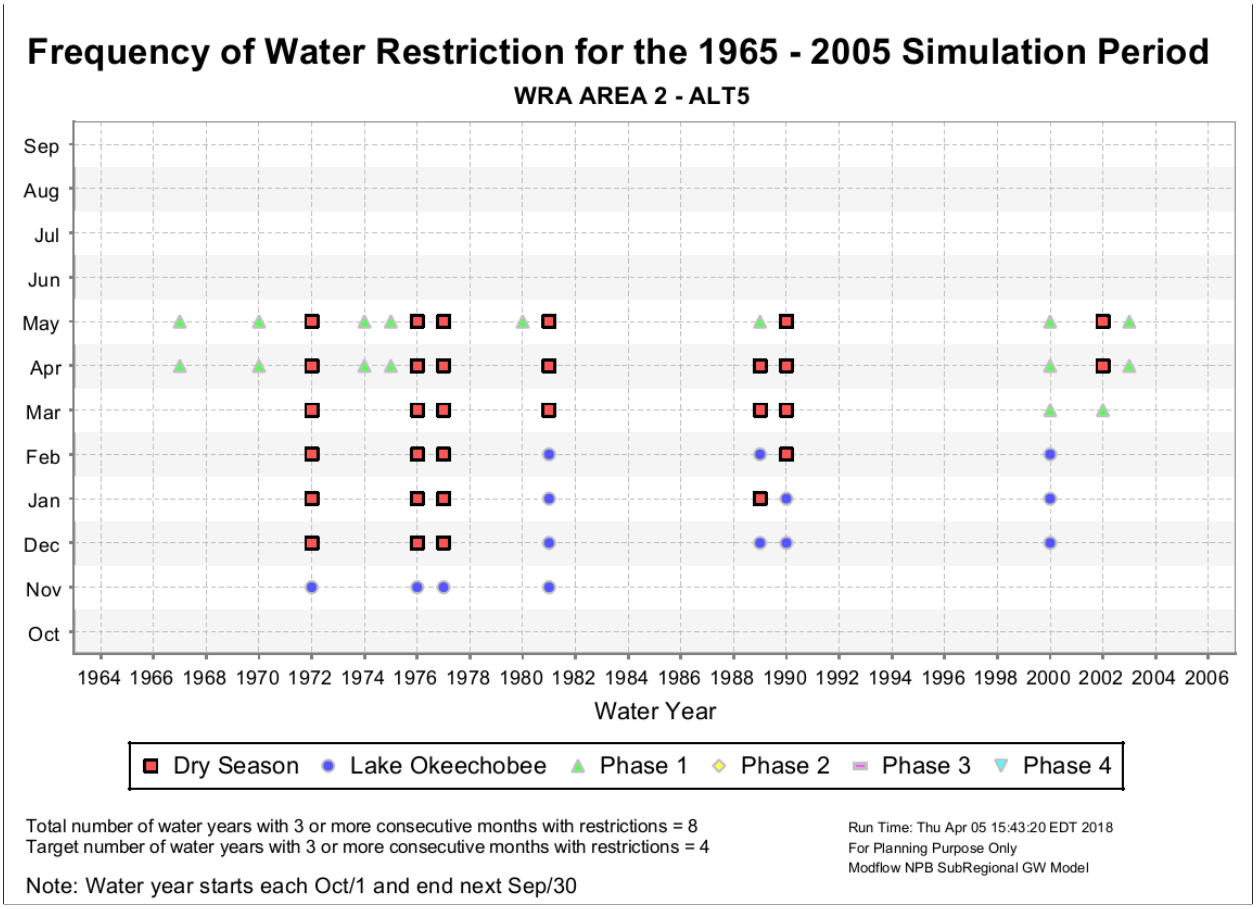

Figure B-8. Locally triggered water restrictions in WRA 2 during the TSP simulation.

Table B-8. Million gallons of demand not met due to water restrictions for all use categories in WRA 2 during the ECB, FWO and TSP simulations for the period of record 1965-2005.

Alt/Type	ASR	PWS	LAN	GOL	NUR	AGR-FL	AGI-OH	AG2-LV	IND
ECB	0	4,438	0	51	0	0	0	0	0
FWO	0	4,419	0	51	0	0	0	0	0
TSP	0	4,417	0	51	0	0	0	0	0

B.4.2 Savings Clause - Flood Protection

B.4.2.1 Stage Duration Curves

The engineering subteam identified areas to evaluate stage duration curves to assess the flood protection impacts of the TSP to the ECB and the FWO conditions (**Figure B-9**). A daily stage duration curve over the POR was assessed for each location. Stage duration curves for ECB, FWO and and the TSP are shown on one graphic, along with the ground elevation within the model cell for quick comparison. In most cases the ECB stage duration curve is hidden beneath the FWO curve indicating they are identical. The following locations were reviewed:

- Loxahatchee Slough
- Mecca Southern Point
- Ranch Colony Western, Eastern, and Central Points
- South Indian River Water Control District (SIRWCD)
- Jupiter Farms Eastern and Western Points
- Hobe St. Lucie Eastern Point
- The Links Central, Eastern, and Western Points
- Kitching Creek Point
- Ibis Point
- Ironhorse Point
- Jupiter Farms 1, 2 Points

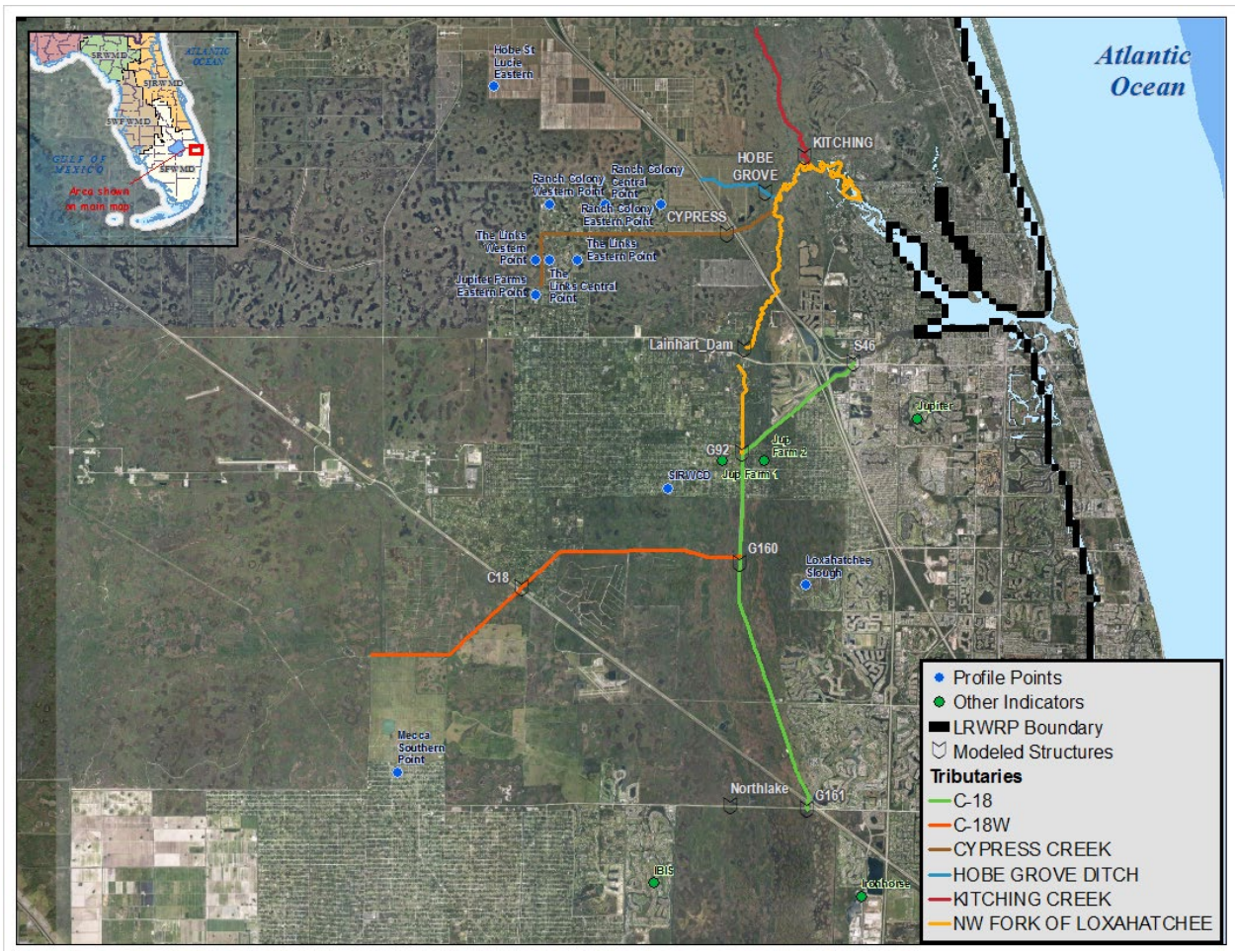

Figure B-9. Stage duration curve locations within the project study area

The Loxhatchee Slough point is located in the vicinity of the western edge of Old Marsh Golf Club, which abuts the Slough. The stage-duration curve below (**Figure B-10**) shows no noticeable increase in surface water stages.

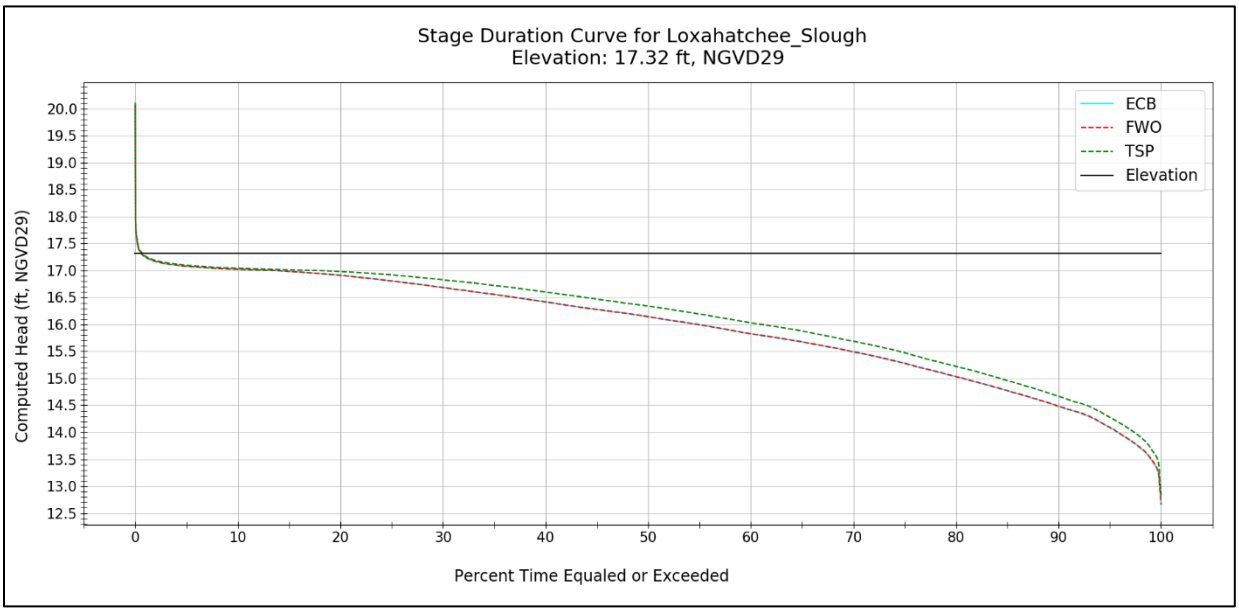

Figure B-10. Stage Duration curves of ECB, FWO and the TSP for Loxahatchee Slough.

The Mecca Southern Point is located in the vicinity of the northern edge of Indian Trail Improvement District residences, adjacent to the C-18 impoundment. The stage-duration curve, **Figure B-11** below, shows no water above ground elevation.

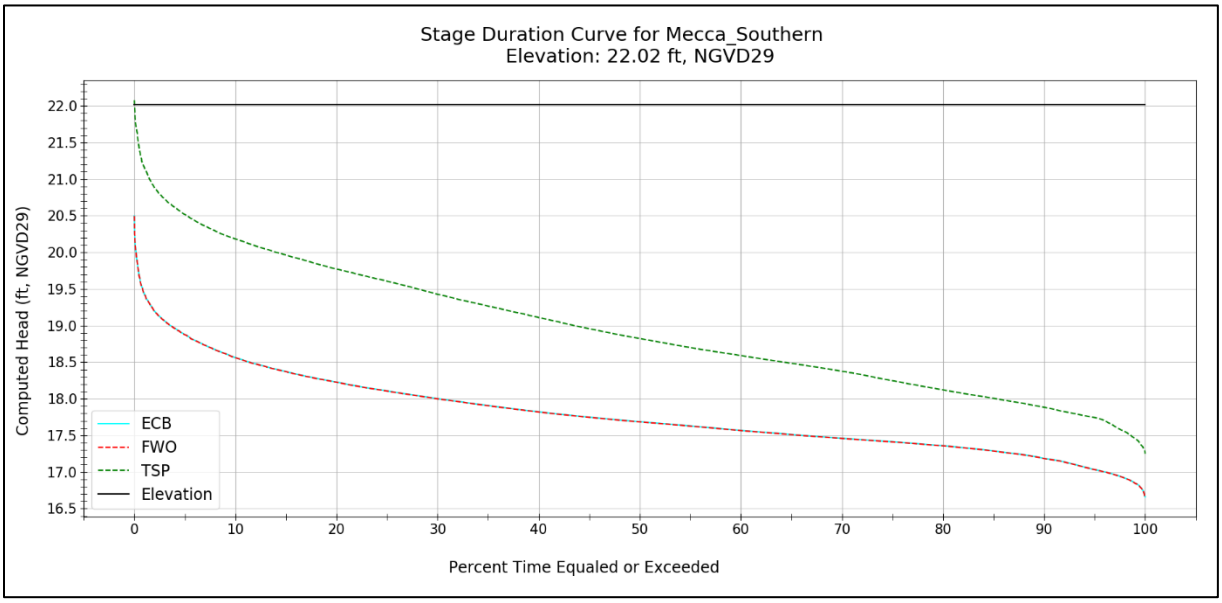

Figure B-11. Stage Duration curves of ECB, FWO and the TSP for Mecca South.

The Ranch Colony Points are located in the Ranch Colony and Old Trail developments, just north of Cypress Creek Canal. **Ranch Colony Western and Central profile points** indicate stages above the control elevations (14.5' to 15.5' NGVD) occur more frequently with the project, but remain below ground (**Figure B-12** and **Figure B-13**). This should not be problematic however it will further be investigated during the detailed design phase. **Ranch Colony Eastern point** is in the vicinity of Old Trail which has a control elevation of 16.0' NGVD. All stages over the model POR stay below this control elevation (**Figure B-14**). The stage-duration curves for all three Ranch Colony Points show no increase in water above ground elevation.

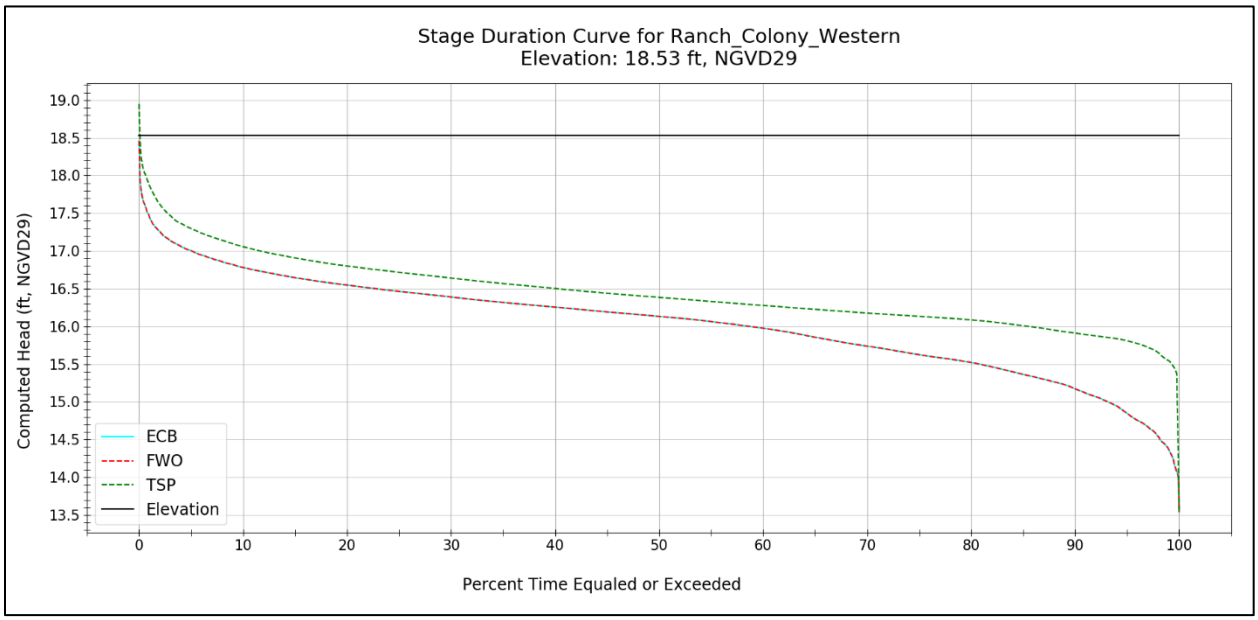

Figure B-12. Stage Duration curves of the ECB, FWO and TSP for Ranch Colony Western.

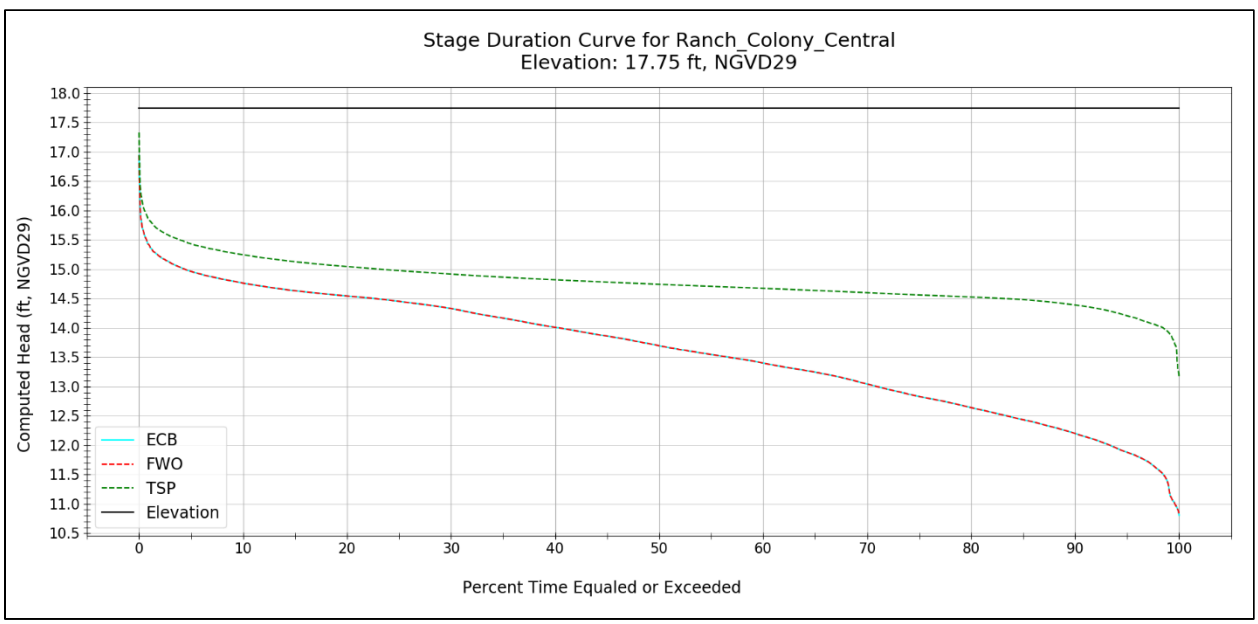

Figure B-13. Stage Duration curves of the ECB, FWO and TSP for Ranch Colony Central.

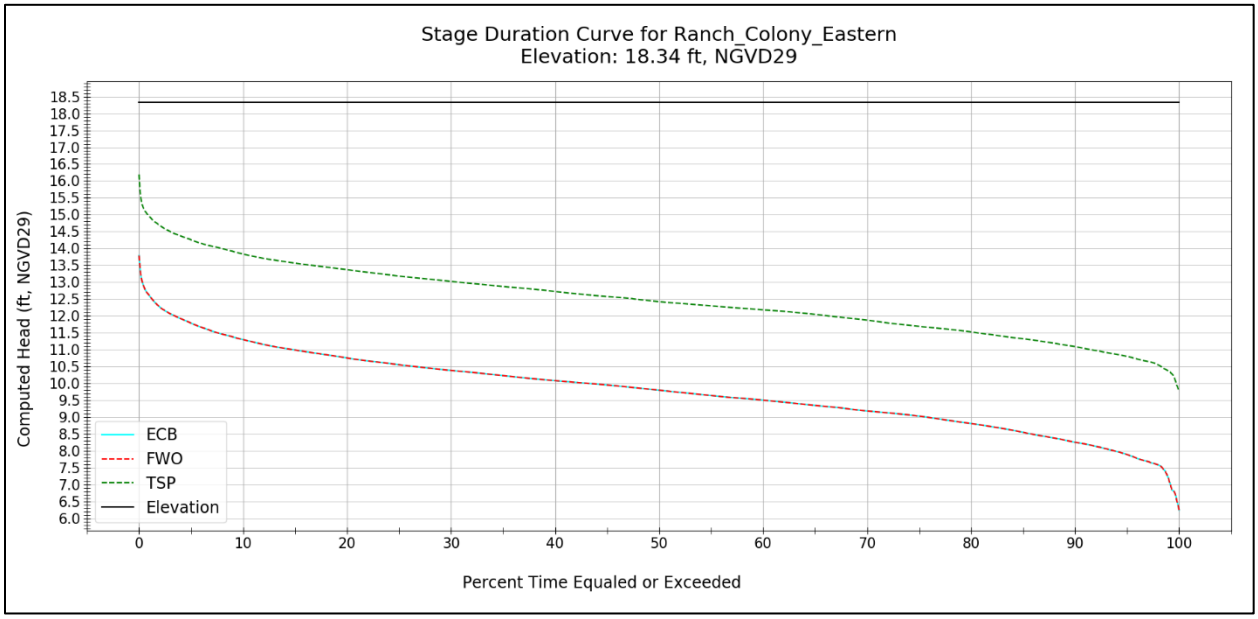

Figure B-14. Stage Duration curves of the ECB, FWO and TSP for Ranch Colony Eastern.

The SIRWCD and Jupiter Farms points represent the Jupiter farms residential development located west of the C-18 Canal. The stage-duration curves, **Figure B-15** and **Figure B-16** below, show no significant changes to groundwater or surface water stages.

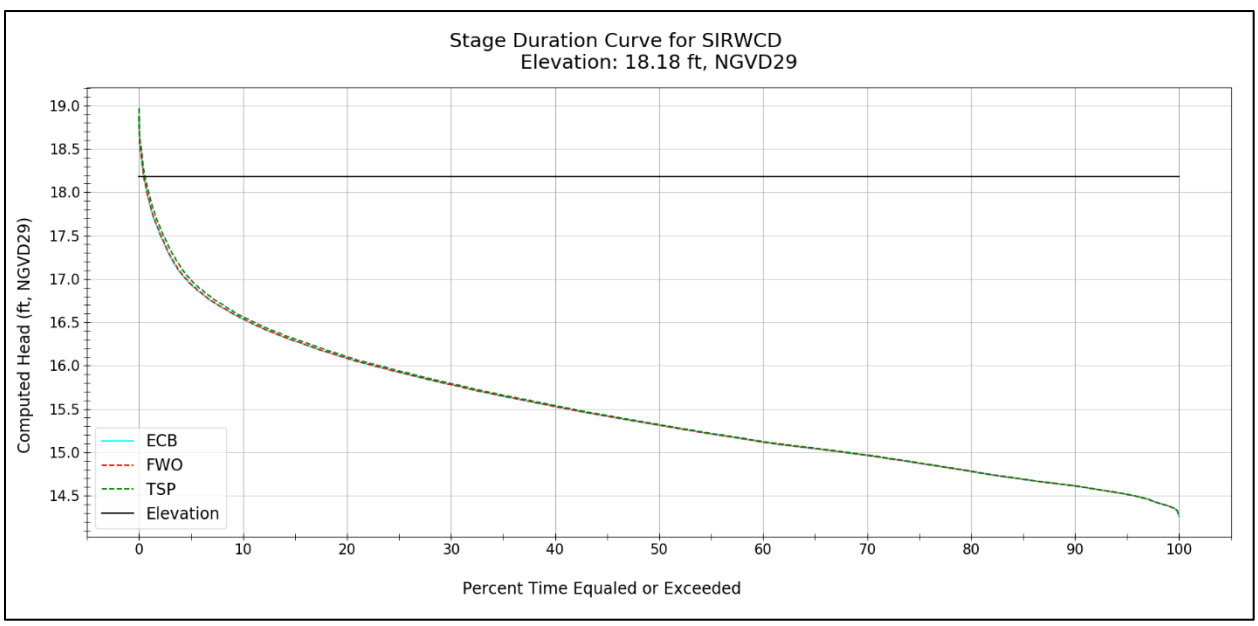

Figure B-15. Stage Duration curves of the ECB, FWO and TSP for SIRWCD.

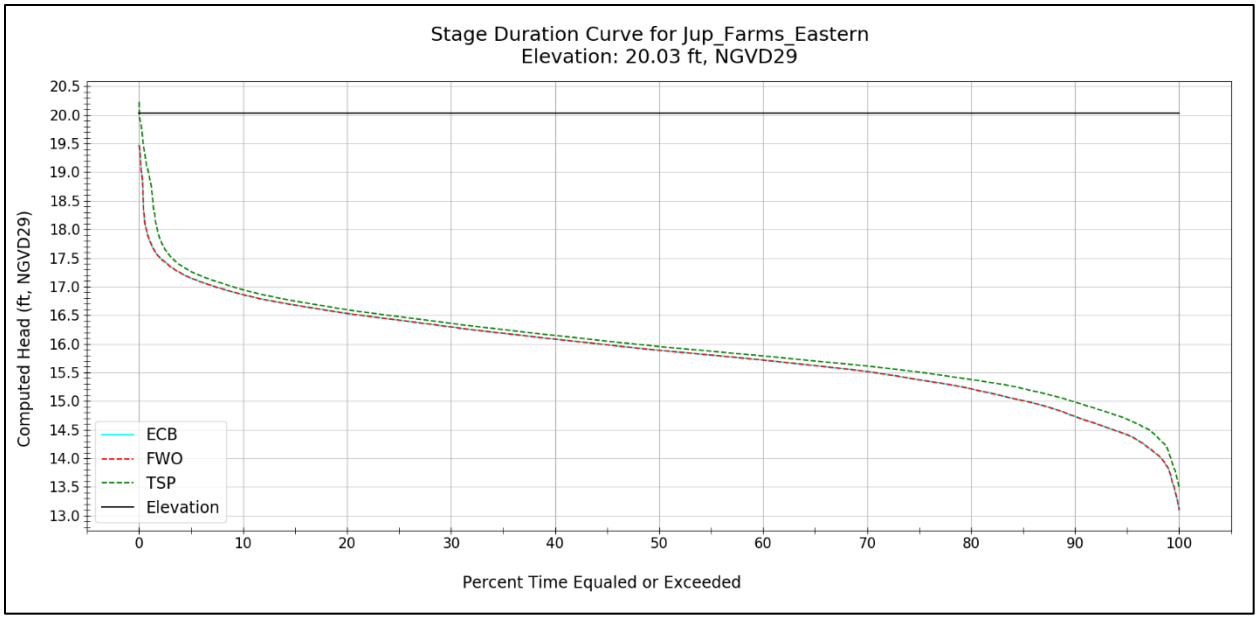

Figure B-16. Stage Duration curves of the ECB, FWO and TSP for Jupiter Farms Eastern Point.

The **Hobe St. Lucie Eastern** point represents the HSLCD agricultural area located north of the proposed flow through marsh. The stage-duration curve, **Figure B-17** below, shows no noticeable changes to groundwater or surface water stages.

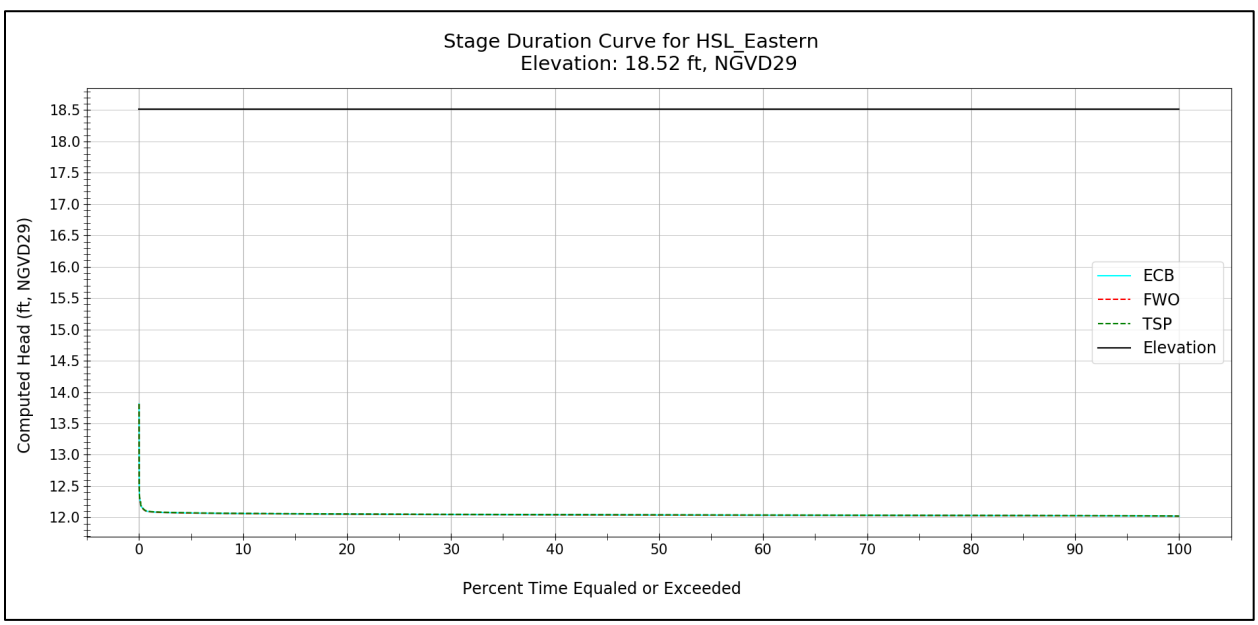

Figure B-17. Stage Duration curves of the ECB, FWO and TSP for Hobe St. Lucie Eastern.

The **Links Eastern and Central** points represent the Links residential development located south of the Cypress Creek Canal. The stage-duration curve for the **Links Eastern** point, **Figure B-18** below, shows no noticeable change to surface water stages. Given that the control elevation of the community is 17.0 feet NGVD, there may be an increase in stages over control elevation which seldom occurs in the ECB or FWO

condition as compared to a 10% frequency with the TSP. This is not necessarily a problem but will be further assessed during detailed design. The **Links Central** point **Figure B-19** below, shows little to no increase in stage frequency above 17.0 feet NVGD.

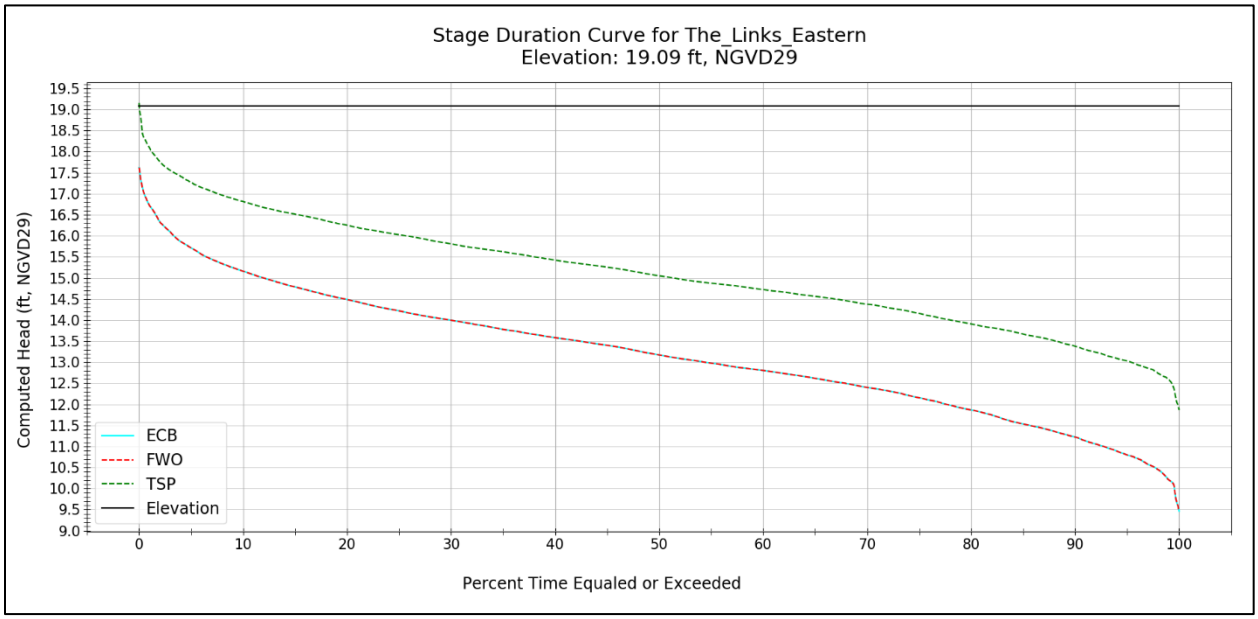

Figure B-18. Stage Duration curves of the ECB, FWO and TSP for The Links Eastern.

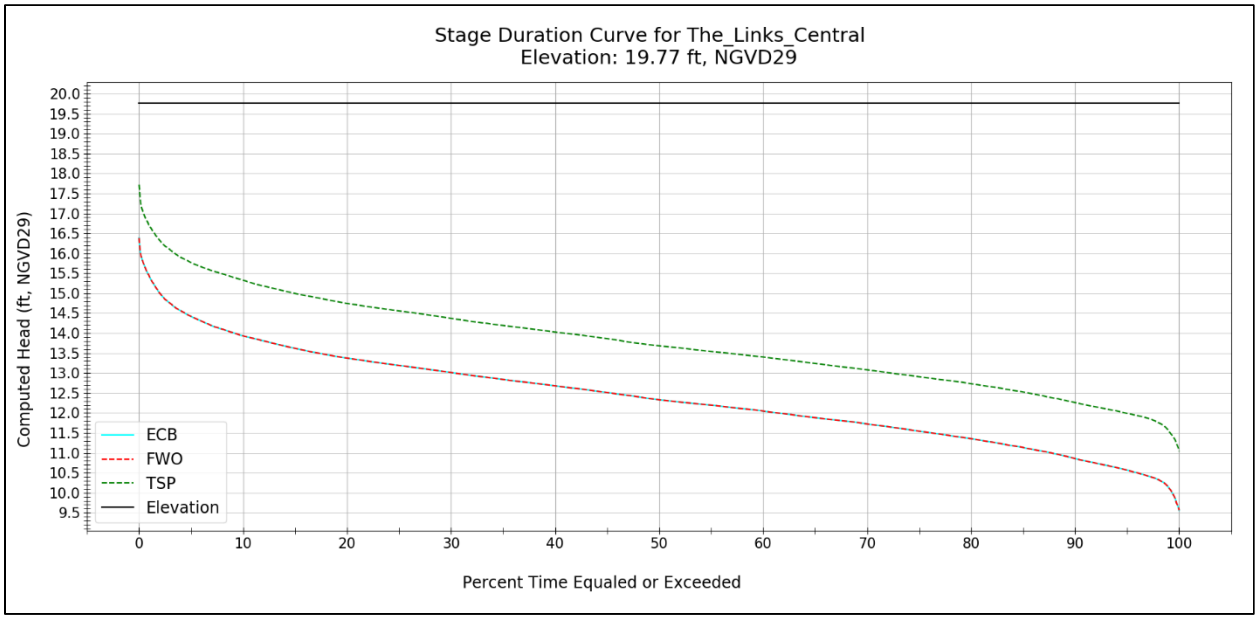

Figure B-19. Stage Duration curves of the ECB, FWO and TSP for The Links Central.

The Links Western Point stage duration curve, **Figure B-20** below, shows a slight increase in time above ground surface, from about 2% in FWO to about 6% with project. However, this point is located on the natural area side, to the west of the Cypress Creek canal, and increases to surface water stages are acceptable and preferred here.

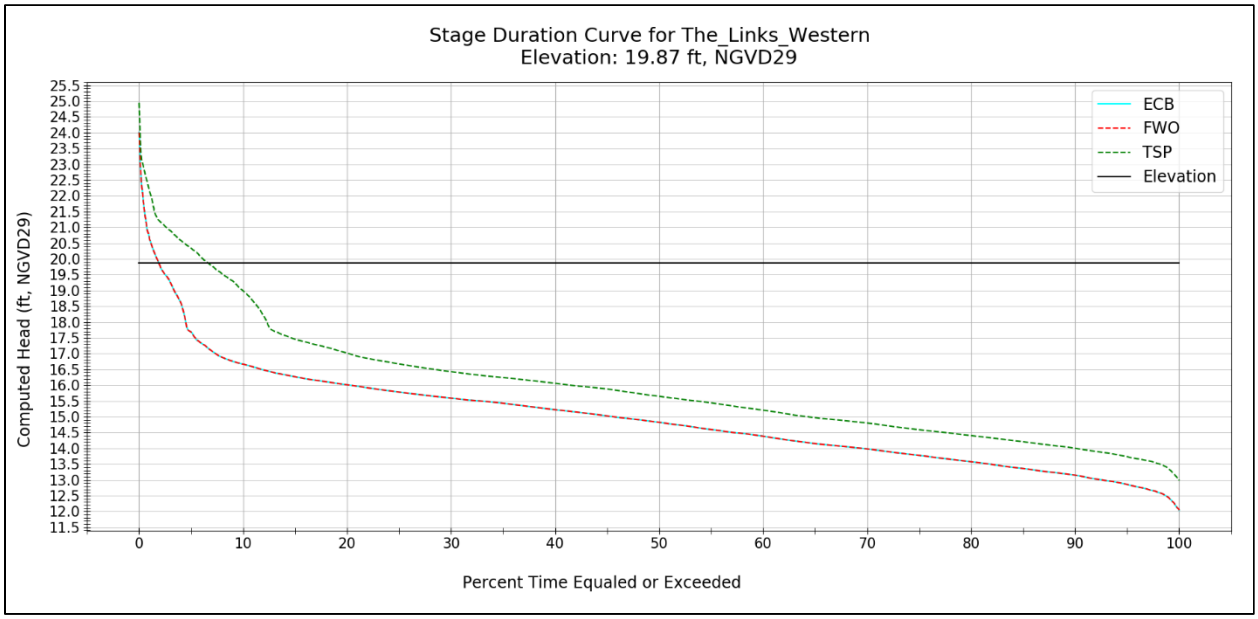

Figure B-20. Stage duration curves of the ECB, FWO and TSP for The Links Western.

Jenkins Ditch Spreader Points upstream of the proposed spreader are identified by the three (3) blue stars in **Figure B-21**. Stage duration curves are shown in **Figure B-22** and **Figure B-23** and indicate no increase in surface water stage.

Figure B-21. Points of interest reviewed for flood protection north of Jenkins Ditch Spreader to Kitching Creek.

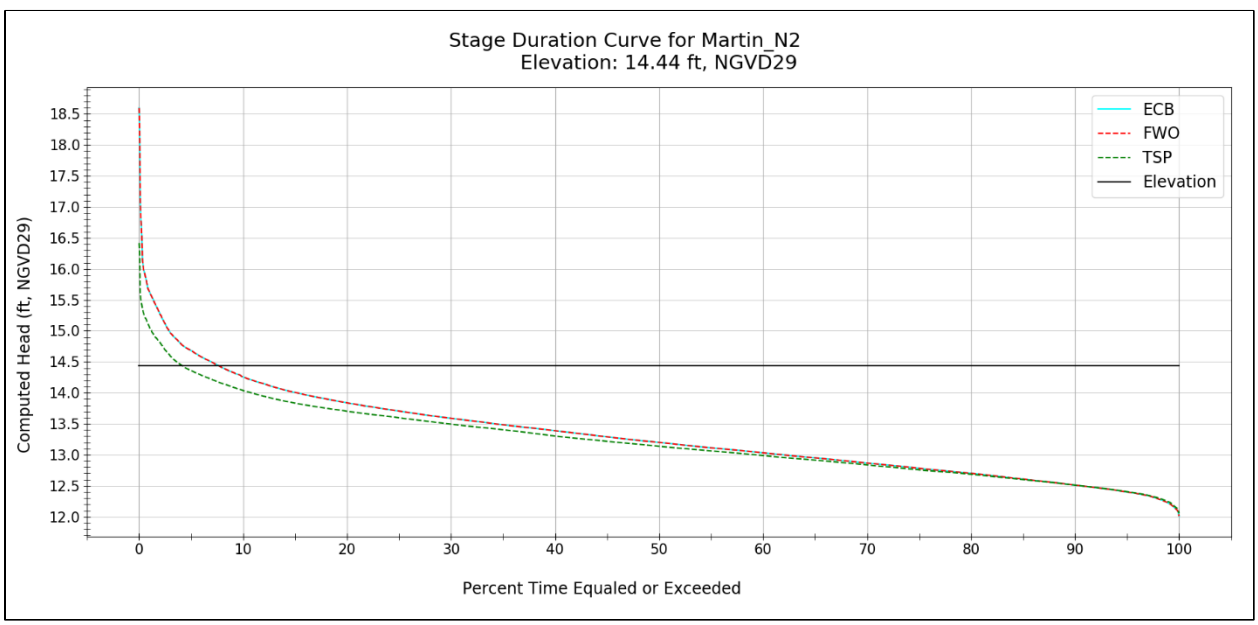

Figure B-22. Stage Duration curves for the ECB, FWO and TSP for the northern upstream point to Jenkins Ditch Spreader.

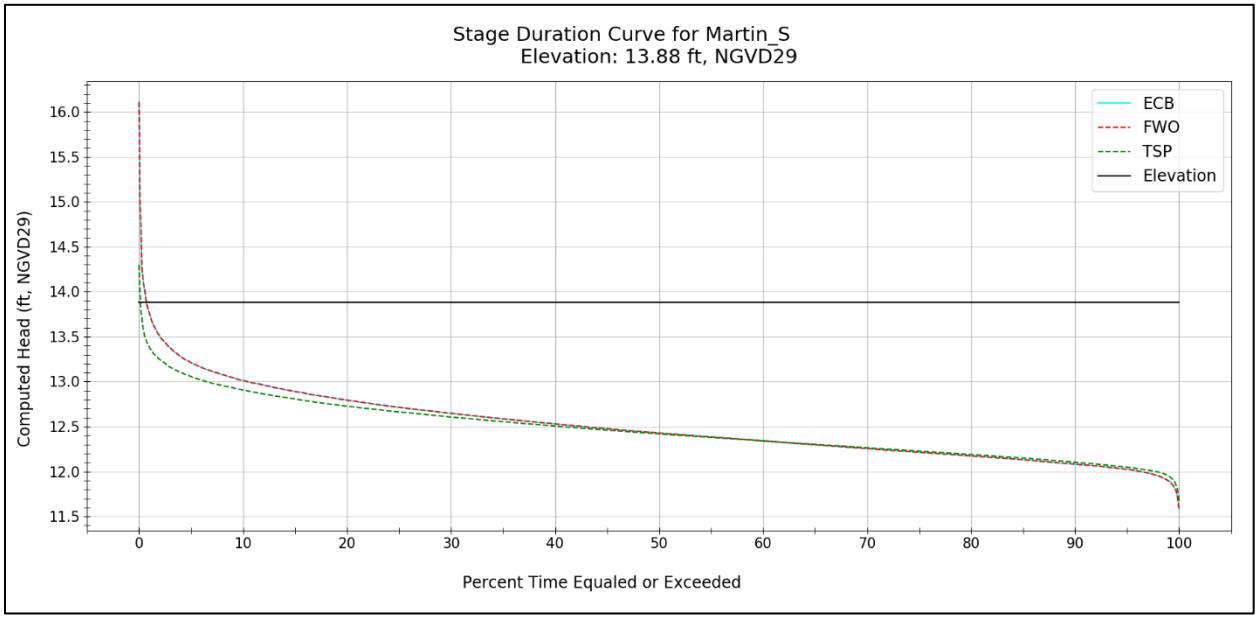

Figure B-23. Stage Duration curves for the ECB, FWO and TSP for southern upstream point to Jenkins Ditch Spreader.

Additional locations were also evaluated. These stage duration curves represent the residential communities of Ibis, Ironhorse, and Jupiter Farms. No location shows any change to surface stages at these residential communities. See **Figure B-9**for the location of these sites, and **Figure B-24**, **Figure B-25**, **Figure B-26**, **Figure B-27** and **Figure B-28** for stage duration curves of these locations.

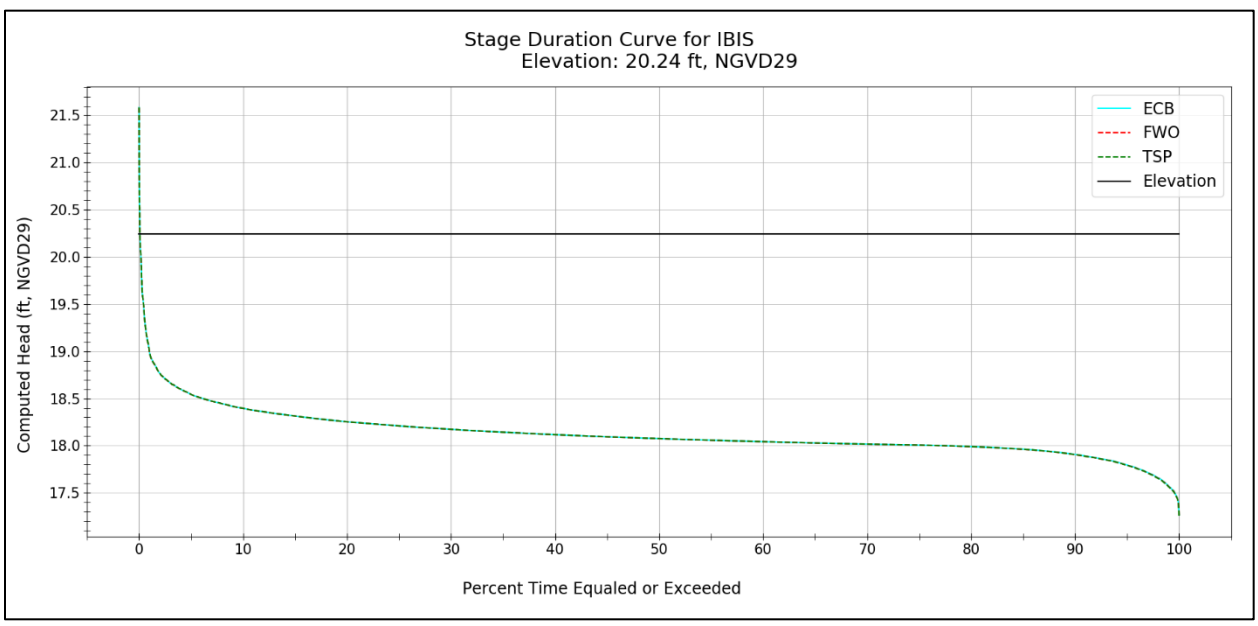

Figure B-24. Stage Duration curves for the ECB, FWO and TSP for Ibis.

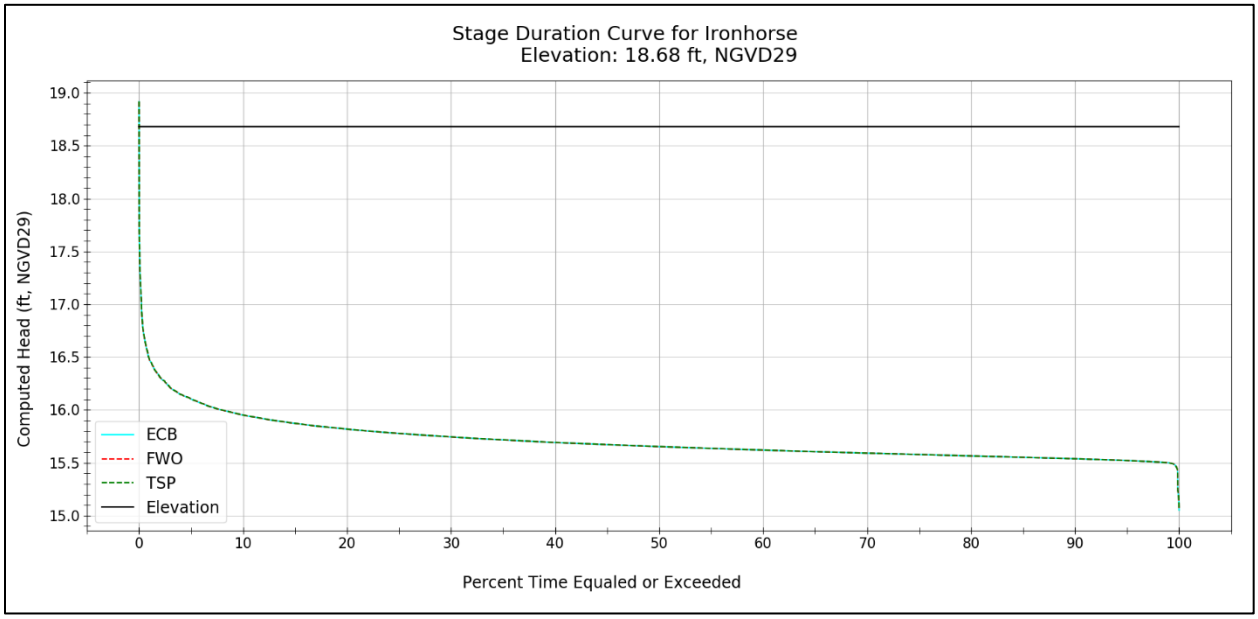

Figure B-25. Stage Duration Curves for the ECB, FWO and TSP for Ironhorse.

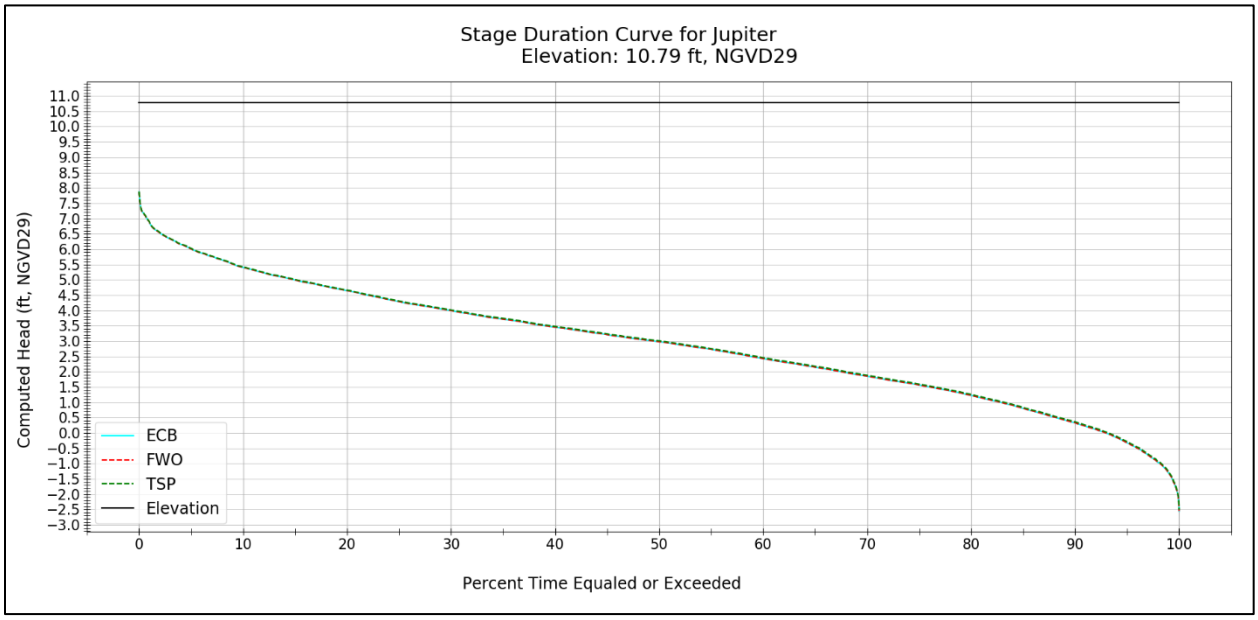

Figure B-26. Stage Duration Curves for the ECB, FWO and TSP for Jupiter.

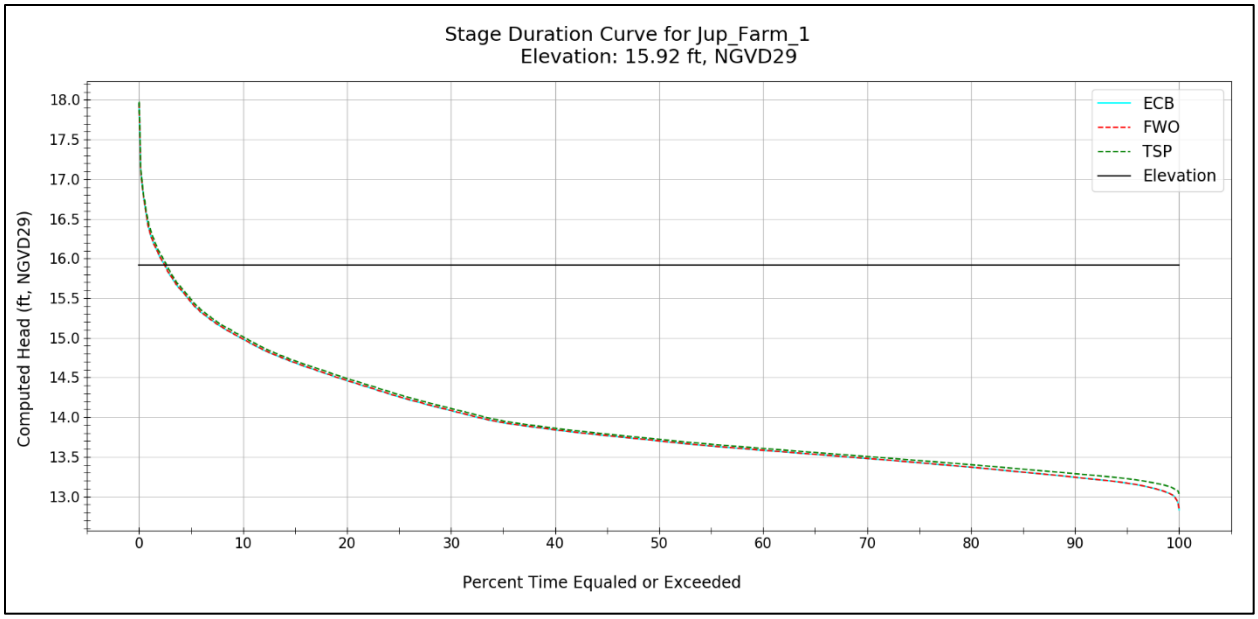

Figure B-27. Stage Duration Curves for the ECB, FWO and TSP for Jupiter Farms 1.

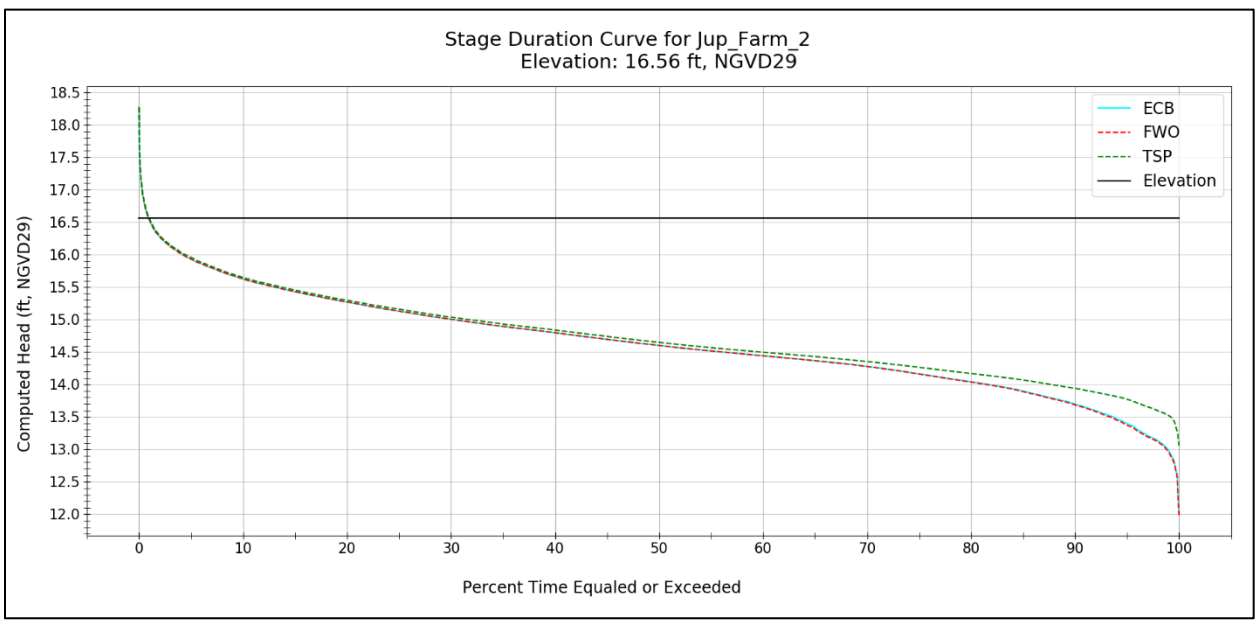

Figure B-28. Stage Duration Curves for the ECB, FWO and TSP for Jupiter Farms 2.

B.4.3 Project Assurances – Identification of Water Made Available by the Project

The total water and the water made available for the natural system and other water related needs are quantified when all project features are constructed and the project is expected to be operational as identified in the with-project condition, the TSP. The pre-project water expected to be available when the project is operational is represented by the FWO. The difference between these two conditions, which is

computed for each water year within the period of simulation, represents the water made available by the project (TSP minus FWO).

B.4.3.1 Water Made Available for the Natural System

The WRDA 2000 Project Assurance requirements are fulfilled by identifying the water for the natural system as shown in **Figure B-29** and **Table B-9** below. The quantity, timing, and distribution of water are identified at five locations:

- C-18 Impoundment outflows to C-18 west canal,
- inflows to Loxahatchee Slough over G-161,
- flows over Lainhart Dam,
- flows from Indian Trail Improvement District (ITID) to the C-18 Impoundment, and
- M-1 Pump Station flows to the M-Canal.

Additional inflows occur and ecosystem benefits (habitat units) are expected as a result of implementation of the TSP at these five locations. The difference between FWO and TSP average annual volumes delivered from each of these sources was calculated, then sorted (high to low) to generate the exceedance curves (**Figure B-29**) and the difference at the 10th, 50th, and 90th percentiles (**Table B-9**) for each source was calculated. Note that except for Lainhart Dam, the other four sources of water are not in the FWO scenario. Therefore, the FWO flows are zero for those four sources.

Ecosystem benefits (habitat units) were identified in the Pal-Mar, Cypress Creek, Loxahatchee Slough degraded wetlands during plan evaluation. The source of water to improve their hydropattern is rainfall, and is controlled by downstream structures included in the TSP. The timing and distribution of water to the Cypress Creek tributary improves, but the quantity of rainfall does not change between the FWO and TSP. Therefore, no water is quantified for these wetlands or the Cypress Creek tributary.

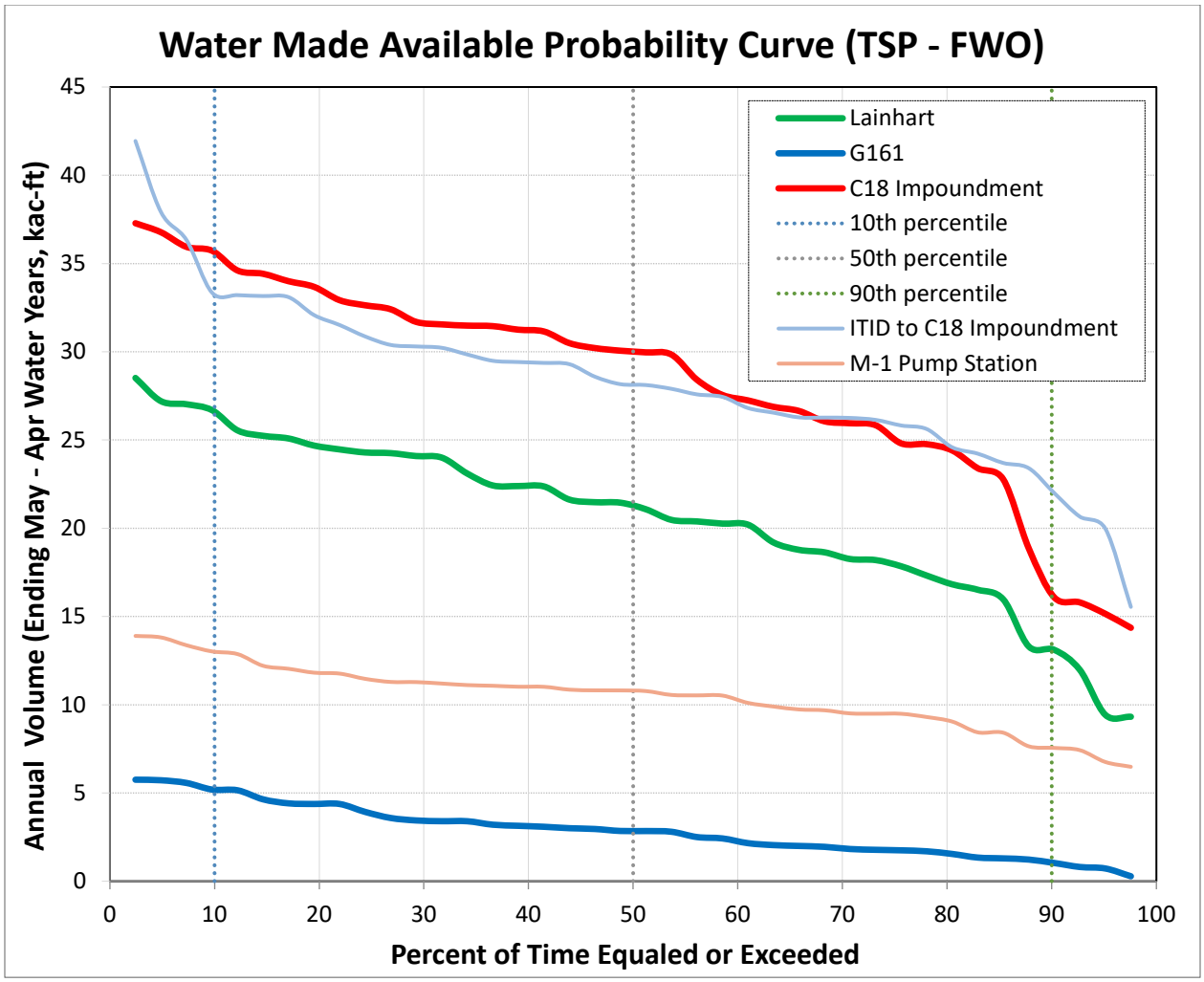

Figure B-29. Probability Curve of Average Annual Water Made (Thousand Acre-Feet) Available by the Project for the Natural System.

Table B-9. Average annual water made available by the project for the natural system (thousand acre-feet).

Location	equaled or exceeded 10% of the time	equaled or exceeded 50% of the time	equaled or exceeded 90% of the time
Lainhart Dam	26.7	21.5	13.1
C-18 Basin Impoundment	35.7	30.1	16.1
G-161	5.2	2.9	1.03
ITID to C-18 Impoundment	33.4	28.2	22.0
M-1 Pump Station to M Canal	13.0	10.8	7.6

B.4.3.2 Water for Other Water Related Needs

The ability of the LRWRP to provide water to meet other water related needs in the LOSA, WRA 1, and WRA 2 were analyzed for the TSP. Based on the analysis, the level of service for water supply has not improved, nor has it been degraded by the project. Therefore, no water was quantified for other water related needs in the LOSA, WRA 1, or WRA 2. However, by virtue of additional water being stored in the C-18 Reservoir and improved hydroperiods within the Project Study Area, additional water may reach water users located in the project area.

B.5 Conclusions

B.5.1 Savings Clause - Elimination or Transfer of Existing Legal Sources of Water

Implementation of the TSP will not cause existing legal sources of water to be eliminated or transferred. The project maintains existing water supply performance for agricultural and municipal water users in LOSA, WRA 1, and WRA 2. Therefore, the TSP fulfills WRDA 2000 Saving Clause requirements which, in part, ensure existing legal sources of water supply such as water for municipal, agricultural, and fish and wildlife uses continue to be available with project implementation.

B.5.2 Savings Clause – Flood Protection

The LECSR-NP model results indicate that implementation of the TSP will not reduce the levels of service for flood protection within the areas affected by the project. Additionally, storm specific HEC-RAS modeling will be performed to inform the design and operations of key Flow-way 3 project features. For example, the Cypress Creek control structure will likely be operable to provide maximum flexibility to maintain consistency with pre-project high stages.

B.5.3 Project Assurances - Identifying Water for the Natural System

The identification of water for the natural system captures the quantity, timing, and distribution of water. Hydrologic model data extracted from the LECSR-NP simulations were used to develop the volume probability curves at five locations in the regional system: C-18 Impoundment outflows to C-18 west canal, inflows to Loxahatchee Slough over G-161, flows over Lainhart Dam, flows from ITID to the C-18 Impoundment and M-1 Pump Station flows to the M-Canal. These locations represent the additional inflows where ecosystem benefits (habitat units) are expected as a result of implementation of the TSP. **Table B-9** presents the water made available for the natural system.

B.5.3.1 Water to be Reserved or Allocated for the Natural System

As required by Section 601(h)(4)(A) of the of the WRDA 2000 and Section 385.35 of the Programmatic Regulations for the Implementation of CERP, the water made available by the project will be protected using the State of Florida's reservation or allocation authority under state law as presented in **Table B-9**. Water made available by the TSP must be protected before the SFWMD and Department of the Army enter into any Project Partnership Agreements to construct TSP project features. The SFWMD has already protected the pre-project water for the natural system in the Loxahatchee River Watershed, including the NW Fork of the Loxahatchee River, through the restricted allocation criteria for the Everglades and North Palm Beach/Loxahatchee River Watershed waterbodies. See Section 3.2.1 of the SFWMD's Applicant's

Handbook (Applicant's Handbook) for Water Use Permit Applications within the South Florida Water Management District.[1]

B.5.4 Project Assurances – Identifying Water Made Available for Other Water Related Needs

No water was quantified for other water related needs (e.g., municipal, agriculture, or irrigation) in the LOSA, WRA 1 or WRA 2.

B.5.5 Project Assurances Commitments for All CERP Projects

The overarching objective of the CERP (referred to as simply the "Plan" in WRDA 2000 and the Programmatic Regulations) is the restoration, preservation, and protection of the South Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The federal government and the State of Florida are committed to the protection of the appropriate quantity, quality, timing, and distribution of water to achieve and maintain the benefits to the natural system described in CERP. As envisioned in WRDA 2000 and the Programmatic Regulations, each PIR will identify this appropriate quantity, quality, timing, and distribution of water for the natural system.

The following language sets forth these commitments:

> *The overarching objective of the Plan is the restoration, preservation, and protection of the South Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The Federal Government and the non-Federal sponsor are committed to the protection of the appropriate quantity, quality, timing, and distribution of water to ensure the restoration, preservation, and protection of the natural system as defined in WRDA 2000, for so long as the project remains authorized. This quantity, quality, timing, and distribution of water shall meet applicable water quality standards and be consistent with the natural system restoration goals and purposes of CERP, as the Plan is defined in the programmatic regulations. The non-Federal sponsor will protect the water for the natural system by taking the following actions to achieve the overarching natural system objectives of the Plan:*
>
> *1. Ensure, through appropriate and legally enforceable means under Federal law,*
>
> *that the quantity, quality, timing, and distribution of existing water that the Federal Government and the non-Federal sponsor have determined in this Project Implementation Report is available to the natural system, will be available at the time the Project Partnership Agreement for the project is executed and will remain available for so long as the Project remains authorized.*
>
> *Prior to the execution of the Project Partnership Agreement, reserve or allocate for the natural system the necessary amount of water that will be made available*

[1] SFWMD. 2015. Applicant's Handbook for Water Use Permit Applications within the South Florida Water Management District. September 7, 2015. https://www.sfwmd.gov/sites/default/files/documents/wu_applicants_handbook.pdf

by the project that the Federal Government and the non-Federal sponsor have determined in this Project Implementation Report.

After the Project Partnership Agreement is signed and the project becomes operational, make such revisions under Florida law to this reservation or allocation of water that the Federal Government and the non-Federal sponsor determines, as a result of changed circumstances or new information, is beneficial for the natural system.

3. For so long as the Project remains authorized, notify and consult with the Secretary of the Army should any revision in the reservation of water or other legally enforceable means of protecting water be proposed by the non-Federal sponsor, so that the Federal Government can assure itself that the changed reservation or legally enforceable means of protecting water conform with the non-Federal sponsor's commitments under paragraphs 1 and 2. Any change to a reservation or allocation of water made available by the project shall require an amendment to the Project Partnership Agreement.

B.6 State Compliance Report

The State Compliance Report, Section 373.1501, Florida Statutes, was formally submitted to the Florida Department of Environmental Protection on May17, 2019 and the Final Order approving the report was issued on June 18, 2019.

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FLORIDA DEPARTMENT OF Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, FL 32399

Ron DeSantis
Governor

Jeanette Nuñez
Lt. Governor

Noah Valenstein
Secretary

June 18, 2019

Mr. Drew Bartlett
Executive Director
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406

Dear Mr. Bartlett:

The South Florida Water Management District (District) submitted the State Compliance Report for the Central and Southern Florida Project Comprehensive Everglades Restoration Plan (CERP) Loxahatchee River Watershed Restoration Project (LRWRP) on May 17, 2019, to the Florida Department of Environmental Protection (Department) for review pursuant to §373.026(8)(b), Florida Statutes (F.S.). The Department reviewed these documents and has determined that sufficient information was provided to demonstrate that the project, as proposed, is consistent with the requirements of §373.026, F.S., and that the District has complied with its responsibilities under §373.1501(5), F.S. The attached Final Order constitutes Department approval of the LRWRP, which is required before the project is submitted to Congress for authorization or receives an appropriation of state funds.

The Department is pleased to support this step in achieving progress toward meeting the state's objectives for the restoration of the greater south Florida ecosystem. We look forward to continued coordination with both the District and the United States Army Corps of Engineers as we move forward together with the implementation of the CERP program. If you have any questions regarding this letter, please feel free to contact me at (850) 245-3188.

Sincerely,

Frank Powell,
Environmental Administrator
Office of Ecosystem Projects

Enclosure:
Final Order – LRWRP State Compliance Report

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

In RE: Loxahatchee River Watershed Restoration Project OGC No. 19-1213
_____/

FINAL ORDER APPROVING THE
COMPREHENSIVE EVERGLADES RESTORATION PLAN
LOXAHATCHEE RIVER WATERSHED RESTORATION PROJECT

Pursuant to Sections 373.026(8)(b) and 373.1501(8) of the Florida Statutes (F.S.), the State of Florida Department of Environmental Protection (Department) enters this Final Order in response to the submittal of the Final State Compliance Report for the Loxahatchee River Watershed Restoration Project (LRWRP) by the South Florida Water Management District (District). The submittal accompanies the Draft Integrated Project Implementation Report (PIR) and Environmental Impact Statement (EIS) proposing the recommended plan for the Central and Southern Florida Project Comprehensive Everglades Restoration Plan of the Loxahatchee River Watershed Restoration Project in Martin and Palm Beach counties, Florida. The submittal and associated materials have been reviewed for compliance with the criteria in Section 373.1501(5), F.S., as outlined below.

The LRWRP study area is approximately 480,000 acres (750 square miles) and is located in northern Palm Beach County and southern Martin County. The study area is bounded on the north by the C-44 Canal, on the south by the C-51 Canal, on the west by the L-8 Canal and Lake Okeechobee, and on the east by the Loxahatchee River Estuary and Lake Worth Lagoon. The project area includes all of the Loxahatchee River watershed and limited portions of the St. Lucie River watershed. Central and Southern Florida Project features within the study area include the L-8 Canal, the east and west legs of the C-18 Canal, and the C-51 Canal.

The purpose of LRWRP is to restore and sustain the overall quantity, quality, timing and

distribution of freshwaters to the federally designated "National Wild and Scenic" Northwest Fork of the Loxahatchee River (NWFLR) for current and future generations. This project also seeks to restore, sustain, and reconnect the area's wetlands and watersheds that form the historic headwaters for the river. The LRWRP tentatively selected plan (TSP), Alternative 5R, includes the C-18W Reservoir (9,500 acre-feet (ac-ft) aboveground reservoir), four aquifer storage and recovery wells located at the reservoir, pump stations and other structures to capture and store water that is currently lost to tide, and redistributes it to increase the volume and improve the timing of water deliveries to the NWFLR. Alternative 5R is planned to achieve 91% of the dry season restoration target flows and 98% of the wet season restoration target flows. The TSP also includes new pump stations and canals, ditch plugs, new and modified culverts and weirs, spreader swales and other measures to rehydrate over-drained wetlands in the study area. These restoration components are intended to restore more natural water deliveries to the Loxahatchee River, promote improved health and functionality of wetland and upland areas, restore hydrologic and ecological connectivity among natural areas, and provide increased quantity and quality of habitat available for wildlife and native vegetation. Alternative 5R plans to restore nearly 17,000 acres of former wetlands that had been converted to agriculture and an additional 10,000 acres of disturbed wetlands in the Loxahatchee Slough, Cypress Creek Natural Area, Pal-Mar, Kitching Creek and the J.W. Corbett Wildlife Management Area. These restored wetlands will connect with 51,000 acres of other wetland communities throughout the study area, resulting in 78,000 acres of connected habitat.

In issuing this order, the Department finds that the District has provided sufficient information to demonstrate compliance with the criteria outlined in Section 373.1501(5), F.S. The Department bases this finding on the following documents:

a) South Florida Water Management District, Loxahatchee River Watershed Restoration Project Final State Compliance Report (May 17, 2019); and

b) United States Army Corps of Engineers, Jacksonville District - Draft Integrated Project Implementation Report and Environmental Impact Statement (PIR/EIS) - Loxahatchee River Watershed Restoration Project (March 2019).

The Department has reviewed the documents referenced above and bases this order on the information and conditions in those documents by the District, the United States Army Corps of Engineers (Corps), and other federal partners.

CONCLUSIONS OF LAW

Section 373.026(8)(b), F.S., directs the Department to approve or approve with amendments, any project component before it is submitted to Congress for authorization or receives an appropriation of state funds. Such approval is based on a determination of the District's compliance with Section 373.1501(5), F.S., in its role as local sponsor for the Project.

1) Section 373.1501(5)(a), F.S.: Comprehensive Needs Analysis and Evaluation: Based upon the information provided, the Department concludes that the District has met the requirements set forth in Section 373.1501(5)(a), F.S. The District has analyzed and evaluated the Project such that all needs will be met in a comprehensive manner and that all applicable water resource issues are adequately considered, including water supply, water quality, flood protection, threatened and endangered species, and other natural system and habitat needs.

2) Section 373.1501(5)(b), F.S.: Determination of Project Feasibility: Based upon the information provided, the Department concludes that the District has met the requirements set forth in Section 373.1501(5)(b), F.S. The District has determined with reasonable certainty that the Project is feasible based upon standard engineering practices

and technologies and are the most efficient and cost-effective of feasible alternatives or combination of alternatives, consistent with Restudy purposes, implementation of project components, and operation of theProject.

3) Section 373.1501(5)(c), F.S.: Consistency with Applicable Law and Regulations: Based upon the information provided, the Department concludes that the District has met the requirements set forth in Section 373.1501(5)(c), F.S. The District has determined with reasonable certainty that the Project is consistent with applicable laws and regulations and can be permitted and operated as proposed. A pre- application conference for the Loxahatchee River Watershed Restoration Project was held on February 15, 2019, between agencies with applicable regulatory jurisdiction, as required by Section 373.1501(5)(c),F.S.

4) 373.1501(5)(d), F.S.: Reasonable Assurances: Based upon the information provided, the Department concludes that the District has met the requirements set forth in Section 373.1501(5)(d), F.S. The District has provided reasonable assurances that the quantity of water available to existing legal users shall not be diminished by implementation of the Project so as to adversely impact existing legal users, that existing levels of service for flood protection will not be diminished outside the geographic area of the Project, and that water management practices will continue to adapt to meet the needs of the restored natural environment. The Corps and the District will undertake additional analysis to ensure adjacent properties are not impacted during the design phase of the project.

5) Section 373.1501(5)(e), F.S.: Coordination with Existing Utilities and Public Infrastructure: Based upon the information provided, the Department concludes that the District has met the requirements set forth in Section 373.1501(5)(e), F.S. The District

provided information to ensure that implementation of the Project has been coordinated with existing utilities and public infrastructure, and that impacts to and relocation of existing utilities or public infrastructure are minimized.

The Department finds that the LRWRP components of the CERP, which are proposed by the District, meet the criteria of Section 373.1501, F.S. Such finding is predicated upon acceptance of the conditions in the referenced documents by the Corps without substantive changes. If the Department finds that the Corps has made substantive changes to the referenced documents, the Department may vacate this Order.

THEREFORE, IT IS ORDERED that the Loxahatchee River Watershed Restoration Project component of the Comprehensive Everglades Restoration Plan is APPROVED under Section 373.026(8)(b), F.S.

NOTICE OF RIGHTS

This agency action is final and effective unless a timely petition for an administrative hearing is filed under §§ 120.569 and 120.57, F.S., before the deadline for filing a petition. The procedures for petitioning for a hearing are set forth below.

A person whose substantial interests are affected by the Department's proposed agency action may petition for an administrative proceeding (hearing) under §§ 120.569 and 120.57, F.S. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000. Petitions by the applicant or any of the parties listed below must be filed within 21 days of receipt of the written notice. Petitions filed by other persons must be filed within 21 days of publication of the notice or receipt of the written notice,

whichever occurs first. The petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of the person's right to request an administrative determination (hearing) under §§ 120.569 and 120.57, F.S. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205, F.A.C.

A petition that disputes the material facts on which the Department's action is based must contain the following information:

(a) The name and address of each agency affected and each agency's file or identification number, if known;

(b) The name, address, any e-mail address, any facsimile number, and telephone number of the petitioner, if the petitioner is not represented by an attorney or a qualified representative; the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests will be affected by the agency determination;

(c) A statement of when and how the petitioner received notice of the agency decision;

(d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;

(e) A concise statement of the ultimate facts alleged, including the specific facts the petitioner contends warrant reversal or modification of the agency's proposed action;

(f) A statement of the specific rules or statutes the petitioner contends require reversal or modification of the agency's proposed action, including an explanation of how the alleged facts relate to the specific rules or statutes; and

(g) A statement of the relief sought by the petitioner, stating precisely the action petitioner wishes the agency to take with respect to the agency's proposed action.

A petition that does not dispute the material facts on which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by Rule 28-106.301, F.A.C.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation is not available in this proceeding.

Any party to this order has the right to seek judicial review of it under § 120.68, F.S., by filing a notice of appeal under rule 9.110 of the Florida Rules of Appellate Procedure with the clerk of the Department in the Office of General Counsel, Mail Station 35, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000, and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice of appeal must be filed within 30 days after this order is filed with the clerk of the Department.

DONE AND ORDERED on this 18th day of June 2019, in Tallahassee, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Noah Valenstein
Secretary

FILED, on this date, pursuant to 120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

D Jones 6/18/19

Clerk Date

CENTRAL AND SOUTHERN FLORIDA PROJECT
COMPREHENSIVE EVERGLADES RESTORATION PLAN

Loxahatchee River Watershed Restoration Project

State Compliance Report
Section 373.1501, Florida Statutes
May 17, 2019

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1 Introduction

The Comprehensive Everglades Restoration Plan (CERP) was documented in the 1999 Central and Southern Florida (C&SF) Project Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement (U.S. Army Corps of Engineers 1999). CERP was approved by Congress as a framework for the restoration of the natural system in Section 601 of the Water Resources Development Act of 2000 (WRDA 2000). The purpose of the CERP is to modify structural and operational components of the C&SF Project to achieve restoration of the Everglades and the south Florida ecosystem, while providing for other water-related needs such as urban and agricultural water supply and flood protection.

The CERP identified 68 different components. These components will work together to benefit the ecological structure and function of more than 2.4 million acres of the south Florida ecosystem by improving and/or restoring the proper quantity, quality, timing and distribution of water in the natural system. The CERP will also address other concerns such as urban and agricultural water supply and maintain existing levels of service for flood protection in those areas served by the project. The CERP components were originally planned for implementation over an approximate 40-year period. The CERP is designed to achieve more natural flows by re-directing current flows that are currently discharged to the Atlantic Ocean and Gulf of Mexico, to a more restored flow of water that is distributed throughout the system similar to pre-drainage conditions.

The Loxahatchee River Watershed Restoration Project (LRWRP) includes three of the 68 components of the CERP. The first panel in Figure 1-1 shows the location of the study area near the eastern coast of Florida in relation to the developed landscape and the boundary of the South Florida Water Management District (SFWMD). The second panel shows the study area over the pre-development condition. Over the last fifty years, much of the watershed has been ditched and drained for agricultural production and urban development. This has resulted in substantial reduction in the spatial extent of wetlands in the watershed and has impacted the hydrologic function of the remaining wetlands, as well as severing vital hydrologic connections.

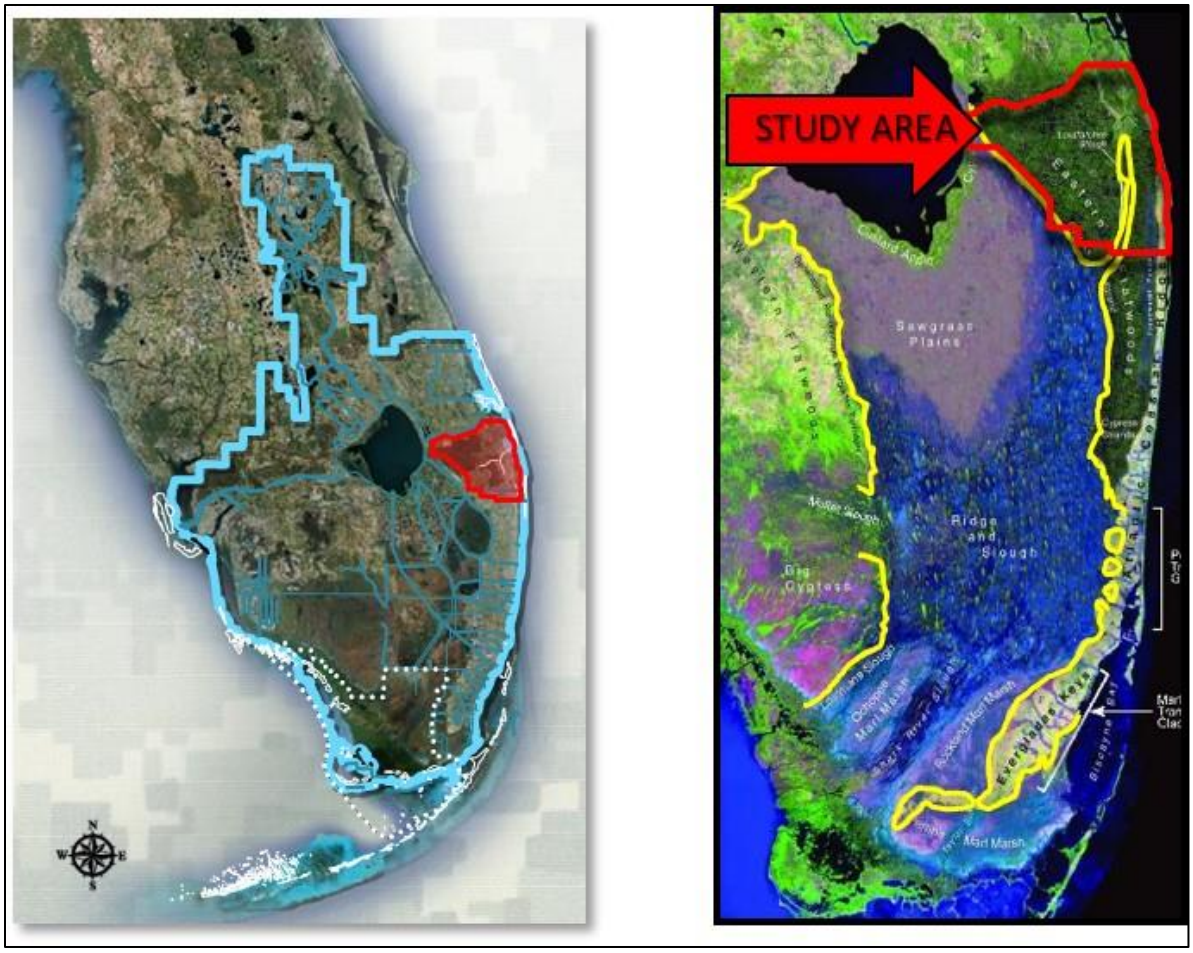

Figure 1-1 LRWRP LOCATION

1.1 Overview of Section 373.1501, Florida Statutes Requirements

Section 373.1501, Florida Statues (F.S.) requires that, in their role as the non-federal sponsor for the Comprehensive Everglades Restoration Plan (CERP), South Florida Water Management District (SFWMD) analyze and evaluate all needs to be met in a comprehensive manner, consider all applicable water resource issues, determine with reasonable certainty that all project components are feasible and cost-effective, and determine with reasonable certainty that all project components are consistent with applicable law and regulations, and can be permitted and operated as proposed. Section 373.1501 F.S. also requires that SFWMD provide reasonable assurances that the quantity of water available to existing legal users is not diminished by implementation of project components so as to adversely impact existing legal users, that existing levels of service for flood protection will not be diminished outside the geographic area of the project component, and that water management practices will continue to adapt to meet the needs of the restored natural environment. Section 373.1501 also requires SFWMD to ensure that implementation of project components is coordinated with existing utilities and public infrastructure and that impacts to and relocation of existing utility or public infrastructure are minimized. This report, along with the additional detail provided in the Loxahatchee River Watershed Restoration Project Implementation Report (LRWRP PIR), provides the information

necessary for the Florida Department of Environmental Protection (FDEP) to determine that SFWMD has conducted the necessary evaluations as set forth in Section 373.1501 F.S.

1.2 Project Study Area

The LRWRP study area is approximately 480,000 acres (750 square miles) and is located in northern Palm Beach County and southern Martin County (Figure 1-2). The study area is characterized as highly urbanized in the eastern portion, and transitions to extensive natural areas to the west and north. The study area is bounded on the north by the C-44 Canal, on the south by the C-51 Canal, on the west by the L-8 Canal and Lake Okeechobee, and on the east by the Loxahatchee River Estuary and Lake Worth Lagoon. The project area includes all of the Loxahatchee River watershed and limited portions of the St. Lucie River watershed. Central and Southern Florida Project features within the study area include the L-8 Canal, the east and west legs of the C-18 Canal, and the C-51 Canal. Transportation infrastructure within the project area includes the Florida Turnpike and Interstate 95, as well as several major east/west county and state roadways (Indiantown Road [SR 706], PGA Boulevard [SR 708], Beeline Highway [SR 710], and Northlake Boulevard). This infrastructure and other development within the watershed have resulted in lowered groundwater levels and altered drainage patterns and flow regimes within the natural and less developed areas.

The LRWRP study includes eight major named natural areas under state, county, and city ownership. See Table 1-1 and Figures 1-2 and 1-3 for descriptions and locations. Each of these areas have experienced some level of impacts from the drainage, water supply, and flood protection afforded by C&SF Project and the agricultural and urban development that followed.

Table 1-1 Description of the LRWRP Natural Areas.

Natural Area	Description
Jonathan Dickinson State Park	Jonathan Dickinson State Park (JDSP) is located in the northeast section of the project area within Martin and Palm Beach Counties and is comprised of 11,471 acres. The park contains portions of several branches of the Loxahatchee River and its upstream tributaries (Northwest Fork, reaches of the North Fork, Cypress Creek, Moonshine Creek, Hobe Grove Ditch, Wilson's Creek, and Kitching Creek).
Northwest Fork of the Loxahatchee River (NWFLR)	The NWFLR, one of Florida's two federally designated National Wild and Scenic Rivers, is a natural river channel that originates in the Loxahatchee and Hungryland Sloughs. Downstream from these sloughs, the NWFLR receives additional input from the other major tributaries of the Loxahatchee River: Cypress Creek/Ranch Colony Canal, Hobe Grove Ditch, and Kitching Creek. A cypress riverine swamp community historically dominated the floodplain of the Loxahatchee River with freshwater stream swamps and cypress communities present upstream from river mile 6.5 and dominant within the floodplain above river mile 8.0.
Loxahatchee River Estuary	The Loxahatchee River Estuary is downstream from the designated National Wild and Scenic River. Salt water from the Atlantic Ocean flows through Jupiter Inlet, merging with the freshwater that flows in from the north, northwest and southwest forks of the river, forming the estuary. This shallow embayment has an average depth of 3.5 feet, a maximum depth of 15 feet, and covers an area of ~ 380 acres.

Natural Area	Description
Pal-Mar	Pal-Mar comprises more than 37,000 acres in southern Martin and northern Palm Beach counties and forms a linkage between J.W. Corbett WMA and JDSP. Cypress Creek historically drained the Pal-Mar area. Due to the transformation of the historic creek into the Cypress Creek Canal and the diversion of water from the historic creek into the Ranch Colony Canal, flows into the creek have been greatly altered and it is no longer a receiving body of Pal-Mar surface water. Western Pal-Mar is primarily a natural area and occurs as a mosaic of wetland/upland communities including depression marsh, wet prairie, dome and strand swamps, pine flatwoods and sloughs. Northern and eastern Pal-Mar have been converted to agricultural usage and have undergone significant hydrological changes.
J.W. Corbett Wildlife Management Area (WMA)	J.W. Corbett WMA encompasses approximately 62,000 acres and is located in the northwest section of the project area. It contains extensive hydric/mesic flatwoods, depression marshes, wet prairies, strand and dome swamps and hydric/mesic hammocks. An intact Everglades sawgrass marsh ecosystem occurs along the southern boundary of J.W. Corbett WMA and is considered a remnant portion of the Greater Everglades ecosystem.
Loxahatchee Slough	Loxahatchee Slough was historically one of the most prominent flow ways in the study area and contained a large portion of the historic headwaters of the Northwest and Southwest Forks of the Loxahatchee River. The 11,000 acre site is the single most ecologically-diverse tract of protected land in Palm Beach County, including nine distinct community types. The slough used to extend all the way to what is now Loxahatchee National Wildlife Refuge but has been cut off by the levees that surround the Refuge and by the C-51 and C-18 canals. These features have altered historic drainage patterns in this area and have allowed for extensive invasions by melaleuca.
Grassy Waters Preserve	The southern half of the historical Loxahatchee Slough has been impounded to form the Grassy Waters Preserve (GWP). The GWP is a managed wetland ecosystem, approximately 12,800 acres (20 square miles), which is owned and operated by the City of West Palm Beach. GWP serves as a surface water catchment, groundwater recharge and storage system for public water supply. GWP is also known as the West Palm Beach Water Catchment Area. The City's management of the GWP as an element of the water supply system has protected and sustained most of this system in a high-quality wetland condition. The wetlands within this catchment area include wet prairies (sawgrass and spikerush), sloughs and cypress and other tree islands configured in a remarkably natural mosaic.
Dupuis Wildlife and Environmental Area (WEA)	The Dupuis WEA includes 21,875 acres located in the westernmost section of the study area, between Corbett WMA and Lake Okeechobee. Once part of the Everglades ecosystem, the hydrology of the area was altered through drainage. Habitats on the property include ponds, wet prairies, cypress domes, pine flatwoods, and remnant Everglades marsh.

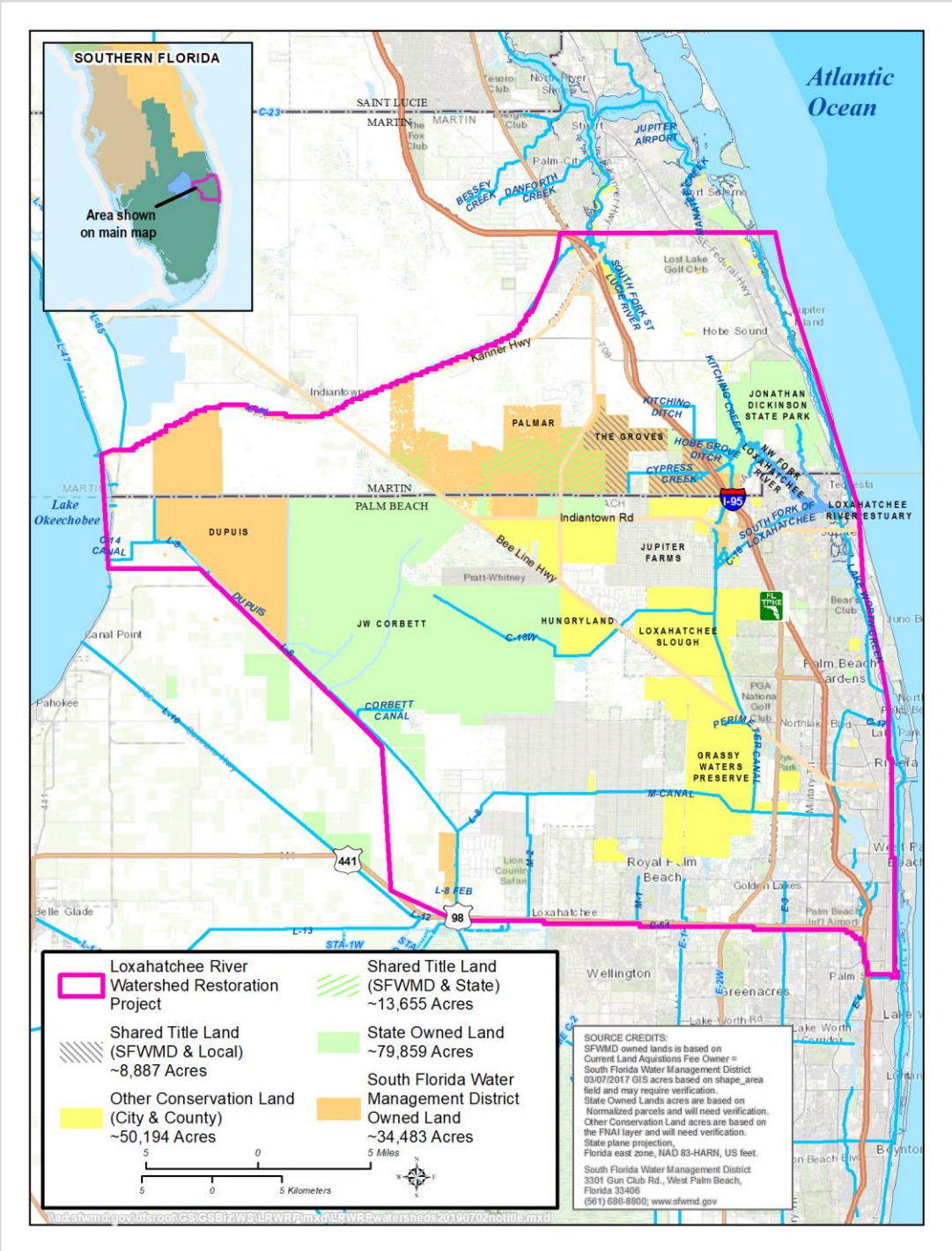

Figure 1-2 LRWRP NATURAL AREAS IN THE STUDY AREA.

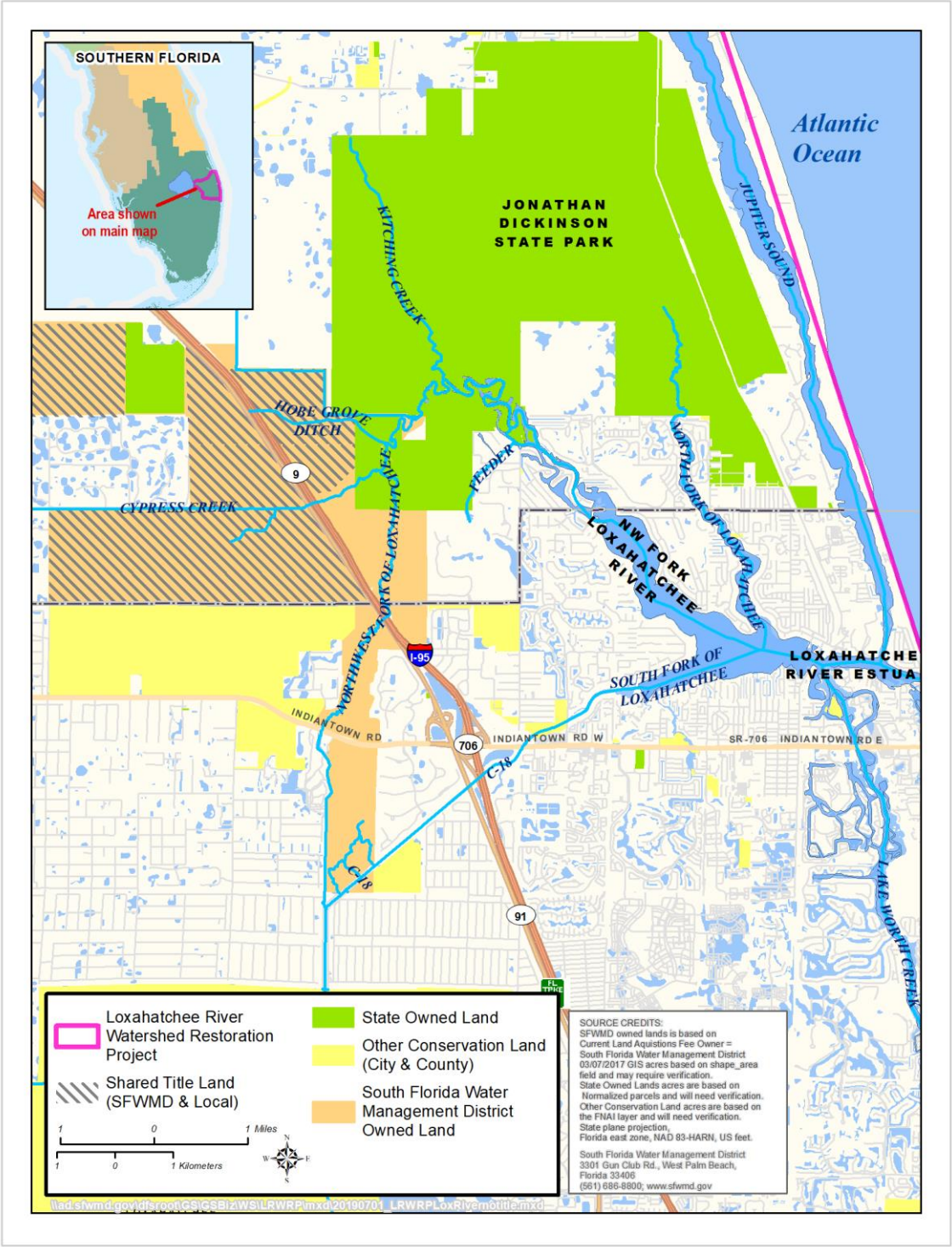

Figure 1-3 EXPANDED VIEW OF THE LOXAHATCHEE RIVER AND ESTUARY BOUNDARIES IN THE PROJECT AREA

1.3 Project Purpose and Need

The purpose of LRWRP is to restore and sustain the overall quantity, quality, timing and distribution of freshwaters to the federally designated “National Wild and Scenic” Northwest Fork of the Loxahatchee River (NWFLR) for current and future generations. This project also seeks to restore, sustain, and reconnect the area’s wetlands and watersheds that form the historic headwaters for the river.

The LRWRP tentatively selected plan (TSP), Alternative 5R, includes a surface storage reservoir, aquifer storage and recovery wells, pump stations and other structures to capture and store water that is currently lost to tide, and redistributes it to increase the volume and improve the timing of water deliveries to the NWFLR (Figure 1-4). The TSP will achieve 91% of the dry season restoration target flows and 98% of the wet season restoration target flows.

Alternative 5R

1. Kitching Creek (Restoration/hydration): (Spreader canal; weir/plug (Jenkins Ditch)
2. Moonshine Creek (MC) & Gulfstream East (GE) Restoration: Connect HSLCD ditch to MC; clear MC vegetation; weir in Hobe Grove Ditch; grade area to historic topography
3. Cypress Creek Canal (CCC)(Reduce over-drainage): Replace CCC weir to raise control elevation, raise berm at Ranch Colony, automate twin 84" culverts; pump and spreader swale; regrade CC southern forks
4. Gulfstream West (GW)(Restoration & reduce over- drainage): Partial backfill & relocate southern end of HSLCD canal; small pump, construct flow through marsh to attenuate flows
5. Pal-Mar East (Restoration & Connectivity): Plug ditches; remove pipes; improve northern berm; construct western berm improve eastern berm; pumps at Thomas Farm to redirect drainage to GW flow- redirect drainage to GW flow-through marsh via north Nine-Gems Canal
6. . C-18W Reservoir (9,500 ac-ft. & 4 ASR wells): Above ground reservoir; inflow pump, discharge structure; seepage control; M-O canal connector and pump
7. . G-160 Structure (Reduce over-drainage): Improve hydroperiod in Loxahatchee Slough
8. G-161 Structure (Connectivity): GWP water to Loxahatchee Slough
9. GWP Triangle (Connectivity): Grade and reconnect
10. M-1 Pump Station (conveyance): Deliver lower M-1 basin water to M-Canal, GWP and G- 161

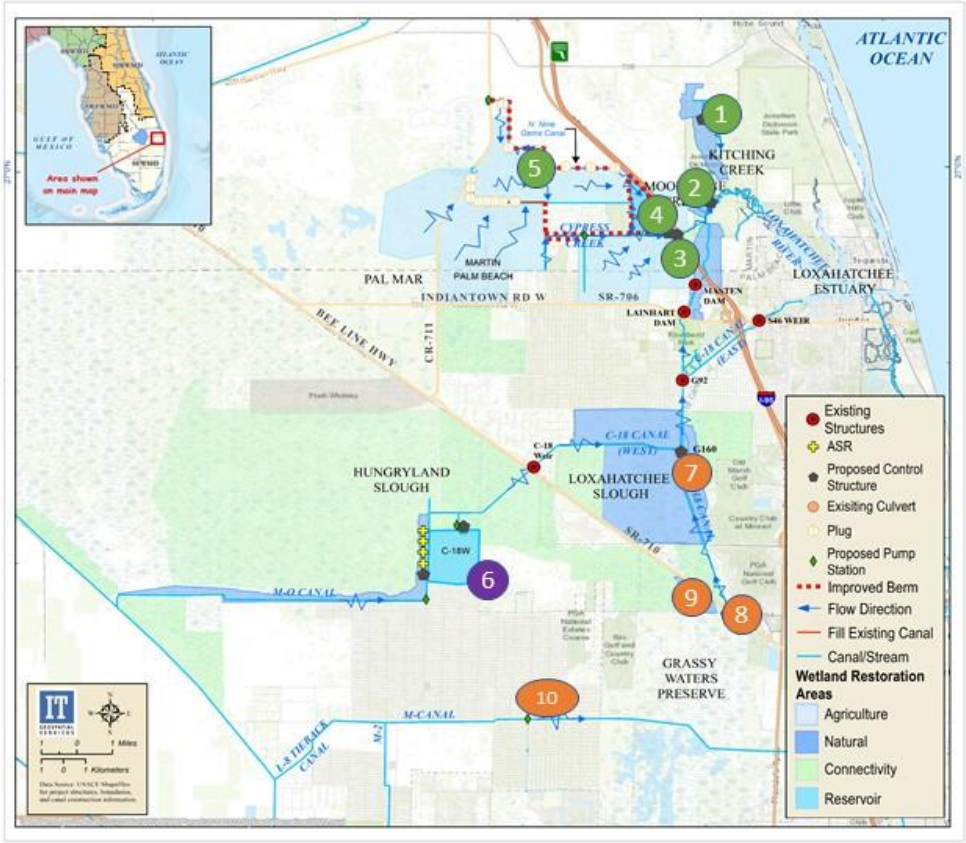

Figure 1-4 ALTERNATIVE 5R - TENTATIVELY SELECTED PLAN

The TSP also includes new pump stations and canals, ditch plugs, new and modified culverts and weirs, and other measures to rehydrate over-drained wetlands in the watershed. These will restore more natural water deliveries to the Loxahatchee River, promote improved health and functionality of wetland and upland areas, restore hydrologic and ecological connectivity among natural areas, and provide increased quantity and quality of habitat available for wildlife and native vegetation. The TSP will restore nearly 17,000 acres of former wetlands that had been converted to agriculture and an additional 10,000 acres of existing but disturbed wetlands in the Loxahatchee Slough, Cypress Creek Natural Area, Pall-Mar, Kitching Creek and the J.W. Corbett Wildlife Management Area. These restored wetlands will connect with 51,000 acres of other wetland communities throughout the watershed, resulting in 78,000 acres of connected habitat.

1.4 Project Features

The features of the TSP are organized into three geographic areas, or flow-ways. All features described below are based on modeling and engineering analysis available for the Draft PIR/EIS. Additional engineering analyses to be performed after review of the Draft PIR/EIS will be incorporated into the Final PIR/EIS and may change dimensions, locations, and/or operations of one or more features of the TSP.

Flow-way 1

Flow-way 1 is located in the southernmost portion of the project area. This flow-way uses the M-Canal and the north to south section of the C-18 Canal to route water from upstream project areas to the NWFLR. The components of this flow-way include the M-1 pump station, G-161, the Grassy Waters Preserve (GWP) Triangle and G-160. Note that though both the G-161 and G-160 structures have been constructed, they are considered components of the TSP. Flow-way 1 is depicted in Figure 1-5.

The M-1 pump station will deliver up to 75 cubic feet per section (cfs) to the M-Canal from the Indian Trail Improvement District's (ITID) Lower M-1 Basin when the M-1 Basin canal stage conditions allow (i.e., when the canal levels are above their seasonal control). Water can be pumped from the M-1 Basin the M Canal and Grassy Waters Preserve (GWP) when stages in the M-1 Canal are above 17.0 ft NGVD29 (15.5 NAVD88) in the dry season and 15.0 ft NGVD29 (13.5 NAVD88) in the wet season.

G-161 is comprised of two 60-inch diameter culvert barrels with a total length of 240 feet and is located immediately west of the intersection of the Beeline Highway and Northlake Boulevard. The G-161 structure will act as the gateway through which water will be transported from Grassy Waters Preserve (GWP) through the system to the NWFLR. This structure can pass up to 150 cfs under Northlake Boulevard into the GWP Triangle. This water then flows northward through the Triangle in a sinuous constructed channel, under the existing railroad bridge, and through an existing Beeline Highway culvert to the C-18 canal. Once delivered to the C-18 canal, this water then continues northward, through G-160 and G-92 to Lainhart Dam and the NWFLR.

The G-160 structure is also considered to be a project feature that was constructed early. It is a reinforced concrete spillway designed to enhance delivery of the restoration flows to the NWFLR while maintaining water elevations within the Loxahatchee Slough. Discharges from G-160 are controlled by two stem-operated vertical lift gates. The design discharge rate, to maintain flood control capability, will be approximately 2,000 cfs via two spillway bays, each 25 ft in length. The

structure is operable to allow for the dual purposes of flood risk management and environmental restoration. The operable gates allow for management of upstream stages to mimic natural slough recession and ascension in water depth between the wet and dry seasons.

The GWP Triangle is located northwest of the intersection of Beeline Highway (SR-710) and Northlake Boulevard. Hydrologic restoration of this area will be accomplished through earth work and strategic construction of a natural conveyance feature, a shallow swale with gentle slopes, running in an east to west direction, which will allow water discharged from G-161 to be spread westward to help improve the hydroperiod in the area. The shallow swale will allow for a hydrologic connection between the western and eastern portions of the triangle. When water levels are high in the western triangle (or vice versa), this shallow swale will facilitate connectivity and equalization of the triangle hydrology, enabling storage and hydroperiod improvement. This provides flexibility to the system and improves the wetland storage capability.

Figure 1-5 LOCATION MAP OF MAJOR FEATURES IN FLOW-WAY 1

Flow-way 2

Flow-way 2 is located in the central portion of the project area and is shown in Figure 1-6. Its primary canal conveyances are the M-O and C-18W Canals. The primary feature of the LRWRP TSP in Flow-way 2 is the C-18W storage reservoir, and four (4) co-located ASR wells. Water from ITID and the J.W. Corbett WMA that otherwise would be discharged to tide via the L-8 and C-51 canals is captured in the reservoir and diverted northward to the NWFLR to achieve restoration flow targets. Excess C-18W basin water will also be diverted to the reservoir.

A new M-O Connector Canal will link the eastern terminus of the M-O Canal to the proposed Seminole-Pratt Whitney Road culverts. This 3,500 ft. long connector canal will be located along the eastern border of the J.W. Corbett WMA and will deliver excess water from the ITID upper

basin to the culverts. A pump station will be constructed to move water from the M-O Canal to this connector canal.

Two 36-inch gated culvert structures will replace an existing sheet pile weir located at the eastern edge of the J.W. Corbett WMA adjacent to the proposed reservoir. The operable structure will help control discharges towards the reservoir while simultaneously providing improved ecological conditions within the J.W. Corbett WMA through operational flexibility during the wet and dry seasons.

A multi-barrel culvert crossing under Seminole-Pratt Whitney Road will be sized to carry the overflow discharge from the new J.W. Corbett WMA operable structure and the M-O connector to the new seepage canal for the C-18W Reservoir. The water will be pumped from the seepage canal into the reservoir at a rate of up to 250 cfs with a pump station to be located along the western perimeter of the C-18W Reservoir. As noted, this pump station will be sized to pump both seepage from the reservoir and inflow from J.W. Corbett WMA and M-O Canal Connector into the reservoir.

The proposed C-18W Reservoir is a 9,500 acre-feet (ac-ft) aboveground reservoir on approximately 1,600 acres of a 1,920-acre former citrus grove. The reservoir will provide pumped diversion and storage of excess flows from the adjacent C-18W Canal, J.W. Corbett WMA, and from ITID upper basin via the M-O Canal. The reservoir will release water back to the C-18W Canal for delivery downstream to Lainhart Dam and the NWFLR. The embankment height will be approximately 18.5 ft above natural ground elevation with a normal design pool depth of approximately 7.5 ft and a normal pool elevation of 27.5 ft NAVD88.

The main inflow/discharge canal for the C-18W Reservoir is located between the C-18W Canal and the northern embankment of the reservoir. A 300 cfs inflow pump station will bring available water into the reservoir from the C-18W Canal. The reservoir will have two main outflow structures 1) a gated culvert discharge structure for normal operations; and 2) an emergency overflow spillway. Both will be along the northern side of the reservoir. The normal discharge structure will include dual 48-in diameter culverts that discharge 300+ cfs, depending on the stages within the reservoir. The proposed overflow structure will be a 50 ft wide concrete spillway crest at an elevation lower than the embankment elevation.

The seepage management system design for the C-18W Reservoir will vary depending on location. A soil-bentonite slurry seepage cut-off wall will be installed adjacent to the residential community to the south, the proposed development to the east, and the FWC Palm Beach County Shooting Sports Park to the northwest. The total length for all seepage wall segments is approximately 2.5 miles. Other areas adjacent to the reservoir will maintain seepage through the use of seepage collection canals. The western seepage canal will receive water from the J.W. Corbett WMA operational structure and the M-O Connector Canal in addition to seepage from the reservoir. A 250 cfs pump station in this western canal will pump canal water into the C-18W Reservoir.

A four well Aquifer Storage and Recovery (ASR) system will be constructed at the C-18W Reservoir to augment surface storage capacity and provide greater flexibility in reservoir operations. The source of surface water for aquifer recharge will be a canal along the western margin of the C-18W Reservoir or directly from the C-18W Reservoir. Each well will pump surface water into the Floridan Aquifer System at 5 million gallons per day (MGD). Water will be recovered

at a rate of 5 MGD and discharged into the C-18W Reservoir, for subsequent distribution into the C-18W Canal.

Figure 1-6 LOCATION OF PROJECT FEATURES IN FLOW-WAY 2

Flow-way 3

Flow-way 3 is located mostly within southern Martin County, with a small portion extending into northern Palm Beach County, as shown in Figures 1-7 and 1-8. The components of Flow-way 3 provide benefits to the Kitching Creek, Cypress Creek and Moonshine Creek tributaries to the NWFLR. Flow-way 3 actions include installing plugs, backfill, and adding water control structures in canals and ditches to reduce over drainage, restore water levels in semi-drained wetlands, and restore base flow to the NWFLR. A flow-through wetland will capture pulsed discharges of water from northern and western agricultural areas and retain the water for on-site benefits and for improved timing of release to the river. Pumps and berm improvements will ensure that nearby

residential and agricultural areas will not be adversely impacted by the changed hydrology of the restored wetlands.

Pal-Mar East (*Nine Gems*): On the Pal-Mar East property, internal drainage canals will be filled, and small drainage pipes and culverts will be removed to improve hydroperiods and ecology within the area. Minor improvements to existing berms will be necessary at irregular intervals along the Pal-Mar East northern and eastern border to ensure water is held on site during larger storm events.

The existing canal along south and west sides of Pal-Mar East will be plugged or backfilled. This will improve connectivity of Culpepper with Nine Gems and allow water to flow from Culpepper to Nine Gems rather than being captured in the existing canal. This canal provides drainage for Thomas Pepper Farm, so alternative drainage for the farm will be required.

Thomas Pepper Farm: The Thomas Pepper farm is located to the west of Pal-Mar East Property and Pratt Whitney Road (SR-711). Because the canal and ditch removals for restoration of Pal-Mar East will disrupt the existing drainage for the farm, an existing drainage ditch that runs along the northern boundary of Pal-Mar will be deepened and/or widened to handle additional flow from the pepper farm. A new culvert and pump will be required to re-route the farm's drainage under Pratt-Whitney Road and into the newly expanded drainage canal.

Cypress Creek Canal (*also known as Ranch Colony Canal*): Modifications to four Culpepper control structures include increasing the inlet control elevations and making the structures operable to achieve a more desirable hydroperiod within the Culpepper property of Pal-Mar East, while simultaneously reducing discharges into the Cypress Creek Canal.

Berm improvements along the Cypress Creek Canal and along the eastern border of Pal-Mar East (western border of the Ranch Colony Community) will provide a uniform protection elevation for the neighborhoods and account for the proposed modification to the inlet control elevations of the four water control structures, which will cause higher stages on the property to the west.
A new control structure near the eastern end of the Cypress Creek Canal will improve management of water elevations within the canal during the wet and dry season. The structure will be a two-bay concrete ogee spillway with telemetry operated vertical lift gates. Each bay will be 10 ft wide with a crest elevation at approximately 9 ft NAVD88. During the dry season, the gates will hold additional water in the canal, assisting in the improvement of groundwater levels by reducing groundwater draw down in Pal-Mar East and the Cypress Creek Natural Area. During the wet season, the gates will help maintain restoration target stages in Pal-Mar East and the Cypress Creek Natural Area. The gates will open to allow high volume flows to pass without causing adverse flooding to nearby private property. The design will maintain or improve the current flood protection for the surrounding developments.

Mack Dairy Spreader Swale: The Mack Dairy Spreader Swale will extend approximately 3,500 feet south from the Cypress Creek Canal, parallel to Mack Dairy Road. It will have an average depth of 3 feet, bottom width of 5 feet, 3H:1V side slopes, and the western edge of the spreader will be higher elevation than the eastern edge. A 50 cfs pump station will send water from the Cypress Creek Canal into the spreader swale. This spreader swale will assist in distributing water in a southerly direction, then allowing the natural topography to cause the water to flow east across the Cypress Creek Natural Area toward the Loxahatchee River, restoring historical flow patterns. The easterly forks of Cypress Creek will be re-graded to maintain low flow velocities and promote native vegetation.

Gulfstream West: The Gulfstream West flow-through marsh feature will pump water from the existing Hobe St. Lucie Conservancy District (HSLCD) drainage canal into a series of collection ditches and spreader berms that will promote sheet flow and re-hydration of the site. The site will be graded, and existing drainage ditches will be removed to provide a more uniform topography and slight north to south gradient to promote flow in a southerly direction. A perimeter levee will ensure water is held on-site. A 250 cfs pump will deliver runoff from Thomas Pepper Farm, HSLCD and Pal-Mar East into the flow through marsh. The existing HSLCD discharge canal will be straightened and used as a bypass canal if total runoff exceeds 250 cfs or when water elevations within the flow-through marsh exceed an average depth of 3 feet. The outflow structure will be a notched weir and is designed to discharge a variable rate depending on the marsh depth, with discharges reaching greater than 250 cfs when water depth within the marsh exceeds 3 feet. At 1.75 feet of depth the discharge will be approximately 30 cfs to provide Cypress Creek tributary baseflow to the Loxahatchee River. All discharge from the flow-through marsh will be downstream of the new Cypress Creek Canal structure.

Gulfstream East and Moonshine Creek: The Gulfstream East and Moonshine Creek area is located east of I-95 and Florida's Turnpike (Figure 1-8). Existing site drainage ditches will be filled, and the property will be re-graded to the historical topography. The Hobe Grove Ditch and historical Moonshine Creek channel are partially separated due to heavy vegetation and sediment. The area will be regraded so as to connect the Hobe Grove Ditch and Moonshine Creek, facilitating flow to the creek. Additionally, a new weir will be installed at the eastern extent of the Hobe Grove Ditch to help hold additional water within the ditch, improving the groundwater levels while helping to promote additional flow down the historic Moonshine Creek. The proposed weir elevation is 7.5 ft NGVD29 (6 ft NAVD88).

Kitching Creek: A spreader swale will be constructed to the east and west from Jenkins Ditch at the north end of the Jonathan Dickinson State Park. This swale will help distribute flows to historic Kitching Creek channels instead of directly down the ditch. A sheet pile weir or earthen plug will be constructed in the ditch upstream of the main Kitching Creek channel at elevation 12.0 ft NGVD to aid in the dispersion of water into the spreader system.

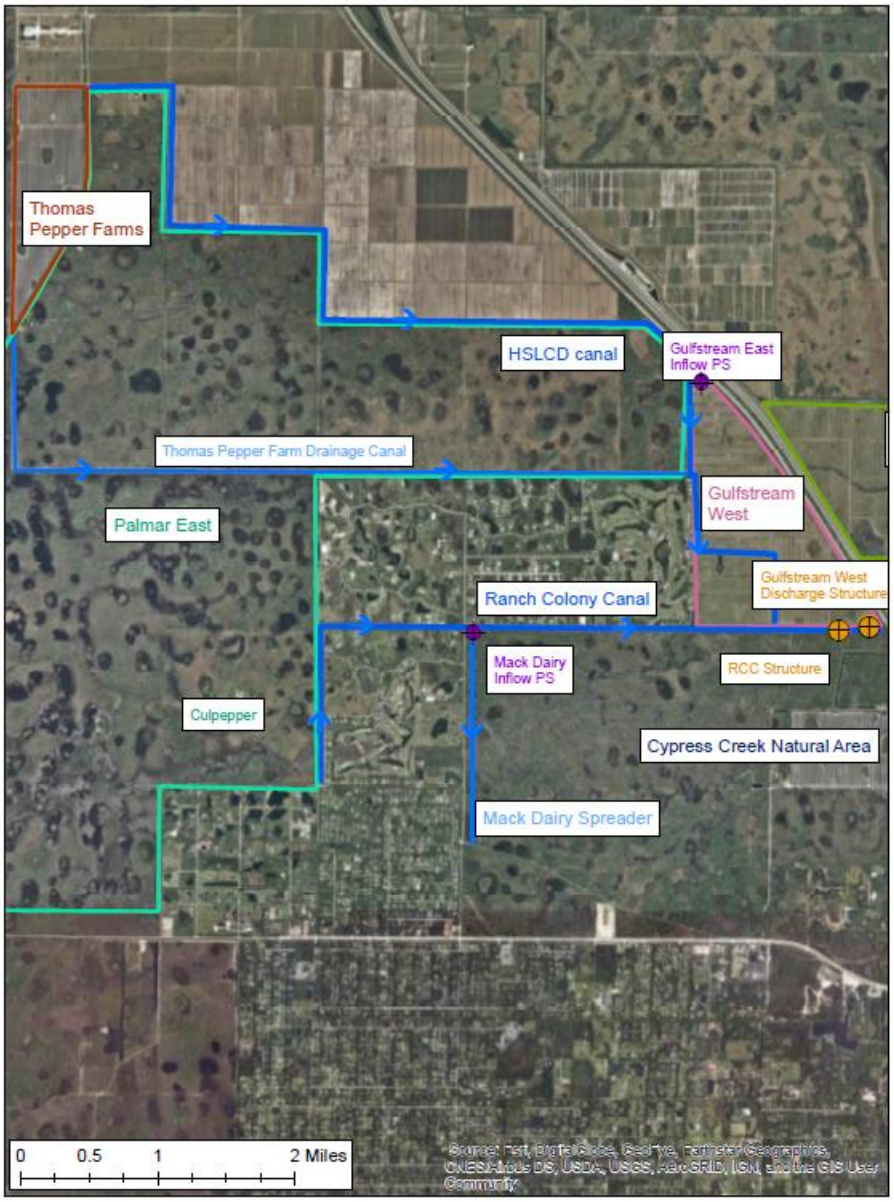

Figure 1-7 LOCATION OF WESTERN PROJECT FEATURES OF FLOW-WAY 3

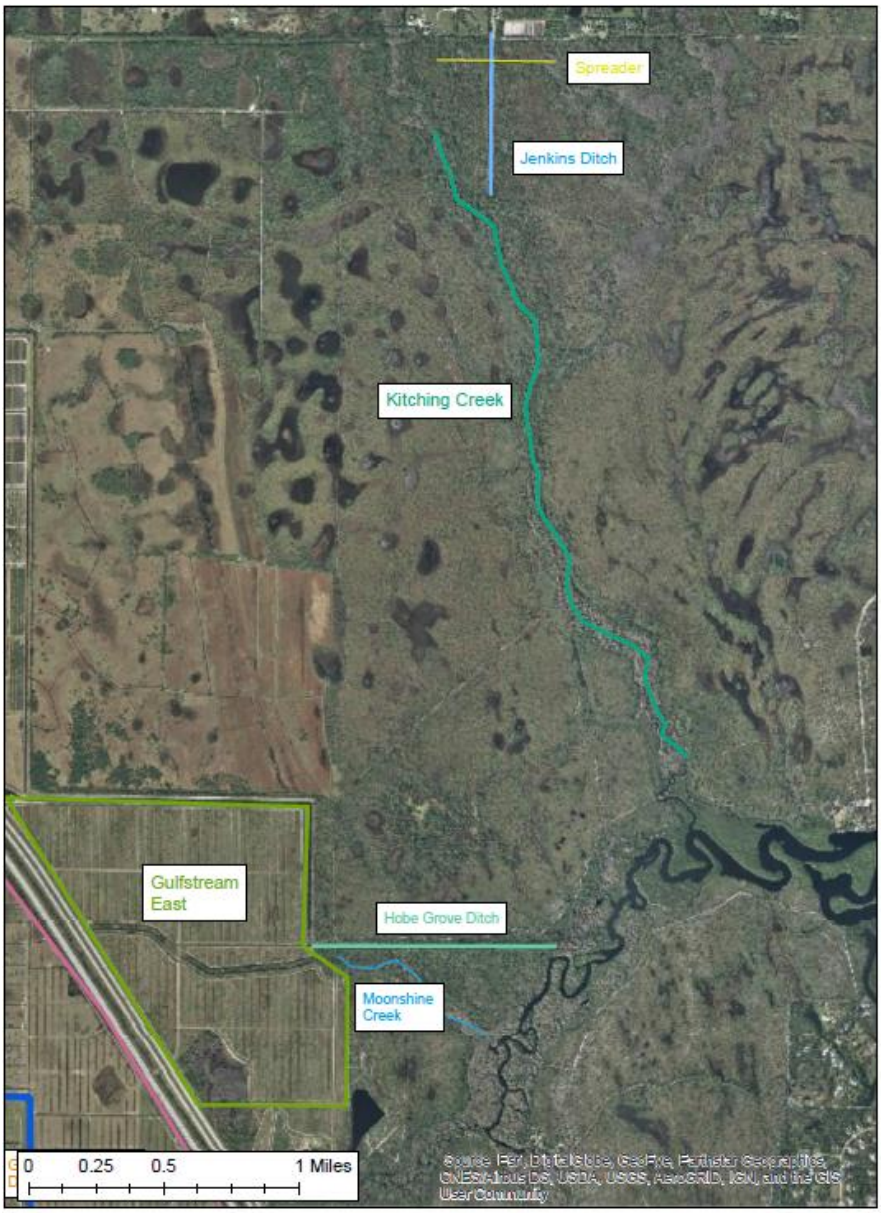

Figure 1-8 LOCATION OF EASTERN PROJECT FEATURES OF FLOW-WAY 3

1.5 State Authority for CERP Projects

The Florida Legislature authorizes the SFWMD to act as local sponsor for CERP projects. Section 373.1501, F.S. requires the SFWMD, for each CERP project, to analyze and evaluate whether all needs are being met in a comprehensive manner, to consider all applicable state water resource issues and to determine if it is technologically feasible and cost effective. Specifically, SFWMD must evaluate the following:

Water Resource Evaluation - water supply, water quality, flood protection, threatened and endangered species and other natural system and habitat needs (Paragraph 373.1501(5)(a), F.S.)

Project Feasibility - determine, with reasonable certainty, project feasibility based upon standard engineering practices, cost effectiveness, consistency with CERP purposes and implementation of other CERP projects, and operations (Paragraph 373.1501(5)(b), F.S.). Consistency with state and federal laws - determine, with reasonable certainty, that each CERP project is consistent with applicable laws and can be permitted and operated as proposed (Paragraph 373.1501(5)(c), F.S.)

Project Assurances - Provide reasonable assurances that the quantity of water available to existing legal users shall not be diminished by a CERP project so as to adversely impact existing legal users; that existing levels of service for flood protection will not be diminished outside the geographic area of the project; and that water management practice will continue to adapt to me the needs of the restored natural environment (Paragraph 373.1501(5)(d), F.S.)
Utility and Public Infrastructure Coordination - Coordinate with existing utilities and public infrastructure or minimize impacts to the relocation of existing public infrastructure and utilities (Paragraph 373.1501(5)(e), F.S.)

The FDEP has oversight to ensure that SFWMD has conducted these required evaluations (Subsection 373.1501(4), F.S.) and these evaluations are necessary for FDEP to approve each CERP project in order for the project to receive state funds and be submitted to Congress for authorization, Paragraph 373.026(8)(b), F.S. The FDEP is required to approve each CERP project following the formal submittal of the state compliance report by the SFWMD to FDEP.

In addition, Paragraph 373.470(3)(c), F.S., requires the SFWMD, in cooperation with the U.S. Army Corps of Engineers (USACE), to complete a Project Implementation Report that identifies the increase in water supplies resulting from each CERP project, which shall be allocated or reserved by SFWMD. FDEP is also required to issue Comprehensive Everglades Restoration Plan Regulation Act permits for construction and operation of each CERP project, Section 373.1502, F.S.

2 Water Resource Analysis and Evaluation

Under Subsection 373.1501(5)(a), F.S., the SFWMD shall “analyze and evaluate all needs to be met in a comprehensive manner and consider all applicable water resource issues, including water supply, water quality, flood protection, threatened and endangered species and other natural system and habitat needs.”

2.1 Water Supply

An existing legal use of water is defined in Florida State law as a water use authorized under a SFWMD water use permit or existing and exempt from permit requirements. Existing legal users of water including agricultural and urban will continue to be met by their current sources All existing legal users will continue to have their needs met during implementation and once the project is operational.

Implementation of the TSP will not cause existing legal water sources to be eliminated or transferred. The project maintains existing water supply performance for agricultural and municipal water users in the Lake Okeechobee Service Area (LOSA) and North Palm Beach Service Area within the LRWRP project area. The recommended plan also fulfills WRDA 2000 Savings Clause requirements which, in part, ensure existing legal sources of water supply such as water for

municipal, agricultural, and fish and wildlife uses continue to be available with project implementation.

Elimination or Transfer of Existing Legal Sources of Water

To analyze the potential elimination or transfer of existing legal sources, affected basins or users are evaluated. The basins and users that may be affected by the project are displayed in Table 2-1, classified according to the categories identified in WRDA 2000.

Table 2-1 Existing Legal Sources Evaluated for Elimination and Transfer.

WRDA 2000, Section 601(h)(5)	User or Natural System Evaluated in LRWRP
(i) an agricultural or urban water supply;	A portion of the Lake Okeechobee Service Area (LOSA). A portion of the Upper East Coast Service Area within the study area (Water Restriction Area 1 – WRA 1). The North Palm Beach Service Area within the study area (Water Restriction Area 2 - WRA 2).
(ii) allocation or entitlement to the Seminole Indian Tribe of Florida under section 7 of the Seminole Indian Land Claims Settlement Act of 1987 (25 U.S.C. 1772e);	Not applicable to this project.
(iii) the Miccosukee Tribe of Indians of Florida;	Not applicable to this project.
(iv)water supply for Everglades National Park; or	Not applicable to this project.
(v) water supply for fish and wildlife.	Loxahatchee River Northwest Fork and Estuary. Watershed wetlands (Loxahatchee Slough, Pal-Mar East, Loxahatchee Tributaries).

The primary LECSR-NP model results evaluated for effects to agricultural or urban water supply are the frequency, severity and volume of water use cutbacks, applicable to Water Restriction Area 1 (WRA 1), which includes the Martin County portion of the study, and Water Restriction Area 2 (WRA 2), which includes a portion of North Palm Beach Service Area. Additional information available to evaluate agricultural and urban water supplies includes sub-regional groundwater differences maps, regional water supply deliveries, and groundwater stages near public water supply wellfields. The selected metrics provide more direct and higher resolution measures of potential water supply effects for the LRWRP Savings Clause assessment than would be provided through assessment of inflow volume probability curves for each user group or basin. Changes in the frequency, severity or volume of water use cutbacks must be evaluated to see if the water sources have been eliminated or transferred in the simulation of the with-project condition.

Existing legal sources of water in WRA 1 include groundwater withdrawn by public utility wellfields, private wells, irrigation wells, and surface water withdrawals for landscape, recreation, and agricultural uses.

Water supply demand continues to be met by locally available water sources, primarily the surficial aquifer system. When Lake Okeechobee falls into the water shortage zone and water use cutbacks are imposed, only the public water suppliers and other users in WRA 1 that rely on the regional system, including Lake Okeechobee, are included in the water shortage order (only HSLCD has some reliance on Lake Okeechobee and is subject to regional water use cutbacks). The WRA 1 is placed under water shortage order when local groundwater levels decline below trigger levels. This function is represented in the LECSR-NP trigger package. Although the LECSR-NP model predicts the absolute number of water supply cutback events and the corresponding frequency of occurrence have a high degree of uncertainty, relative comparisons between the Existing Condition Base (ECB), Future Without (FWO) and Tentatively Selected Plan (TSP) provide a meaningful comparison to quantify potential effects of the project (Table 2-2).

In WRA 1, the frequency and severity of water restrictions (water use cutbacks) triggered by dry conditions including droughts are identical between the ECB, FWO and the TSP.

Table 2-2. Frequency, Duration and Severity of Water Shortages in the Pre-project and Post-project Simulations for Water Restriction Area 1 (in months).

	Frequency (months)	Duration (months)	Severity (months)
ECB	5	22	27
FWO	5	22	27
TSP	5	22	27

WRA 2 receives water supply from the regional system and water use cutbacks can be triggered by either Lake Okeechobee stages or by stages at local groundwater trigger sites in the service area. The TSP does not change either the frequency or severity water use cutbacks relative to the ECB and FWO (Table 2-3). The TSP results in a slight reduction in demands not met for PWS. Over the entire 41 years of simulation; 14 years showed water use cutbacks.
In the TSP, the total demand not met for public water supply in WRA 2 in 14 years with water restrictions is 4,417 million gallons (MG). The FWO had a slightly larger demand not met, 4,438 MG. Thus, the TSP showed a 21 MG improvement in demands not met. Averaged over the 14 years of cutbacks, the difference is not significant, representing an improvement of less than 1 percent.

Table 2-3. Frequency, Duration and Severity of Locally Triggered Water Use Cutbacks in Water Restriction Area 2 (in months).

Alt	Frequency (months)	Duration (months)	Severity (months)
ECB	2	16	16
FWO	2	16	16
TSP	2	16	16

Urban, agricultural and tribal water supply is not diminished with the LRWRP TSP. The model results are further described in Annex B (B.3.4.1 and B.3.4.2) of the PIR.

2.2 Water Quality

Water body classifications vary throughout the study area. The primary Central and South Florida Flood Control Project (C&SF) Canals (L-8, C-18) are categorized as Class III waterbodies, The M-Canal, downstream of the City of West Palm Beach's Control 2 pump station, is classified as a Class I water body. The LRWRP is not expected to significantly affect the Loxahatchee River's compliance with applicable Outstanding Florida Waters anti-degradation criteria. Water quality conditions in Loxahatchee River are expected to improve as compared to the FWO project condition because in general the freshwater inflows will be greater and will be more similar to the historic hydrologic pattern before the C&SF project interrupted natural drainage to the NWFLR. Particularly in the Flow-way 3 area, more flow will be via sheet flow rather than direct canal discharges.

Loxahatchee River Watershed

Aquatic habitats within the LRWRP project area are very diverse and water quality conditions associated with those water bodies are correspondingly highly variable. Freshwater surface water systems within the project area include extensive wetland systems and both natural and man-made lakes. In addition to the relatively natural aquatic habitats, there are also extensive man-made canal networks and while these are considered freshwater surface waters, their physical and chemical characteristics often differ markedly from natural systems.

Variability in water quality mirrors the diversity in land uses. Within basins predominated by undeveloped lands that remain relatively pristine the water quality is characterized by low nutrient levels, variable but often elevated dissolved oxygen levels reflective of high biological productivity, and low concentrations of pollutants typically associated with land development (metals, petroleum hydrocarbons, other organics). For example, the interior of GWP is considered in near pristine condition, with observed total phosphorus (TP) concentrations of approximately 10 parts per billion (ppb). In contrast, the edges of GWP, along the M and perimeter canals, are degraded by water with higher nutrient concentrations as is evidenced by the presence of vegetation, primarily cattails, that is indicative of nutrient enrichment. Water quality degradation is found in basins with land cover dominated by urban and/or agricultural uses, where relative pollutant presence is inversely related to the level of success in the implementation of appropriate storm water best management practices. The eastern C-51 Basin is representative of the urbanized condition while the westernmost segment of the L-8 Basin is representative of areas where surface water quality is strongly influenced by localized agricultural operations.

Loxahatchee River Estuary

Estuarine water quality largely reflects the cumulative influence of freshwater interaction with the land as it moves downstream to the estuaries. Tidally driven mixing of such freshwaters delivered to the estuary with seawater incursions through inlets generates the varied salinity regimes of these transitional habitats that are crucially important to the overall biological integrity of the estuaries and near-shore environments. In addition to salinity, which is perhaps the key water quality parameter to consider when addressing estuarine system conditions, the cumulative loading of other water quality constituents to the estuaries strongly influences the nature and health of the estuaries. In the project area, the Loxahatchee River Estuary is the ultimate estuarine receiving water, and the existing water quality conditions generally reflect their watershed conditions and local physical, chemical and biological processes.

The Loxahatchee River Estuary has been greatly altered from its historical, pre-development condition due to the combination of watershed changes over time and the installation or

stabilization of the Jupiter Inlet to the Atlantic Ocean. In the Loxahatchee River Estuary salinity stresses are correlated with proximity to locations of major pulsed inflow of stormwater during flood control operations. Evidence of salinity stress is present in the Southwest Fork of the River, fed primarily by C-18 Basin inflows passing through the S-46 Structure. Salinity in the Loxahatchee Estuary can rebound quickly as a result of greater tidal exchange. The historical stabilization of Jupiter Inlet has resulted in a greater saltwater influence further upstream into the system contributing to the relatively favorable salinity regime in the existing central estuary. That inland salinity penetration has also been favored by reductions in dry season base flows. The net effect is that the mid to upper reaches of the NWFLR are now more saline than in the past, and the vegetative communities along certain river reaches reflect this changed surface water quality condition. Cypress and associated freshwater wetland communities have been variably replaced by mangroves reflecting this upstream movement of the estuarine water quality condition. This is viewed as a problem in that some of the last remaining "wild and scenic" habitats of this part of the river are threatened by this changed water quality condition.

The SFWMD, Loxahatchee River District, and others have conducted long term water quality monitoring studies within the Loxahatchee System, and have documented that ambient conditions generally do not suggest excessive eutrophication due to excessive nutrient loading. However, concerns do exist that continuing land development may contribute to increased nutrient loading (Stoner et al. 2016) that could ultimately catalyze algal blooms and/or fish kills. Further, as evidenced by the conditions in the St. Lucie Estuary to the north, concerns exist that water quality degradation due to modified upstream water management practices could inadvertently increase the chances of similar unacceptable estuarine water quality impacts.

Table 2-4. Numeric Nutrient Criteria Specific to the Loxahatchee River and Estuary.

Estuary	Total Phosphorus	Total Nitrogen	Chlorophyll a
(q) Loxahatchee River Estuary	For estuary segments with criteria expressed as annual geometric means (AGM), the values shall not be exceeded more than once in a three-year period. For all other estuary segments, the criteria shall not be exceeded in more than 10 percent of the measurements and shall be assessed over the most recent seven-year period.		
1. Lower Loxahatchee	0.032 mg/L as AGM	0.63 mg/L as AGM	1.8 µg/L as AGM
2. Middle Loxahatchee	0.030 mg/L as AGM	0.80 mg/L as AGM	4.0 µg/L as AGM
3. Upper Loxahatchee	0.075 mg/L as AGM	1.26 mg/L as AGM	5.5 µg/L as AGM
4. Loxahatchee River Estuary (Southwest Fork)	0.075 mg/L as AGM	1.26 mg/L as AGM	5.5 µg/L as AGM

Nutrient Criterion

Phosphorus and nitrogen compounds are of concern to the ecosystems of the Loxahatchee River Watershed, including the Loxahatchee River and Slough, Grassy Waters Preserve (GWP), and the Loxahatchee Estuary, since they can negatively affect the flora and fauna of aquatic ecosystems. The Florida Department of Environmental Protection (FDEP) has established surface water quality numeric nutrient criteria for many Florida water bodies and where there are no numeric criteria, the narrative criteria apply (62-302.530(47)(b), F.A.C). Florida has developed National Pollutant Discharge Elimination System (NPDES) Total Maximum Daily Loads (TMDLs) for many watersheds that have been determined to have excessive nutrient pollution. Additional information on the status and implementation of TMDLs within the study area can be found at http://www.dep.state.fl.us/water/tmdl/.

Estuary-specific numeric interpretations of the narrative nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., are outlined in the table above. The concentration-based estuary interpretations are open water, area-wide averages. Numeric values listed in Table 2-4 above for nutrient and nutrient response values do not apply to wetlands or to tidal tributaries that fluctuate between predominantly marine and predominantly fresh waters during typical climatic and hydrologic conditions unless specifically provided by name. The interpretations expressed as load per million cubic meters of freshwater inflow are the total load of that nutrient to the estuary divided by the total volume of freshwater inflow to that estuary. The numeric values listed above will be superseded if, pursuant to subsection 62-302.531(2), F.A.C., a more recent numeric interpretation of the narrative nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., such as a Level II Water Quality Based Effluent Limitation (WQBEL), Site Specific Alternative Criterion (SSAC), Total Maximum Daily Load (TMDL), or Reasonable Assurance Demonstration, is established by the Department.

For streams, if a site-specific interpretation pursuant to paragraph 62-302.531(2)(a) or (2)(b), Florida Administrative Code (F.A.C.), has not been established, then biological information shall be used to interpret the narrative nutrient criterion in combination with Nutrient Thresholds. The narrative nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., shall be interpreted as being achieved in a stream segment where information on chlorophyll *a* levels, algal mats or blooms, nuisance macrophyte growth, and changes in algal species composition indicates there are no imbalances in flora or fauna, and either:

1. The average score of at least two temporally independent stream condition indices (SCIs) performed at representative locations and times is 40 or higher, with neither of the two most recent SCI scores less than 35, or
2. The nutrient thresholds set forth in Table 2-5 are achieved.

Table 2-5. Stream Numeric Nutrient Criteria Relative to the LRWRP Study Area.

Nutrient Watershed Region	Total Phosphorus Nutrient Threshold[1]	Total Nitrogen Nutrient Threshold[1]
Peninsular	0.12 mg/L	1.54 mg/L
South Florida	No numeric nutrient threshold. The narrative criterion in paragraph 62-302.530(47)(b), F.A.C., applies.	No numeric nutrient threshold. The narrative criterion in paragraph 62-302.530(47)(b), F.A.C., applies.

[1]These values are annual geometric mean concentrations not to be exceeded more than once in any three-calendar year period.

Phosphorus is typically considered the limiting nutrient in many South Florida systems. Increased concentrations often correlate with increased algal development and can lead to an imbalance in animal and plant communities (Sklar, Chimney, Newman et.al., 2005). The FDEP has developed water quality standards for phosphorus within the Everglades Protection Area (EPA) (FAC 2017), lakes, rivers and springs (FAC 2016b), and estuaries (FAC 2016a). The total phosphorus nutrient threshold (i.e. the annual geometric mean) for peninsular biological region is 0.12 mg/L (FAC 2016b), unless an estuary site-specific value has been established (FAC 2016a), as shown in Table 2-5.

Surface Water Quality

The water quality evaluation for the LRWRP was focused on the three geographic flow-ways and the Loxahatchee River, as well as specific locations within the watershed. The flow-ways are as follows:

- Flow way 1: L-8 canal, M canal, Grassy Waters Preserve, Lox Slough, Lake Okeechobee
- Flow way 2: C-18 basin, C-18 West Weir, C-18 Canal, S-46
- Flow way 3: Pal Mar, Pal Mar East (Nine Gems), Cypress Creek Canal, Hobe Grove Ditch, Kitching Creek

The primary focus of the water quality alternative evaluation was the impact of the changed flow on the concentration and total daily loads of phosphorus and nitrogen at various points. This was determined from a spreadsheet analysis of LECSR-NP modelled flows and baseline assumptions for existing TP and TN concentrations (Table 2-6).

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Table 2-6. Historical and Existing Total Phosphorus and Total Nitrogen Concentration Inflows and Outflows to LRWRP Area.

Flow-way	Basin/area	Volume (ac-ft) Inflow	TP (mg/L) Inflow	TN (mg/L) Inflow	Volume (ac-ft) Outflow	TP (mg/ L) Outflow	TN (mg/L) Outflow
3	PalMar	NM	NM	NM	NM	NM	NM
3	Cypress Creek	NM	0.079	1.11	20,886	0.053	<1.54
3	Hobe-St. Lucie	NM	0.110	1.26	3,759	0.071	<1.54
3	Kitching Creek	NM	0.079	1.32	10,534	0.075	1.893
2	C-18 Basin	27,804	0.017	1	44,594	0.017	0.98
2	C-18 Basin	16,790	0.016	1.225	44,594	0.017	1.037
2	Lox Slough	20,639	0.015	1.011	34,081	0.017	0.81
1	Lake Okeechobee	57,503	0.185	2.45	NA	NA	NA
1	L-8+Lake	117,925	0.143	2.3	117,925	0.123	1.636
1	ITID	27,804	0.039	1.352	27,804	0.039	1.352
1	GWP	13,442	0.01	0.839	2,977	0.01	0.839
1	GWP	13,442	0.01	0.839	17,660	0.013	1.011
River	Loxahatchee River NWF	85,039	0.055	1.02	NA	NA	NA
River	Loxahatchee River SWF	45,675	0.041	0.946	NA	NA	NA

(Data sources: SFWMD, DbHydro, 2017; ITID; Loxahatchee River District (river keeper data). NM = Not measured NA = Not applicable

All alternatives were evaluated using the water quality spreadsheet tool noted above and hydrologic input from the Lower East Coast Sub-regional model (LECSR). The total phosphorus (TP) and total nitrogen (TN) concentrations and loads were calculated based on the estimated concentration of each water input source and adjusted based on assumptions for project features that are known to improve water quality e.g., deep vs. shallow storage). All alternatives, including the TSP, showed a net decrease in system wide phosphorus concentration and load. None of the alternatives saw a detrimental increase in the amount of phosphorus in the system. While the three sites that were analyzed for TN showed decreases in concentration, daily loads were slightly increased, likely the result of increased flow. Tables 2-7, 2-8 and 2-9 show the TP and TN conditions for the TSP and the FWO. This plan does not deliver water to, nor does it take water from Lake Okeechobee. Detailed analyses can be found in Appendix C.1, Appendix C.2.1 and Appendix C.2.2 of the PIR.

Table 2-7. Summary for total phosphorus concentration and load (average annual)

Location	FWO (ppb)	FWO load (kg)	TSP (ppb)	TSP load (kg)
G-161	10	0	10	34
G-92	41	3,517	21	2,265
Lainhart	43	5,688	28	4,432
NWFLR	50	12,709	39	10,607

Table 2-8. Summary for total nitrogen concentration and load (average annual)

Location	FWO (mg/L)	FWO load (tons)	TSP (mg/L)	TSP load (tons)
G-92	0.92	78	0.87	96
S-46	0.95	53	0.90	44
NWFLR	1.17	297	1.12	299

Table 2-9. Alternative 5R (TSP) compared to the FWO.

Flow way	Basin/Natural Area	Inflow				Outflow			
		TP (mg/L)	TP Diff. To FWO (Alt-FWO)	TN (mg/L)	TN Diff. To FWO (Alt-FWO)	TP (mg/L)	Diff. To FWO (Alt - FWO)	TN (mg/L)	Diff. TN To FWO (Alt-FWO)
3	PalMar	N/M		N/M		N/M		N/M	
3	Cypress Creek	0.05	-0.029	1.11	0	0.05	-0.003	<1.54	0
3	Hobe-St. Lucie	0.11	0	1.26	0	0.068	-0.003	<1.54	0
3	Kitching Creek	0.079	0	1.32	0	0.071	-0.004	1.363	0
2	C-18 Basin	0.029	0.012	1	0	0.028	0.011	0.985	0.005
2	C-18 Basin	0.029	-0.014	1.225	0.121	0.028	-0.001	0.985	-0.052
2	Lox Slough	0.014	-0.001	1.011	0	0.013	-0.016	0.81	0
1	Lake Okeechobee C10A	0.185	0	2.45	0		0		0
1	L-8+Lake to C51	0.133	0.01	2.3	0	0.123	0.123	1.636	1.636
1	ITID	0.039	0	1.352	0	0.039	0	1.352	0
1	Grassy Waters Preserve	0.01	0	0.839	0	0.01	0	0.839	0
1	Grassy Waters Preserve	0.01	0	0.839	0	0.02	0.007	1.011	0
River	Loxahatchee River NWF	0.039	-0.011	1.11	-0.06		0		0
River	Middle Estuary (S/W Fork)	0.021	-0.02	0.899	-0.047		0		0

The project is not expected to degrade water quality and is instead expected to provide ancillary water quality improvement to the NWFLR and estuary.

2.3 Flood Protection

The TSP design features will maintain the existing levels of flood protection. Flood protection was evaluated by a combination of best professional judgment interpreting model results and engineering analyses. Consistent with the Draft Guidance Memoranda, the same models and results used for plan formation were applied for the LRWRP Savings Clause assessment. This varies from typical storm event analyses by using a long period of record simulation and focusing on the wet events included within the 1965–2005 simulation period. Stage duration curves for various areas of interest were reviewed to compare TSP relative to FWO and ground elevations to determine if the TSP may impact flood protection. Maps of cell locations and stage duration curves relative to discussion of model results can be found in Annex B, Figures B-10 through B-28 of the PIR.

Several areas within the project area that were analyzed include 1) the Hobe St. Lucie Conservancy District Unit 2 Agricultural Area, 2) the three geographical sections in Martin County that include the Ranch Colony, Old Trail and other residential developments, and 3) Indian Trail Improvement District residential areas. Groundwater levels in the Flow-way 3 area are significantly depressed as a result of a canal system that does not have any substantial control structures. This results in excessive discharges to the Cypress Creek Tributary in the wet season and little or no available water during the dry season. The alternatives, including the TSP result in an increase in groundwater levels, in some cases by greater than two (2) feet.

In southern Martin County, several residential developments (Old Trail, Ranch Colony, the Links, Colony Park) drain to Cypress Creek via the Cypress Creek Canal. This canal also provides drainage for areas to the west (Culpepper, Pal-mar) via a series of culverts that discharge into the canal. In the existing condition, all the drainage to Cypress Creek flows unimpeded, resulting in excessive storm water flows and excessively reduced area groundwater levels. Complaints of depleted groundwater stages, resulting in excessive interior lake drawdowns in the dry season, are common. Control elevations for the communities are variable, ranging from 14.5’ NGVD to 17.0’ NGVD.

The Ranch Colony points that were analyzed are in the Ranch Colony and Old Trail developments just north of the Cypress Creek Canal. Overall groundwater levels are expected to be elevated as a result of the implementation of the LRWRP and that is borne out with these graphics. The central and western Ranch colony stage duration curves (Figures 2-1 and 2-2) indicate that stages above the control elevations (14.5’ to 15.5’) occur in both the base conditions and the project conditions, though slightly more frequently with the project. These levels, however, remain considerably below ground surface. This increase in groundwater elevation is not expected to be problematic, however, it will be further investigated during the design phase. Canal improvements and operational structures are expected to provide slight improvements with respect to the ability to management water being discharged from these communities.

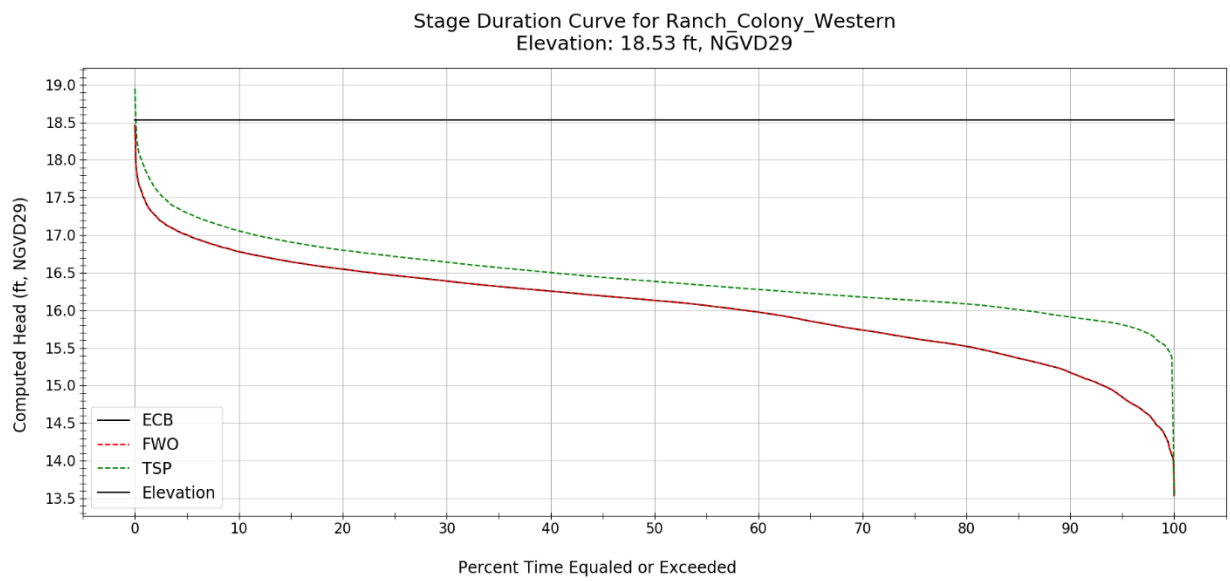

Figure 2-1. Stage duration curves for the ECB, FWO and TSP for Ranch Colony Western Point

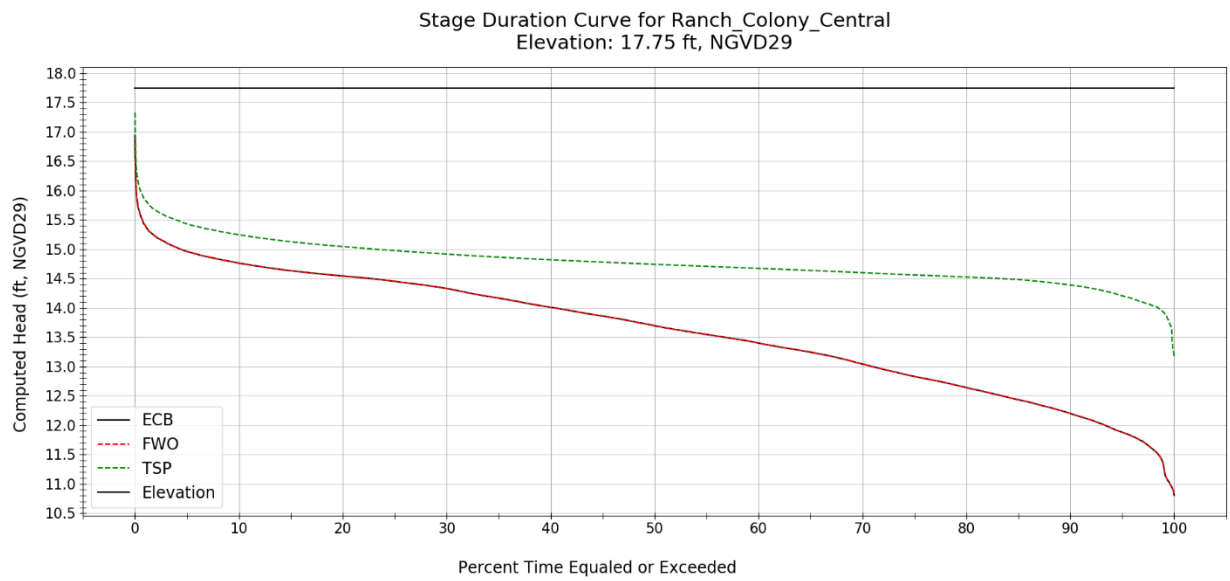

Figure 2-2. Stage duration curves for the ECB, FWO and TSP for Ranch Colony Central Point.

The stage duration curve for the Ranch Colony Eastern point (Figure 2-3, below) is in the vicinity of the Old Trail community. Old Trail has a control elevation of 16.0' NGVD. All stages over the model period of record stay below this control elevation. The stage durations curves for all three Ranch Colony Points show no increases above ground elevation. Note that when lines present on top of each other (not change between the conditions), colors may not present exactly as shown in the legend (that is, dashed lines may appear solid).

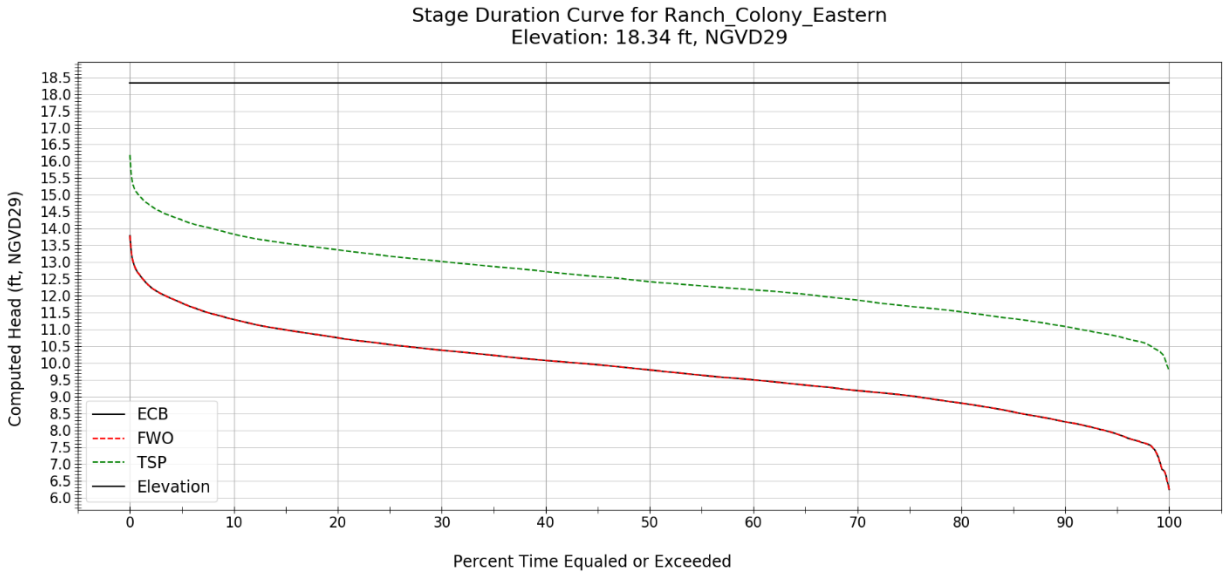

Figure 2-3. Stage Duration Curve for the ECB, FWO and TSP for the Ranch Colony Eastern Point.

The stage duration curve for the HSLCD agricultural area located just to the north of the project's proposed wetland restoration improvement in Pal-Mar east shows no change in ground or surface water levels, as seen in Figure 2-4.

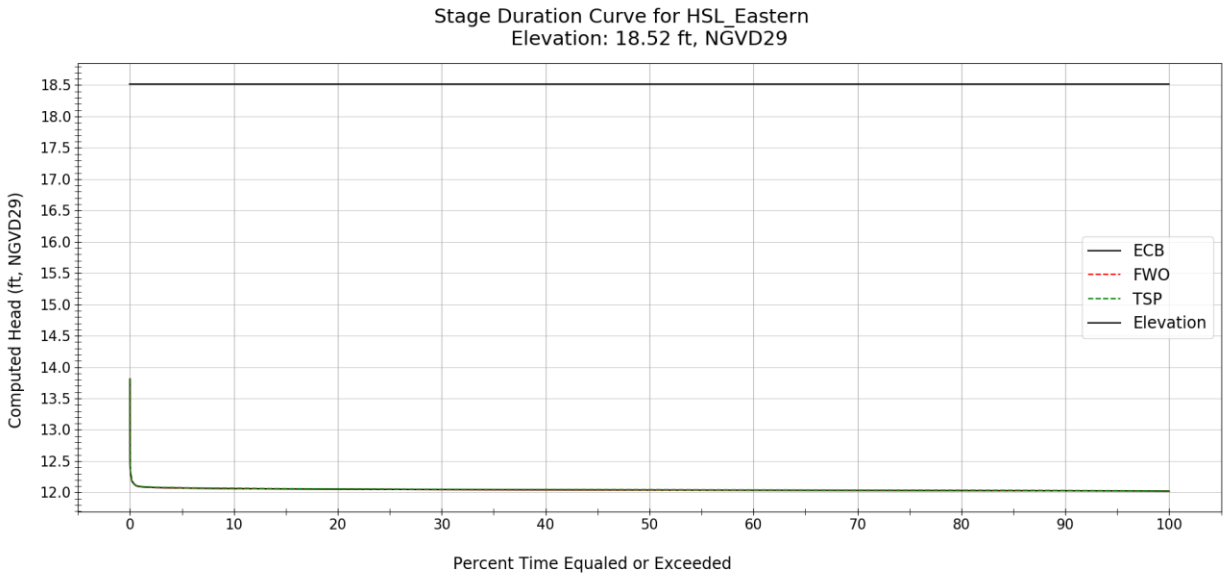

Figure 2-4. Stage duration curve for the ECB, FWO and TSP for the Hobe St. Lucie Conservancy District Agricultural area.

Several points were selected to represent the neighborhoods upstream of the proposed spreader swale on Jenkins Ditch in Martin County. These curves showed a slight decrease in surface water stage for these communities as shown in Figure 2-5. Curves for the Jupiter Farms, Ibis and Iron Horse communities showed no change in surface or groundwater stages for these areas. Please see Annex B in the PIR for these additional stage duration curves.

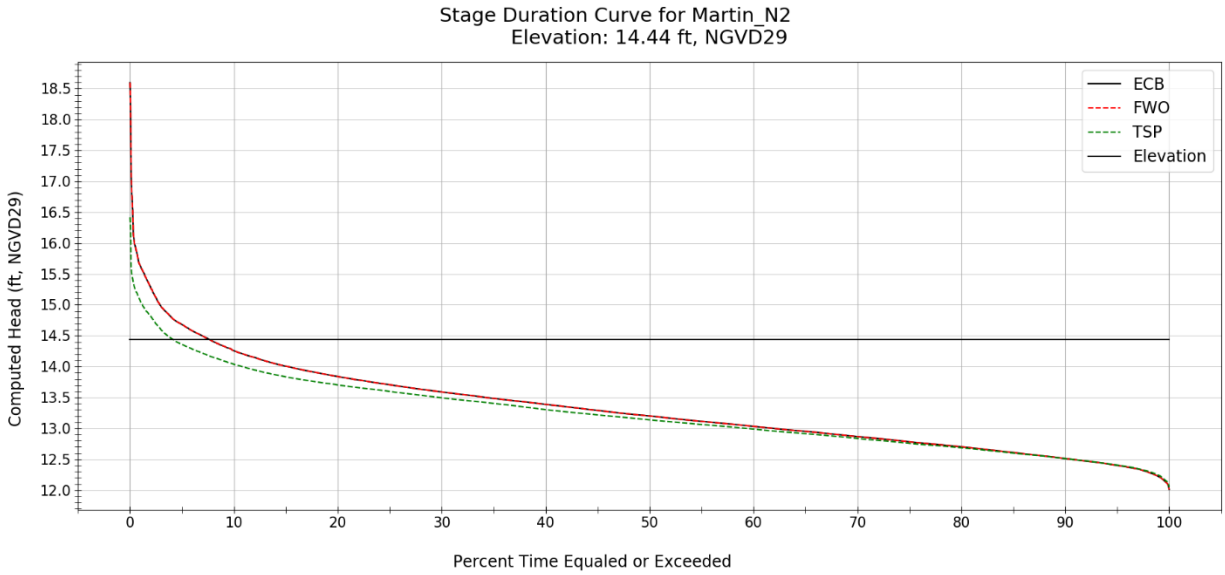

Figure 2-5 Stage duration curves for the ECB, FWO and TSP for the Jenkins Ditch neighborhood.

2.4 Threatened and Endangered Species

The natural mosaic of uplands and wetlands also provides habitat for a number of listed animal species including wetland dependent species such as the wood stork, Audubon's crested caracara, and the Everglade snail kite. Red-cockaded woodpeckers often nest in wet pine flatwood and formerly occurred in JDSP and other locations within the project area. In 1999, only about 25 clans composed of two to eight individuals were known to occur within J.W. Corbett WMA. Since 2006, 92 of these birds have been relocated from public land in Florida and Georgia to the Dupuis WMA in the western watershed. An average of 45% of these woodpeckers have stayed in the area for a least one year. Additionally, the number of breeding pairs and young produced has increased, and in 2015 twelve (12) breeding pairs produced 17 fledglings (http://www.ces.fau.edu/dupuis/wildlife-studies.php).

A threatened species, the West Indian manatee is an important marine mammal that lives within the estuarine and marine waters of the project area. The Loxahatchee River, along with several other locations such as Jupiter Sound and the North Palm Beach Waterway (NPBW) supports a 'relatively moderate' abundance of manatee in comparison to other areas of the county (2007 Palm Beach County Manatee Protection Plan). Species under the National Marine Fisheries Service's (NMFS) purview occur in the estuary, including Johnson's seagrass. Further offshore and beyond the project effect, elkhorn and staghorn corals and their critical habitats also occur.
The U.S. Army Corps initiated consultation with the U.S. Fish and Wildlife Service (FWS) on the potential effects of eight species pursuant to the FWS letter dated April 20, 2017. FWS provided a Coordination Act Report on February 1, 2019 and the Corps has revised their Biological Assessment to include red cockaded woodpecker to assist FWS in developing a Biological Opinion. Details of the life history of each species and the Corps' effects determinations are found in Annex A of the PIR. Table 2-10 provides a comparison of the FWO and alternatives with respect to the potential to affect eight species found within the study area. Further details on the T&E species identified can be found in Appendix C.2.1 to the PIR.

Table 2-10. Effects of alternatives on threatened and endangered species

Species	FWO	Alternatives 2, 5R, 10, 13
Everglade Snail Kite	Hydroperiods would remain the same; habitat availability would be unchanged. Everglade snail kite presence would remain primarily in Grassy Waters Preserve (GWP).	Rehydration and vegetation shifts within would increase suitable habitat for apple snails, thereby increasing spatial extent of suitable foraging opportunities for snail kites providing a moderate beneficial effect in Pal Mar and Cypress Creek. Alternatives would provide a significant beneficial effect to species foraging habitat in Loxahatchee Slough which is adjacent to known habitat in GWP. Based on performance measure 4, Alternative 13 would have the most potential benefit, followed by alternative 5R and 2, and alternative 10 the least overall improvement to potential Everglade snail kite habitat. Additional water from G-161 from GWP to the river is not expected to alter hydroperiods.
Wood Stork	Colonies occur at SWA and the golf course; project features are within core foraging areas; foraging opportunities would be generally unchanged.	Restoration of wetlands from former agricultural sites and improvement of natural area hydrology will provide increased foraging opportunities for the woodstork. Restoration actions are likely to improve the timing of wetland hydroperiods and recession rates in Pal Mar, Cypress Creek Natural Area, Jonathan Dickson State Park, and Loxahatchee Slough. Impoundments will maintain a minimum water depth of 6 inches and soil inversion of any contaminated soils to avoid any risk of bioaccumulation of contaminants from former agricultural sites. Foraging habitat benefits are highest with alternative 13 (C-18 natural flow-way), followed by Alternative 5R and 2, and alternative 10 providing the least overall improvement to wood stork foraging habitat.
Audubon's Crested caracara	Widespread foraging and possible unknown nesting; foraging opportunities could decrease with future land development	Foraging opportunities would be preserved in natural areas; hydrologic restoration to former citrus groves and other parcels could make them unattractive to caracara.
Eastern Indigo Snake	Maintenance of current water levels would not affect upland habitat.	Potential loss of habitat as former citrus is converted to a flow through marsh.

Species	FWO	Alternatives 2, 5R, 10, 13
Manatee	Lack of dry season and wet season flows to the Northwest Fork of the Loxahatchee River (Lainhart Dam and Tributaries) will continue to negatively affect freshwater submerged aquatic vegetation (*Vallisneria*) Salinity fluctuations in Florida Bay and southern estuaries would continue, potentially reducing quality sea grasses for foraging. Freshwater high volume flows into the South Fork and Middle Estuary of Loxahatchee River from S-46 would continue to degrade seagrasses.	All alternatives improve wet season flows from 78 to 98% or 100% for Alt 10. Dry season flows are improved from between 57 and 65% to 95% by Alt 10 with the larger storage feature, followed by alternative 5R to 91%, Alt 2 to 87%, and Alt 3 to 80%. Flow improvements are likely to improve low salinities (less than 5 psu) in the area of the river where *Vallisneria* is expected to improve (River Mile 10.5 to 6.5) thereby increasing foraging potential for manatee within this region and provide minor beneficial effects. There is a minimal reduction in high volume discharge events or seasonal low volumes from S-46 and a slight change in lower salinity conditions near River mile 4.0. This results in little to no improvements of low salinity stress on seagrass beds, and minimal increase in stress from Northwest Fork flows.
Panther	Maintenance of current water levels would not affect upland habitat.	Panther are rare in the project area; hydrologically restored areas would be less attractive habitats.
Florida bonneted bat	The project area is not within the current consultation area for bats.	The project area is not within the current consultation area for bats.
Okeechobee gourd	The project area is not within the current consultation area for Okeechobee gourd.	The project area is not within the current consultation area for Okeechobee gourd.

State Listed Species

The CERP project area contains habitat suitable for the presence, nesting, and/or foraging of 11 State-listed threatened and endangered species and 1 species of special concern. Threatened wildlife species include the American oystercatcher, black skimmer, least tern, little blue heron, roseate spoonbill, tricolored heron, reddish egret, burrowing owl, Florida sandhill crane, Southeastern American kestrel, gopher tortoise, and Florida pine snake. Sherman's fox squirrel is a species of special concern.

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

2.5 Other Natural System Habitat Needs

The TSP's natural system benefits within the project have the following project objectives:

- Increase the natural area extent of wetlands.
- Restore wet and dry season flows to the National Wild and Scenic Northwest Fork of the Loxahatchee River and the river floodplain.
- Restore oysters, seagrass and other estuarine communities in the Loxahatchee River Estuary.
- Restore connections between Corbett WMA, Pal-Mar/Cypress Creek basin, Loxahatchee Slough, Grassy Waters Preserve and Loxahatchee River to improve hydrology, sheetflow, hydroperiods, natural storage, and vegetation communities.
- Restore native plant and animal species abundance and diversity in Loxahatchee River watershed natural areas, river, and estuary.

Appendix F of the Loxahatchee River Watershed Restoration Project PIR contains a description of the conceptual plan that is being proposed for recreation purposes. Recreation features are being planned in the Loxahatchee River Watershed Restoration Project as an incidental project benefit.

The plan is primarily a trail-oriented plan which follows the flow ways toward the Loxahatchee River. Large tracts of public land within the watershed offers several possible flow ways to the Loxahatchee River. While the project will connect and enhance the flow ways for providing water to the Loxahatchee River with water control structures and storage areas; the recreation features will enhance trail connections with portages and bridges.

3 Determination of Project Component Feasibility

Section 373.1501(5)(b), F.S., states that the SFWMD shall "determine with reasonable certainty that all project components are feasible based upon standard engineering practices and technologies and are the most efficient and cost-effective of feasible alternatives or combination of alternatives, consistent with Restudy purposes, implementation of project components, and operation of the project."

3.1 Engineering Design Features of the Tentatively Selected Plan

Included in Appendix A of the draft PIR are the general assumptions, guidance parameters, and primary references used in the conceptual design of storage, conveyance, and hydraulic control features specified in the TSP. Table 3-1 highlights the key features proposed in the TSP and the final array of project alternatives. Sections contained in Appendix A define each proposed feature of the selected plan for each flow-way followed by a description of non-TSP features. The Project Delivery Team (PDT) agreed that the preliminary design of features may be optimized during the preconstruction engineering and design phase (PED) at the discretion of the team.

Table 3-1-1. Design features proposed for the TSP and final array of alternatives.

Project Feature	Feature Type	TSP	Alt 2	Alt 10	Alt 13
Flow-way 1					
G-160	Conveyance	Yes	Yes	Yes	Yes
G-161	Conveyance	Yes	Yes	Yes	Yes
Grassy Waters Preserve Triangle	Conveyance/Storage	Yes	Yes	Yes	Yes
M-1 Lower Pump Station	Pump Station	Yes	--	--	--
C-51 Phase II Reservoir	Storage	--	--	44 kac-ft[1]	--
Force Main	Conveyance	--	--	Yes	--
Flow-way 2					
C-18W Reservoir	Storage	9.5 kac-ft	7.2 kac-ft	7.2 kac-ft	--
Aquifer Storage & Recovery (ASR)	Storage	4 wells	2 wells	--	4 wells
M-O Canal Connector	Conveyance/Pump	Yes	Yes	Yes	Yes
C-18 West Canal Weir Modification	Conveyance	--	--	--	Yes
L-8 Shallow	Storage	--	4.3 kac-ft	--	6.5 kac-ft
C-18W Natural Storage	Storage	--	--	--	Yes
Flow-way 3					
Palmar East	Conveyance/Storage	Yes	Yes	--	Yes
Thomas Pepper Farm	Conveyance	Yes	Yes	--	Yes
Ranch Colony Canal	Conveyance/Storage	Yes	Yes	Yes	Yes
Gulfstream West	Conveyance/Storage	Yes	Yes	--	Yes
Gulfstream East and Moonshine	Conveyance/Storage	Yes	Yes	Yes	Yes
Kitching Creek	Conveyance/Storage	Yes	Yes	Yes	Yes
Mack Dairy Spreader Swale	Conveyance	Yes	--	--	Yes

[1]kac-ft represents 1000 acre-feet

3.2 Efficiency and Cost Effectiveness

Upon identification of the final array of alternatives, each alternative was evaluated for its effects on the environment (ecological and social benefits). The alternatives were compared using the Corps' "Principles and Guidelines" criteria (Completeness, Acceptability, Efficiency, and Effectiveness), which are:

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

Project benefits were quantified using project specific performance measures, planning level costs were calculated for each alternative plan, and an analysis was conducted using Cost Effectiveness and Incremental Cost Analysis (CE/ICA) to identify alternatives that maximize environmental benefits compared to costs. The evaluation and comparison resulted in the identification of the National Ecosystem Restoration (NER) plan and the recommended plan.

3.3 Effectiveness

An effective alternative alleviates the specified problems and achieves the specified opportunities for the Loxahatchee River Watershed Restoration Project (LRWRP). Because LRWRP problems and opportunities drove the development of planning objectives, effectiveness was evaluated by how well the alternatives would achieve the planning objectives. Table 3-**2**,
Table 3-3, **Table 3-4**, **Table 3-5**, and **Table 3-6** present how each alternative would perform with respect to each objective. Additional details on hydrologic performance can be found in Appendix A. Additional details on ecological performance can be found in Section 5, Appendix C.2.1, and Appendix G of the PIR.

Table 3-2. Effectiveness for Objective 1 - Flows to the River.

Objective 1: Restore wet and dry season **flows of water** to the National Wild and Scenic Northwest Fork of the Loxahatchee River and the river floodplain.				
Low flows to the Northwest Fork of the Loxahatchee River and its floodplain have contributed to the loss of the rare riverine cypress forest and its transition to communities of salt tolerant vegetation such as mangroves. The 2006 Loxahatchee River Science Plan (citation) developed flow targets at Lainhart Dam for the wet and dry seasons. The wet season target is daily flow greater than 110 cfs for greater than 120 days. The dry season target is greater than 68 cfs. An exceedance of minimum flows and levels (MFL) occurs when flow is less than 30 cfs for more than 20 consecutive days. For wet and dry seasons, this table shows the percent of the days per season, averaged across years, which meet the target for that season. All four alternatives achieve flow targets for the wet season. All four alternatives make improvements (see below) over the FWO for the dry season restoration target. Alt 13 performs substantially poorer than the other alternatives in the dry season. Alt 13 is the only alternative that still shows exceedances of minimum flows and levels for the 41-year period of analysis. Alt 10 performs the best for the dry season.				
(Wet and Dry Season Flow at Lainhart Dam, 0-100% scale, target is 100%) *(number of Minimum Flow and Level exceedances, target is 0)*				
Future Without (FWO) Project Condition	**Alt 2 (Two reservoirs)**	**Alt 5 (One reservoir)**	**Alt 10 (In-ground reservoir)**	**Alt 13 (Natural storage)**
Wet Season (78%)	98%	98%	100%	98%
Dry Season (65%)	87%	91%	95%	80%
MFL exceedances (17%)	0	0	0	12

Table 3-3. Effectiveness for Objective 2 - estuarine communities.

Objective 2: Restore oysters, seagrass, and other **estuarine communities** in the Loxahatchee River Estuary.

Long term restoration of ecological communities in the Loxahatchee River Estuary is inferred from dry season flows at Lainhart Dam and the corresponding salinity restoration targets described in the 2006 Loxahatchee River Science Plan.

The goal is to increase base flow to limit saltwater intrusion in the tidal floodplain while maintaining the appropriate environmental conditions in the riverine floodplain for aquatic dependent species, communities and wildlife. Base flows should be high enough to provide groundwater movement from the river channel to the surrounding floodplain soils and should be high enough to support fish passage during lower flow conditions. High flows during the wet season particularly in the months of August–November are critical for maintaining the hydroperiod of the floodplain cypress swamp and many other native flora dependent on seasonal high water levels in the riverine floodplain. Salinity target zones representing various portions of the river and estuary have been developed as part of the Restoration Plan for the Northwest Fork of the Loxahatchee River (SFWMD 2006). These "salinity envelopes" are used as surrogates for key VECs (USEPA 1987). Besides the freshwater floodplain VEC, the river and estuary have been divided into four major salinity zones: #1 Freshwater: salinity = 0 psu, #2 Oligohaline: 2 to 8 psu, #3 Mesohaline: 10 to 20 psu, and #4 Polyhaline: 20+ psu. Tidal floodplain, Vallisneria americana, fish larvae and juveniles, oysters, and seagrass, respectively, have been targeted as ecological indicators in these zones. A salinity model was used to estimate changes in salinity. The sensitivity of the tool and how salinity performance was scored was limited, as well as baseline salinities for the tidal river which appear to meet targets. The results indicate slight improvements in the Vallisneria, Oligohaline, and Mesohaline zones for all alternatives with the most improvement from Alt 10 and least improvement from Alt 13. The polyhaline zone remains unchanged except for a slight decrease in performance from Alts 5 and 10. The biggest lift is with the mesohaline zone. These results are consistent with the dry and wet season flows from Lainhart Dam, which are more sensitive to estimating restoration performance downstream in the tidal river and estuarine zones.

(Performance measure for estuarine communities, 0-1.00 scale, target is 1.00)

	FWO	**Alt 2 (Two reservoirs)**	**Alt 5 (One reservoir)**	**Alt 10 (In-ground reservoir)**	**Alt 13 (Natural storage)**
Tidal River (0-2 psu)	1.0	1.0	1.0	1.0	1.0
Vallisneria- (0-5 psu)	0.78	0.80	0.80	0.81	0.79
Oligohaline – Fish larvae (2-8 psu)	0.21	0.23	0.23	0.24	0.23
Mesohaline – Oysters (10-20 psu)	0.39	0.45	0.45	0.46	0.43
Polyhaline - Seagrass (>20 psu)	0.92	0.92	0.91	0.91	0.92

Table 3-4. Effectiveness for Objective 3 - Area of Wetlands.

Objective 3: Increase natural area extent of wetlands.
Over-drainage and conversion to urban and agricultural uses reduced the extent of wetlands in the project area. LRWRP alternatives use various measure to restore wetlands in the

watershed. The restored wetlands provide improved habitat for natural communities, and fish and wildlife species. Restored wetlands provide on-site benefits, connectivity with other natural areas, and improved timing of water deliveries to the Loxahatchee River. All alternatives restore wetlands in the watershed. Alt 13 restores the greatest number of acres because it would restore wetlands on the C-18W site and western Loxahatchee Slough that are not attempted to be restored by the other alternatives. Alt 10 restores the fewest number of acres because it has fewer measures in Flow-way 3 than the other alternatives. Alts 2 and 5 restore approximately the same number of acres of wetlands.				
(Number of acres restored, more is better).				
Future Without (FWO) Project Condition	**Alt 2 (Two reservoirs)**	**Alt 5 (One reservoir)**	**Alt 10 (In-ground reservoir)**	**Alt 13 (Natural storage)**
Restored agricultural areas (formerly functioning wetlands), 0	13,356	16,292	2,009	17,673
Restored natural areas (existing but impacted wetlands), 0	12,352	9,546	7,904	13,803
Total, 0	25,708	25,838	9,913	31,476

Table 3-5. Effectiveness for Objective 4 - Connectivity

Objective 4: Restore connections between Corbett Wildlife Management Area, Pal-Mar/Cypress Creek basin, Loxahatchee Slough, Grass Waters Preserve and Loxahatchee River to improve hydrology, sheetflow, hydroperiods, natural storage, and vegetation communities.				
Reconnecting natural areas provides opportunities for flora and fauna to move between areas and for water to reach the Loxahatchee River. Connectivity performance is estimated using scores for four criteria: hydrologic connectivity, greenway and overland connections, water quality incidental improvements, and foraging, breeding, and nesting conditions for endangered and/or rare species. Each criterion was estimated using GIS and best professional judgment. All four alternatives improve connectivity. Alt 13 has more connections via C-18 west natural storage through Avenir to Loxahatchee at two locations, which contributes to its highest score. Alt 10 restores the lowest connectivity. Alts 2 and 5 restore the same amount of connectivity.				
(Quality of connection, range 0 to 1.00, higher is better).				
Future Without (FWO) Project Condition	**Alt 2 (Two reservoirs)**	**Alt 5 (One reservoir)**	**Alt 10 (In-ground reservoir)**	**Alt 13 (Natural storage)**
0	0.67	0.67	0.46	0.83

Table 3-6. Effectiveness for Objective 5 - Plant and Animal Abundance and Diversity.

Objective 5: Restore native plant and animal species abundance and diversity in Loxahatchee River watershed natural areas, river, and estuary.				
Objective 5 is estimated based on restoration of habitat for these species. Habitat restoration for fish and wildlife is quantified using a combination of the average wetland hydrology scores and connectivity scores (shown in objective 4) for each alternative. Wetland hydrology will be restored by project alternatives and improve wetland structure and function. Connectivity allows for more access and/or availability of habitat for fish and wildlife life history characteristics (feeding, breeding, nursery, and growth to maturity). All alternatives performed better than the FWO. Alt 13 would produce the greatest restoration of plant and animal species abundance and diversity. Alt 10 would provide the least. Alts 2 and 5 would provide the same restoration, intermediate between Alts 13 and 10. The relationships among the alternatives for restoration of fish and wildlife (objective 5) is parallel to the patterns predicted for wetland acres restored (objective 3) and for connectivity (objective 4).				
(Index score for native plant and animal abundance and diversity, range 0 to 1.00, higher is better).				
Future Without (FWO) Project Condition	**Alt 2 (Two reservoirs)**	**Alt 5 (One reservoir)**	**Alt 10 (In-ground reservoir)**	**Alt 13 (Natural storage)**
0.32	0.48	0.48	0.39	0.53

3.4 Efficiency Analysis: Environmental Benefits and Costs of Alternative Plans

The LRWRP recommended plan is justified by the environmental benefits derived by the south Florida ecosystem; however, a comparison of the benefits and costs of alternative plans is also conducted to ensure that a selected alternative is efficiently producing the environmental benefits. The measurement of efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the nation's environment. Cost effectiveness and incremental cost analysis (CE/ICA) is used to help identify the plans that reasonably maximize ecosystem restoration.

As the name suggests, the CE/ICA has two distinct steps. The first step, Cost Effectiveness (CE) analysis, identifies which alternative plans are cost effective. A cost effective plan has the following characteristics:

1. The same level of output could not be produced by another plan at less cost;
2. A larger level of output could not be produced by another plan at the same cost; and
3. A larger level of output could not be produced by another plan at less cost.

The second step is the Incremental Cost Analysis (ICA). Cost effective plans are compared by examining the additional (incremental) costs for the additional (incremental) amounts of output produced by successively larger cost effective plans. The plans with the lowest incremental costs per unit of output for successively larger levels of output are called best buy plans. The results of these calculations and comparisons of costs and outputs between alternative plans provide a basis for addressing the decision question "Is it worth it?" i.e., are the additional outputs worth the costs incurred to achieve them?

The CE/ICA analysis follows guidance from the U.S. Army Corps of Engineers (USACE), Engineering Regulation (ER) 1105-2-100, Appendix E, para. E-36. Costs are based initially on a planning level estimate and benefits are based on the habitat unit (HU) evaluation. As per this guidance, CE/ICA analysis compares the alternative plans' average annual costs against the appropriate average annual HU estimates. This ensures an "apples to apples" comparison. The average annual benefits (lift) are calculated as the difference between with-plan and without-plan conditions over the 50-year period of analysis (through year 2075).

Because a precise construction schedule was not developed for each alternative plan included in the CE/ICA, the two assumptions listed below were used to derive the construction duration estimates and shown in **Table 3-7** used in the calculation of annualized costs and habitat units.

1. An annual budgetary limit of $40,000,000 total available for project implementation is assumed based on the SFWMD's and the U.S. Army Corps of Engineers Jacksonville District's s experience with previous ecosystem restoration projects in south Florida.
2. Costs of real estate already acquired by the non-federal sponsor (NFS) were not considered as part of the $40 million per year budgetary limit, although these costs were included in the total project cost and interest during construction (IDC) calculations discussed below.

Table 3-7. Estimated Pre-Construction Engineering and Design (PED) and construction durations assumed for CE/ICA (in months).

Alternative	Alt 2	Alt 5R	Alt 10	Alt 13
PED Duration (months)	24	24	24	24
Construction Duration (months)*	118	94	153	81

*Construction durations are rounded to the closest full month.

3.4.1 Costs of Final Array of Alternative Plans

Costs of a plan represent the value of goods and services required to implement and operate/maintain the plan. The cost estimate for the alternatives includes construction; lands, easements, rights-of-way, relocation (LERR); planning, engineering and design (PED); construction management; and operation, maintenance, repair, replacement, and rehabilitation (OMRR&R). For comparison of alternatives in this report and analysis, costs are expressed in October 2018 price levels.

The costs generated by this tool are planning level costs, not absolute costs. These costs should only be used to compare the costs of alternatives relative to one another and are not to be used as the detailed costs for construction. These costs were developed using historical costs from USACE and SFWMD constructed projects, and recent cost estimates developed for similar features in other projects.

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

3.4.2 Average Annual Costs

The timing of a plan's costs is important. Construction and other initial implementation costs cannot simply be added to periodically recurring costs for project operation, maintenance and monitoring if meaningful and direct comparisons of the costs of the different alternatives are to be made. A common practice of equating sums of money across time with their equivalent at an earlier point in time is the process known as discounting. Through this mathematical process, which involves the use of an interest rate (or discount rate) officially prescribed by Federal policy for use in water resource planning analysis (set at 2.75% at the time of the evaluation), the cost time streams for the alternative plans were mathematically translated into an equivalent time basis value. There is some uncertainty as to how any of the alternatives would be implemented. It is recognized that any of the plans would likely be implemented over a considerable length of time. For purposes of this evaluation, construction costs are assumed to incur on an equal monthly basis during the implementation of the alternative plans and would be implemented with the year-constrained timeline.

ER 1105-2-100 requires that interest during construction (IDC) be computed, which represents the opportunity cost of capital incurred during the construction period. IDC was computed for planning, engineering, and design (PED) costs and construction costs from the middle of the month in which the expenditures were incurred until the first of the month following the estimated construction completion date, and also assume the constrained timelines.

The total first cost is the sum of construction, real estate, PED, and construction management. The total project investment is the first cost plus IDC. Table 3-8 summarizes the first cost, total investment cost and average annual costs of each alternative plan. The least costly plan in average annual terms is Alt 5, followed closely by Alt 13. The average annual costs for Alt 2 and Alt 10 are significantly higher than the other two alternative plans.

Table 3-8. Planning level costs and average annual costs of alternative plans.

	Summary of Costs for LRWRP Alternative Plans*			
	Alt 2	**Alt 5R**	**Alt 10**	**Alt 13**
Cost Component				
Construction	$320,011,000	$287,125,000	$448,847,000	$191,479,000
Lands	$170,389,000	$115,084,000	$98,246,000	$230,255,000
Planning, Engineering, & Design	$13,903,000	$12,485,000	$18,961,000	$8,938,000
Construction Management	$14,700,000	$13,201,000	$20,048,000	$9,451,000
Total First Cost	**$519,004,000**	**$427,895,000**	**$586,102,000**	**$440,123,000**
Interest During Construction				
Construction	$53,715,000	$37,619,000	$99,732,000	$21,598,000
Lands	$53,637,000	$28,167,000	$41,472,000	$47,986,000
Total Interest During Construction	**$107,352,000**	**$65,786,000**	**$141,204,000**	**$69,585,000**
Total Project Investment	**$626,355,000**	**$493,681,000**	**$727,306,000**	**$509,708,000**
Average Annual Cost				

	Summary of Costs for LRWRP Alternative Plans*			
	Alt 2	**Alt 5R**	**Alt 10**	**Alt 13**
Total First Cost & Total IDC	$23,201,000	$18,286,000	$26,940,000	$18,880,000
OMRR&R	$4,269,000	$3,745,000	$2,185,000	$4,128,000
Average Annual Cost	**$27,470,000**	**$22,031,000**	**$29,125,000**	**$23,008,000**

*October 2018 price levels. Costs do not include costs of recreation features.
*Annual costs are based on a 50-year period of analysis and 2.75%.
*Costs are planning level costs and may not coincide exactly with the detailed costs of the recommended plan presented in other sections of the report.
* Planning level costs include 32-45% contingency due to the limited design of alternatives.
* Any discrepancies in the sum of costs are due to rounding.

Based on the four Principles and Guidelines criteria, Alt 5 would be recommended over the other alternatives. After reviewing the results, PDT agencies requested additional analysis and refinement of alternatives. Different agency stakeholders had strong support for Alts 5, 10 and 13 and requested modifications that focus on strengthening the performance of these alternatives where they were weakest in comparison to the other alternatives. Alternatives 5 and 10 were refined to improve their performance for the watershed wetlands, and Alternative 13 to improve its performance for the river, estuary and floodplain. Refinements were made to improve these alternatives without diminishing the performance in the habitats where they were already performing well. These refined alternatives were designated as Alternative 5R, 10R and 13R. The revised alternatives were not modeled, however performance for the new alternatives was inferred from the performance of the original, modeled alternatives. New cost estimates were prepared for each of these refined alternatives and additional analysis to determine watershed and river benefits was conducted, resulting in the selection of Alt 5R as the TSP. Alternative 5R costs are shown in **Table 3-9** below.

Table 3-9. Planning level costs and average annual costs of Alternative 5R (TSP).

Cost Component	Cost
Construction	$302,819,000
Lands	$137,528,000
Planning, Engineering and Design	$15,747,000
Construction Management	$16,958,000
Total First Cost	**$473,052,000**
Interest During Construction - Construction	$38,890,000
Interest During Construction - Lands	$33,585,000
Total Interest During Construction	**$72,475,000**
Total Project Investment	**$545,727,000**
Average Annual Cost Item	
Annualized Total First Cost & Total IDC	$20,207,000
OMRR&R of New Project Features	$3,863,000
OMRR&R Sub-Total	**$4,399,000**
Water Quality Monitoring	$400,000
Hydrometerological Monitoring	$200,000

Ecological – Biological Opinion Monitoring	$TBD
Ecological – General Ecological Monitoring	$117,000
Adaptive Management Monitoring	$117,000
Invasive Species Monitoring	$47,000
Monitoring – Sub-Total	**$881,000**
Total Average Annual Cost	**$25,487,000**
October 2018 price levels. This table does not include costs of recreation features Annual costs are based on a 50-year period of analysis and 2.75% interest. Annualized costs for the TSP have been refined since the initial analysis to select TSP Costs are planning level costs and do not coincide exactly with the detailed costs of the TSP presented elsewhere in the report. Planning level costs include 32-45% contingency due to the limited design of the alternatives Endangered Species Act coordination is ongoing, and the Biological Opinion is not yet available; costs of monitoring are still to be developed	

3.4.3 Ecological Benefits Evaluation

The PDT devised a project specific tool, referred to as a planning model, to evaluate habitat units (HUs) for alternatives within the LRWRP project area. The primary areas evaluated included the Loxahatchee Estuary, the Northwest Fork of the Loxahatchee River, and the wetlands within the Loxahatchee River watershed. The LRWRP planning model is a Microsoft Excel spreadsheet that uses project performance measures to derive a HU score that represents the ecological performance achieved by each alternative. This planning model was approved for use by the USACE Ecosystem Restoration Planning Center of Expertise on August 26, 2016. The complete description of the model, equations and calculations, and further information pertaining to the alternative evaluation is described in Appendix G of the PIR. The HU score produced by the planning model represents an “end point” of total performance of each alternative. The HUs for the alternatives represent conditions once the ecological systems have had time to respond fully to the hydrological changes produced by the alternatives.

These model-predicted “end point” HUs must undergo several modifying steps before fair comparisons of alternatives can be done. These steps are listed below and expanded in the next subsections.

1. Begin with the unadjusted HUs.
2. Adjust for rate of response. Some communities respond more quickly than others (e.g. grasses respond faster than trees).
3. Adjust for start time. Higher cost alternatives take longer to build than lower cost alternatives, thus take longer to begin producing ecological benefits)
4. Calculate average annual HUs
5. Benefit of an alternative equals average annual HUs with the alternative minus average annual HUs without an alternative (FWO)

Total Unadjusted Habitat Units

Conceptual ecological models (CEMs), as used in the Everglades restoration program, are non-quantitative planning tools that identify the major anthropogenic drivers and stressors on natural systems, the ecological effects of these stressors, and the best biological attributes or indicators of these ecological responses (Ogden et al. 2005). These CEMs have been peer reviewed and provide the framework for the planning and assessment of the CERP. The LRWRP planning model was used to aggregate the results of project performance measures. Each of the performance measures for the LRWRP planning effort was derived from those approved for use in LRWRP by Restoration, Coordination and Verification (RECOVER). Three performance measures were identified (**Table 3-10**).

Each performance measure has targets and a predictive metric based on hydrologic requirements necessary to meet empirical or theoretical ecological thresholds. Detailed estimates of hydrology across the 41-year period of record (January 1965 – December 2005) generated by the LECSR-NP hydrologic model were used to calculate performance measure scores.

Table 3-10. Performance measures used to quantify plan benefits.

Region	Performance Measure (PM)	Description
Salinity and Flow (Loxahatchee River floodplain and Loxahatchee Estuary)	**Salinity and Flow Performance Measure 1** • PM 1.1 Wet Season Flow Targets • PM 1.2 Dry Season Flow Targets	Measure of the frequency of flows correlated to downstream estuarine salinities favorable to freshwater, estuarine and marine fish; shellfish; oyster and SAV. Measure of temporal-seasonal agreement between predicted salinity regimes in and pre-drainage salinity targets.
Watershed (lands in the watershed)	**Watershed Hydrology, Performance Measure 4** • PM 4.1 Hydroperiod	Measure of hydrologic conditions favorable for nine wetland plant community types.
	Connectivity, Performance Measure 9 • 9.1 Hydrologic • 9.2 Greenway • 9.3 Water Quality • 9.4 Fish and Wildlife (Endangered and/or Rare Species)	Measure of connectivity based on hydrologic connections of wetlands, occurring within proposed greenbelts, providing more natural overland flow for nutrient filtration, and supporting fish and wildlife function connectivity between restored habitats.

Performance measure scores are displayed as a function of restoration potential or achievement of the target with the minimum value of zero representing a fully degraded ecosystem and a maximum value of 100 representing the restoration target. Habitat suitability indices in performance measure 4 (Watershed hydrology) and 1 (river flows and estuarine performance) were developed based on 8 major plant communities in the watershed and 6 major habitat zones

in the river and estuary. In the watershed, the area associated with indicator regions that identify the dominate habitats used for the hydrologic target and index is multiplied by the index number to identify HUs. Performance measure 9 (Connectivity) is also associated with the watershed HU calculation but is indexed based on qualitative analysis of four criteria and multiplied by the whole watershed acreage. For the watershed, PM 4 accounts for 90% of the HU score and PM 9 accounts for 10%. River flows were compared to restoration flow targets, indexed 0-1 and multiplied by habitat zone acreage to produce HUs. HUs for each zone are added to produce the total HUs for each alternative. The planning model used to identify HUs is explained in detail in Appendix G. make sure this is explicit description of combining watershed wetland improvements with connectivity (90/10); and river floodplain /estuary analysis – these are additive. HU results for the existing conditions baseline (ECB), the FWO project condition, and the alternatives are displayed in **Table 3-11**.

Table 3-11. Total habitat units for each alternative condition.

Benefit Region	ECB	FWO	Alt 2	Alt 5	Alt 10	Alt 13
River and Estuary	1,029	1,029	1,377	1,441	1,504	1,266
Floodplain	314	314	420	440	459	386
Watershed (Wetlands and Connectivity)	25,711	25,407	37,747	37,516	30,892	41,300

The habitat units in the table above represent the model-predicted conditions for the FWO and alternatives once the ecological systems have fully responded to the hydrological changes produced by the alternatives. These “end point” HUs must be adjusted before they are compared to each other. The adjustments are for the rate of response of the ecosystem to the hydrologic changes and the differing lengths of time when construction is complete and ecosystem changes start to occur. After these adjustments are incorporated, average annual HUs can be calculated.

Adjust for Rate of Response

The first adjustment to “end point” HUs is for the rate of response of the ecosystem to the hydrologic changes. Natural ecosystems are complex, dynamic systems and the exact functional form of the relationship among variables is rarely if ever known. South Florida ecosystems have been subject to extensive research and monitoring, and credible estimates of response times can be predicted based on how key ecosystem components have responded to varying hydrologic conditions. The rate at which LRWRP benefits accrue over various time intervals, depending on the region, were estimated using these inferences. Linear interpolation was used as a simple method for inferring the rate at which benefits would accrue between those time intervals for each of the three regions of the project area for both the FWO and future with project conditions.

Loxahatchee River and Estuary: An ecological response time for the Loxahatchee River Estuary was estimated based on the expected response time of oysters and submerged aquatic vegetation to improved salinities. The ecological response time was estimated to be approximately 6 years until full impact would be realized. See **Table 3-12**.

Table 3-12. Percentage of river and estuary benefits achieved over time.

0-2 years	2-5 years	5-20 years	20-50 years	50-100 years
20%	75%	100%	100%	100%

Loxahatchee River Floodplain: An ecological response time for floodplain of the Northwest Fork of the Loxahatchee River was estimated based on the ability of LRWRP to improve conditions riverine cypress forests to recruit and grow to maturity, but also understory shrub and other smaller vegetation area types. The ecological response time for the river floodplain was estimated to be approximately 75-100 years until full impact would be realized, with a large percentage of benefits accruing earlier once the desirable hydrological conditions have been restored. See **Table 3-13**.

Table 3-13. Percentage of floodplain benefits achieved over time.

0-2 years	2-5 years	5-10 years	10-30 years	30-50 years	50-75 years	75-100 years
0%	30%	50%	60%	75%	80%	100%

Loxahatchee Watershed: The ecological response time for the Loxahatchee River watershed was estimated based on the ability of LRWRP to improve conditions for aquatic and herbaceous, shrubby, and forested vegetation communities; periphyton; piscivorous fish; and aquatic prey organisms in the diverse headwaters' watershed consisting of mesic and wet flatwoods, mesic and hydric hammocks, wet prairies, depression and slough marsh, and floodplain, strand, and dome swamps. The expected ecological response time is estimated to be 75-100 years until full impact would be realized with a large percentage of benefits accruing earlier once the desirable hydrological conditions have been restored. See **Table 3-14**.

Table 3-14. Percentage of watershed wetlands benefits achieved over time.

0-2 years	2-5 years	5-10 years	10-30 years	30-50 years	50-75 years	75-100 years
50%	60%	70%	75%	80%	95%	100%

Adjust for differing start times

The second adjustment to "end point" HUs is for the differing lengths of time when construction is complete and ecosystem changes start to occur. The alternative plan with the shortest estimated duration to complete construction will start accruing benefits prior to all other plans. Thus, the start of the 50-year period of benefit accrual considered in this analysis is set by Alt 13. Alt 5 will begin accruing benefits approximately one year after Alt 13; Alt 2 approximately three years after Alt 13; and Alt 10 approximately six years after Alt 13. The progression of ecosystem responses (habitat units) coming online and then subsequently accruing over the 50-year analysis period is included in Figure 3-1 for the river and estuary (consists of riverine floodplain and estuary) and Figure 3-2 for the watershed (consisting of wetlands and connectivity). These figures incorporate the differences in rate of response as well as start times.

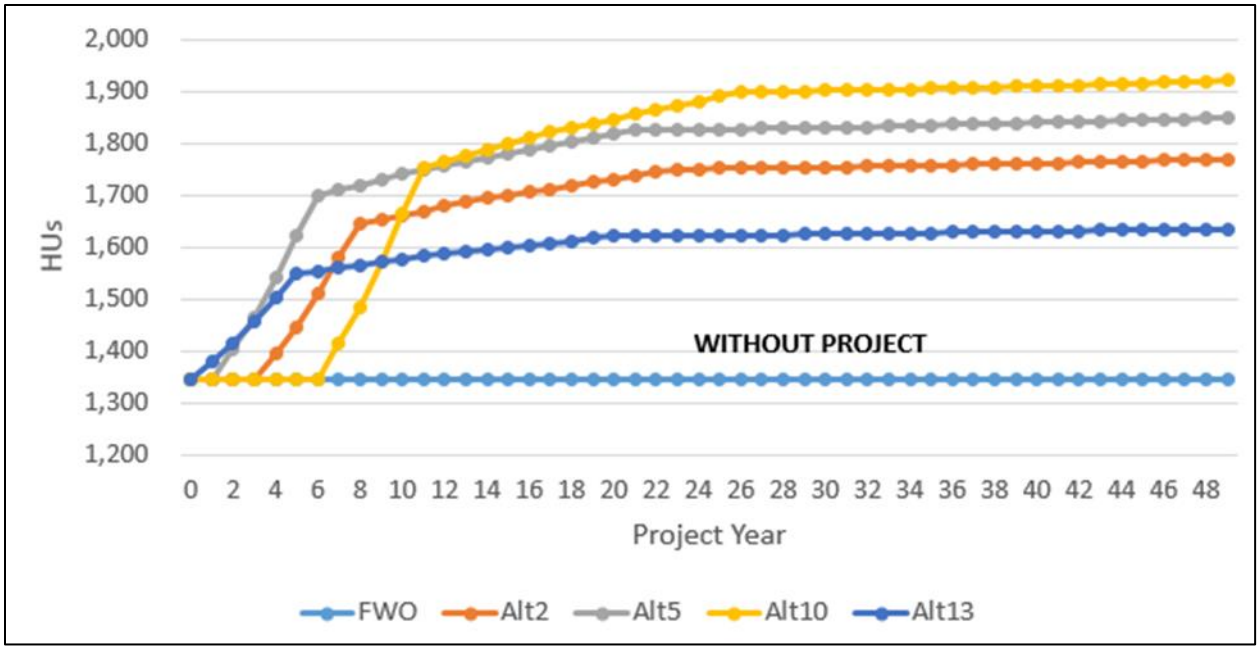

Figure 3-1 ANNUAL RIVER AND ESTUAY HUs OVER TIME.

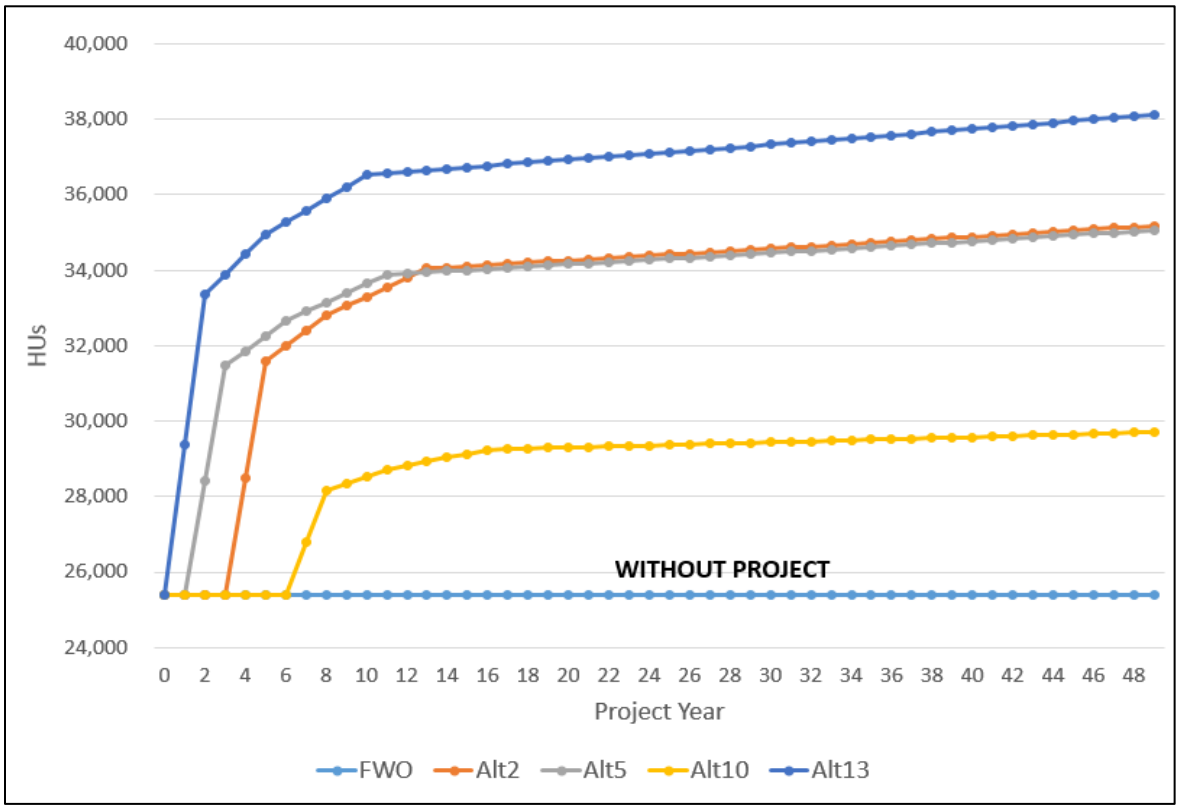

Figure 3-2 ANNUAL WATERSHED HUs OVER TIME

Average Annual Habitat Units and Average Annual Benefits

Table 3-15 presents the average annual habitat units for the future without project condition and for each alternative for the 50-year period of analysis. In calculating lift in HUs for each alternative the FWO number of habitat units is assumed to stay constant throughout the period of analysis. The table also displays the average annual benefits, or lift, for each alternative. Benefits are the difference between the average annual habitat units with the alternative plan and the average annual habitat units in the Future Without Project condition. Alt 13 yields the greatest average annual lift in wetland/connectivity HUs, while producing in the least HU lift of the four alternative plans for river and estuary HUs. Similarly, Alt 10 performs the best for one HU type (river and estuary) but the worst for the other (wetland/connectivity). Alt 5 ranks second in lift for both habitat types and Alt 2 is third for both habitat types.

Table 3-15. Average annual habitat units and average annual benefits.

	Future Without Project	Alt 2	Alt 5	Alt 10	Alt 13
Loxahatchee River / Estuary and Floodplain					
Average Annual Habitat Units	1,343	1,684	1,767	1,744	1,593
Average Annual Habitat Unit Benefit	**0**	341	424	431	250
Watershed (wetlands & connectivity)					
Average Annual Habitat Units	25,407	33,461	33,696	28,727	36,340
Average Annual Habitat Unit Benefit		8,054	8,289	3,320	11,133

3.5 Cost Effectiveness and Incremental Cost Analysis

Sometimes it is difficult to summarize the results of CE/ICA when the analyses are performed separately on HUs for distinct species, communities or geographic areas. This phenomenon often occurs simply because different management measures or alternative plans have different functions, provide different types of output, and provide benefits to different biological communities. This is the case for the LRWRP, in which certain features or alternatives provide greater benefits to the Northwest Fork of the Loxahatchee River, the river floodplain, and the Loxahatchee estuary, while other alternatives provide greater benefits for the wetlands within the Loxahatchee River watershed.

Costs and benefits were examined for each geographic area separately. A combined HU score summing all geographic areas of the study area would not appropriately represent the significance of the Northwest Fork of the Loxahatchee River. The Loxahatchee watershed contains more than 20 times as many acres as the river, floodplain, and estuary, and the combined HU score for all areas would be dominated by the watershed HU's and would hide any benefits to the river. Therefore, the two geographic areas, watershed wetlands and river/floodplain/estuary, were analyzed separately.

River, Estuary, Floodplain

The first step of the CE/ICA determined which plans were cost effective for providing river and estuary benefits. Table 3-16 outlines the four alternative plans in the final array, the average annual HU lift for the river and estuary for each alternative plan, average annual cost per unit output for each alternative plan, and whether each alternative is cost effective. Alt 5 and Alt 10 are both cost effective alternatives for producing a lift in river and estuary habitat units and are carried forward to the ICA. Alt 13 and Alt 2 produce fewer HUs than Alt 5 for a greater cost, making those plans non-cost effective. This is shown graphically in Figure 3-3.

Table 3-16. Cost Effectiveness of Alternative Plans - River, Estuary, Floodplain Benefits.

Alternative*	Average Annual Cost CRF (i=2.75%, n=50)	Average Annual NER Benefits (HU Lift)	Average Annual Cost per Unit Output	Cost Effective (Yes/No)
No Action Plan	$ -	-	N/A	N/A
Alt 5	$ 22,031,000	424	$ 52,000	Yes
Alt 13	$ 23,008,000	250	$ 92,000	No
Alt 2	$ 27,470,000	341	$ 80,000	No
Alt 10	$ 29,125,000	431	$ 68,000	Yes

* Alternatives are displayed in order of increasing AAEQ cost.
All $ values rounded to the $1,000's.
Any discrepancies in costs are due to rounding.
Average annual costs include construction cost; Planning, Engineering & Design; construction management costs; IDC; and O&M.

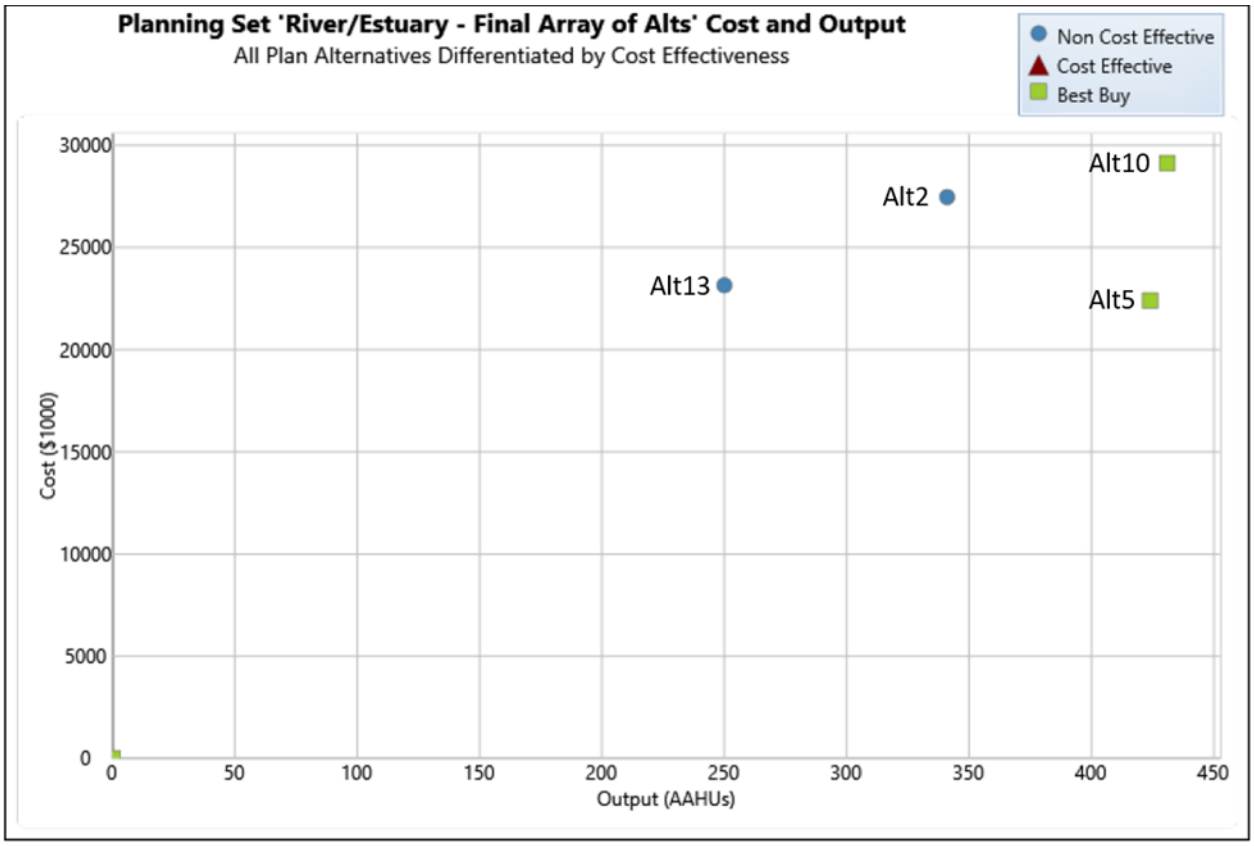

Figure 3-3 AVERAGE ANNUAL COST AND AVERAGE ANNUAL RIVER ESTUARY FLOODPLAIN BENEFITS.

Table 3-17 shows the incremental cost analysis for the two cost effective plans for benefit to the river/estuary, Alt 5 and Alt 10. The HU lift gained by going from Alt 5 to Alt 10 is approximately seven units (7.17 HUs), each of which has an incremental cost of approximately $989,000. The additional HUs from Alt 10 are 19 times as expensive per HU than the approximately $52,000 per unit for the first 424 units of lift provided by Alt 5. These increments are shown in **Table 3-17.**

Table 3-17. Incremental cost analysis - river, estuary, floodplain HUs.

Alternative*	Average Annual Plan Cost	Average Annual Plan Outputs (Habitat Units)	Incremental Average Annual Cost Increase	Incremental Average Annual Habitat Unit Increase	Incremental Average Annual Cost/Average Annual Habitat Unit
No Action Plan	-	-	-	-	-
Alt 5	$ 22,031,000	424	$ 22,031,000	424	$ 52,000
Alt 10	$ 29,125,000	431	$ 7,094,000	7.17	$ 989,000
*Alternatives are displayed in order of increasing AAEQ cost. Alt5 is compared to No Action Plan and Alt10 is compared to Alt5. All costs rounded to the $1,000's.					

Watershed

The first step of the CE/ICA determined which plans were cost effective for providing watershed benefits. **Table 3-18** outlines the four alternative plans in the final array, the average annual HU lift for the wetland/connectivity for each alternative plan, average annual cost per unit output for each alternative plan, and whether each alternative is cost effective. Alt 5 and Alt 13 are both cost effective and are carried forward to the ICA. Alt 2 and Alt 10 are not cost effective because they cost more than both Alt 5 and Alt 13 and produce a smaller lift in watershed HUs than those alternatives. This is shown graphically in Figure 3-4.

Table 3-18. Cost-effectiveness of alternative plans -watershed benefits.

Alternative*	Average Annual Cost CRF (i=2.75%, n=50)	Average Annual NER Benefits (HU Lift)	Average Annual Cost per Unit Output	Cost Effective (Yes/No)
No Action Plan	$ -	-	N/A	N/A
Alt 5	$ 22,031,000	8,289	$ 2,700	Yes
Alt 13	$ 23,008,000	11,133	$ 2,100	Yes
Alt 2	$ 27,470,000	8,054	$ 3,400	No
Alt 10	$ 29,125,000	3,320	$ 8,800	No

* Alternatives are displayed in order of increasing AAEQ cost.
Average annual cost rounded to the $1,000's; average annual cost per unit output rounded to the $100's.
Any discrepancies in costs are due to rounding.
Average annual costs include construction cost; Planning, Engineering & Design; construction management costs; IDC; and OMRR&R.

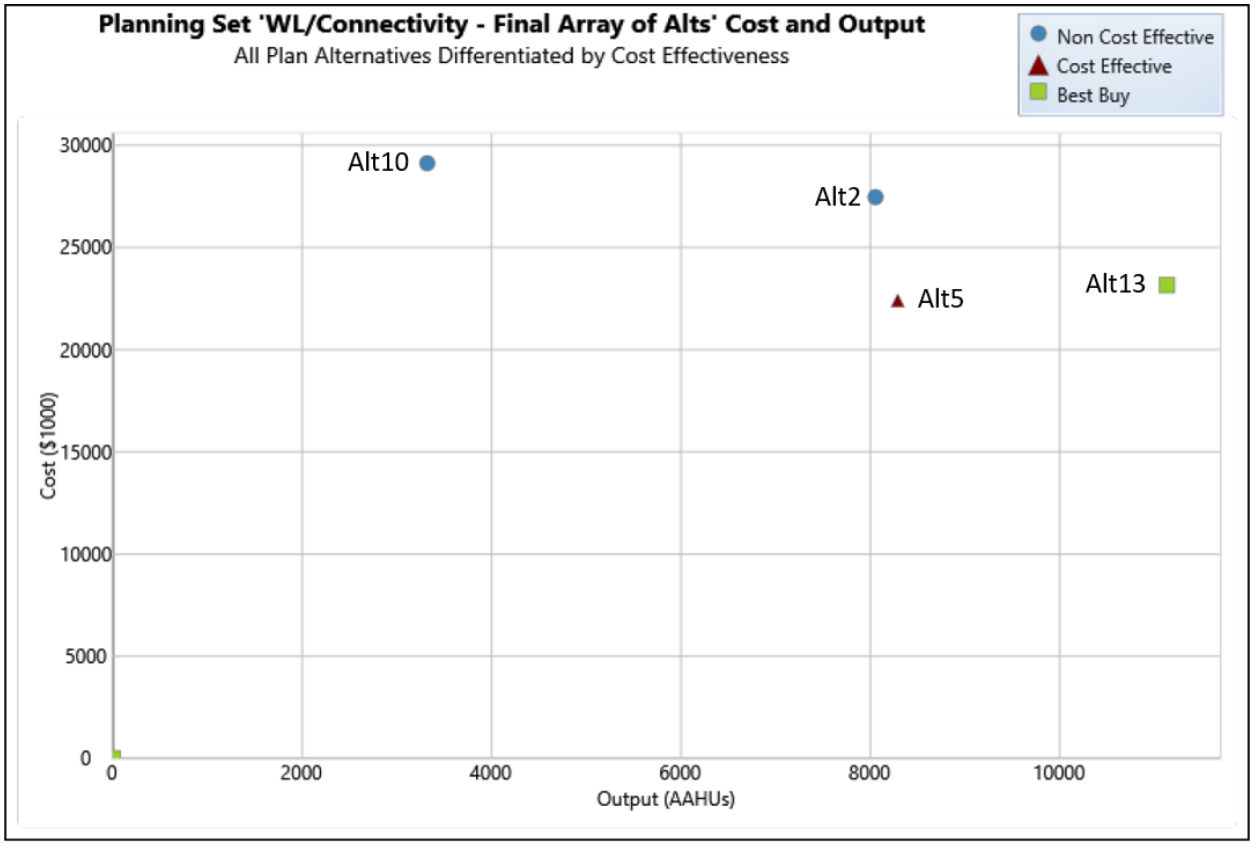

Figure 3-4 INCREMENTAL COST AND OUTPUT OF BEST BUY PLANS FOR WATERSHED BENEFITS.

The incremental Cost analysis on the two cost effective plans (**Table 3-19)** identified Alt 13 as the only Best Buy plan. This plan has the lowest average annual incremental cost per HU of the two cost effective plans and produces the greatest HU output of the two cost-effective plans. Note that for the watershed there is only one best-buy plan.

Table 3-19. Incremental cost analysis - watershed.

Alternative*	Average Annual Plan Cost	Average Annual Plan Outputs (Habitat Units)	Incremental Average Annual Cost Increase	Incremental Average Annual Habitat Unit Increase	Incremental Average Annual Cost/ Average Annual Habitat Unit
No Action	$ -	-	$ -	-	$ -
Alt 5	$ 22,031,000	8,289	$ 22,031,000	8,289	$ 2,700
Alt 13	$ 23,008,000	11,133	$ 23,008,000	11,133	$ 2,100

* Alternatives are displayed in order of increasing AAEQ cost.
Average annual plan cost and incremental cost rounded to the $1,000's; average annual cost incremental cost per HU rounded to the $100's.

Efficiency Conclusion
Efficiency is evaluated using cost effectiveness and incremental cost analysis. The only cost effective plan for both habitat types is Alt 5. Alt 5 is also a Best Buy plan for river, estuary and floodplain benefits. Alt 2 is cost effective for neither habitat type. Alt 10 is cost effective for the river, estuary and floodplain only, and Alt 13 is cost effective for the watershed only. Based on the cost effectiveness and incremental cost analysis for both habitats, Alt 5 is the most efficient plan. This is the same conclusion reached for effectiveness criterion in Subsection 3.3.

3.6 Completeness

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

All four alternatives rely on additional water from a local drainage district, Indian Trail Improvement District (ITID). The assumption that ITID water will be available is only a low risk to implementation of the LRWRP alternatives. A change in operation of ITID flood control infrastructure is assumed but is not a formal management measure in the alternatives. ITID has expressed that it would discharge more water than is currently allowed by its permits, if its permits were modified, in order to better reduce flooding in its service area. Implementation of any of the four alternatives would include infrastructure that would accept the additional water discharged by ITID at its northern boundary. Alt 13 does not yet have an administrative method to allow the LRWRP to flow water across the proposed Avenir wetland mitigation site, or a replacement mitigation site (if necessary). The PDT did not work to resolve this situation since the effectiveness and efficiency criteria pointed the team toward Alt 5 rather than Alt 13.

Alt 10 relies on an independent third party (rock mining company) to excavate the hole that would become the in-ground reservoir. While the rock mining company has expressed interest in having the LRWRP use the rock mine after rock removal is complete, USACE does not have a contract agreement or other authority to ensure that the completed rock mine is the size required for the LRWRP. If mining stops and the rock mine is too small for the LRWRP, further excavation of the in-ground reservoir by USACE is not planned. Excavation of this volume of material would be very costly, and USACE would not be able to recover the cost by selling the rock, as is done by private rock mining companies. Stockpiling and managing up to 40,000 acre-feet (~64 million cubic yards) would be cost prohibitive.

Since effectiveness and efficiency criteria pointed the team toward Alt 5, and completeness and acceptability support Alt 5, the team chose not to work through and to attempt to fully resolve the completeness concerns with Alt 13 and Alt 10.

3.7 Acceptability

An acceptable alternative plan is workable and viable with respect to acceptance by State and local entities and the public and compatible with existing laws, regulations, and public policies.
Alts 2 and 5 have no acceptability concerns. Alts 10 and 13 have acceptability concerns that represent risks that these alternatives might not be implementable.

Alt 13 has acceptability risks such that the alternative might not be implementable. Alt 13 would use the C-18W site as a restored wetland with natural storage of water. Water from the C-18W site would be moved eastward across the adjacent, privately owned disturbed wetland to a third disturbed wetland farther east that would be restored by Alt 13. The owner of the privately-owned land adjacent to the C-18W site received permits in 2018 to be used as a compensatory wetland

mitigation site for the proposed Avenir mixed-use development. Alt 13 does not have an administrative method or proposed path to an agreement that would allow LRWRP to flow water across this wetland mitigation site. There is a risk that an acceptable agreement might not be achievable. Avenir might not have an alternate site for wetland mitigation. USACE might be unwilling to take-on the mitigation obligations of the private developer.

Alt 10 also has acceptability risks that the alternative might not be implementable. As part of the water quality compliance approach for Alt 10, structure S-76 near Lake Okeechobee would be closed to prevent Lake Okeechobee's high nutrient water from entering the L-8 Canal and being transported to the in-ground reservoir. Even incrementally reducing the get-away capacity of Lake Okeechobee may be unacceptable. The in-ground reservoir would be a replacement water supply source for the City of West Palm Beach, in accordance with the Savings Clause. Only a portion of the storage capacity of the reservoir would be used for restoration of the Loxahatchee River. None of the other three alternatives create this new potential direct conflict for limited water during dry conditions – a conflict that must be managed by future project operators.

Since effectiveness and efficiency criteria pointed the team toward Alt 5, and completeness and acceptability support Alt 5, the team chose not to work through and to attempt to fully resolve the acceptability issues with Alt 13 and Alt 10.

3.8 Summary of Principles and Guidelines Evaluation Criteria

Table 3-20 summarizes the effectiveness, efficiency, completeness, and acceptability analyses. The "plus" (+) symbols in table represent the relative effectiveness in meeting each planning objective – more (+) is better. Based on all four criteria, Alt 5 would be the National Ecosystem Restoration (NER) plan and recommended TSP.

Table 3-20. Summary of principles and guidelines evaluation criteria.

	Alt 2	Alt 5	Alt 10	Alt 13
Effectiveness in Meeting Project Objectives				
Flow at Lainhart Dam	++	++	+++	+
River/Estuary	++	++	++	+
Acres restored	++	++	+	+++
Connectivity	++	++	+	+++
Plant-Animal	++	++	+	+++
Efficiency				
River/Estuary Habitat Units		Cost Effective Best Buy	Cost Effective Best Buy	

	Alt 2	Alt 5	Alt 10	Alt 13
Wetland Habitat Units		Cost Effective		Cost Effective Best Buy
Completeness	yes	yes	yes	no
Acceptability	yes	yes	no	no

3.9 Identifying the Tentatively Selected Plan

Based on the four Principles and Guidelines criteria, Alt 5 is the recommended over Alts 2, 10, and 13. After reviewing the results, PDT agencies requested additional analysis of modified alternatives. Different agency stakeholders had strong support for Alts 5, 10, or 13.
Stakeholders requested modifications that focus on strengthening the performance of these alternatives where they were weakest in comparison to the other alternatives. PDT agencies and stakeholders requested that Alt 10 be revised to improve its performance for the watershed wetlands and that Alt 13 be revised to improve its performance for the river, estuary, and floodplain, all without reducing the performance of these alternatives in the habitats where they were already performing well. Additionally, stakeholders requested the team look at revisions to Alt 5 to improve its performance.

The PDT developed three additional alternatives, 10R, 13R, and 5R. These revised alternatives contained additional selected measures from the alternatives that had undergone H&H modeling and detailed analysis. Performance of the revised alternatives were inferred from the performance of the original, modeled alternatives. The revised alternatives were not modeled. New cost estimates for the revised alternatives were prepared.

3.9.1 Alt 10R

Alt 10R is Alt 10 plus the flow-way 3 wetland restoration measures from Alt 13. The average annual watershed benefits of Alt 10R increased from Alt 10 but remained less than Alt 5, while cost of Alt 10R was nearly double the cost of Alt 5. Alt 10R is not recommended over Alt 5.

3.9.2 Alt 13R

Alt 13R is Alt 13 plus the deep in-ground reservoir and associated features from Alt 10. The average annual river benefits of Alt 13R grew but remained less than the river benefits of Alt 5. However, the cost of Alt 10R is nearly double the cost Alt 5. Alt 13R is not recommended over Alt 5.

3.9.3 Alt 5R

Alt 5R is Alt 5 plus two wetland measures from Alt 13. Alt 5R has a 10.2% increase of average annual watershed wetland benefits for only a 5.5% increase of average annual cost (Table 3-21). The river floodplain, and estuary benefits of Alt 5R are assumed to be the same as Alt 5. Alt 5R is recommended over Alt 5 and was recommended at the TSP.

Table 3-21. Cost-effectiveness analysis for wetland benefits of alternatives 5 and 5R.

Alternative	Average Annual Cost CRF (i=2.75%, n=50)	Average Annual Watershed Benefits	Average Annual Cost per Average Annual Benefit	Cost Effective (Yes/No)
No Action	$ -	0	N/A	N/A
Alt 5	$ 22,031,000	8,289	$ 2,700	Yes
Alt 5R	$ 23,316,000	9,138	$ 2,600	Yes

Alternative 5R is the Tentatively Selected Plan (TSP). Evaluations using the four "Principles and Guidelines" criteria (effectiveness, efficiency, completeness, and acceptability) support Alternative 5 over Alternatives 2, 10, and 13. Additional analysis of revised alternatives 5R, 10R, and 13R concluded with a recommendation of Alternative 5R. The RECOVER system-wide evaluation of Alternatives 2, 5R, 10, and 13 identified the same patterns of performance of the alternatives that the PDT identified – Alternative 10 performing best for the river but worst for the watershed wetlands, Alternative 13 performing best for the watershed wetlands but worst for the river, and Alternative 5R performing second best for both river and watershed.

Alternative 5R

1. Kitching Creek (Restoration/hydration): (Spreader canal; weir/plug (Jenkins Ditch)
2. Moonshine Creek (MC) & Gulfstream East (GE) Restoration: Connect HSLCD ditch to MC; clear MC vegetation; weir in Hobe Grove Ditch; grade area to historic topography
3. Cypress Creek Canal (CCC)(Reduce over-drainage): Replace CCC weir to raise control elevation, raise berm at Ranch Colony, automate twin 84" culverts; pump and spreader swale; regrade CC southern forks
4. Gulfstream West (GW)(Restoration & reduce over- drainage): Partial backfill & relocate southern end of HSLCD canal; small pump, construct flow through marsh to attenuate flows
5. Pal-Mar East (Restoration & Connectivity): Plug ditches; remove pipes; improve northern berm; construct western berm improve eastern berm; pumps at Thomas Farm to redirect drainage to GW flow- redirect drainage to GW flow-through marsh via north Nine-Gems Canal
6. . C-18W Reservoir (9,500 ac-ft. & 4 ASR wells): Above ground reservoir; inflow pump, discharge structure; seepage control; M-O canal connector and pump
7. . G-160 Structure (Reduce over-drainage): Improve hydroperiod in Loxahatchee Slough
8. G-161 Structure (Connectivity): GWP water to Loxahatchee Slough
9. GWP Triangle (Connectivity): Grade and reconnect
10. M-1 Pump Station (conveyance): Deliver lower M-1 basin water to M-Canal, GWP and G- 161

Figure 3-5 THE LRWRP TSP, ALTERNATIVE 5R

3.10 RECOVER System Wide Evaluation

As required in the CERP Programmatic Regulations, the REstoration COordinaton VERification (RECOVER) team, CERP's interagency science group, evaluated ecological effects of the final array of alternatives (Alt 2, Alt 5R, Alt 10 and Alt 13) for the LRWRP. The scope of the review covered all areas expected to be improved by CERP, beyond the boundaries of the LRWRP footprint, and includes performance measures (PMs), evaluation tools, and best professional judgment that reach beyond the tools and expertise of the traditional USACE planning process. The tools and professional backgrounds of the reviewers represented decades of experience studying and modeling the ecology of south Florida. The purpose of the review was three-fold: to provide insight into whether some alternatives performed better ecologically than others, to indicate whether alternatives may lead to unintended ecological conditions, and to investigate unintended effects beyond LRWRP's boundaries that could potentially contradict CERP on a regional scale.

3.11 Key Findings:

All areas that LRWRP intends to improve can be improved by the proposed alternatives included in the final array. These areas include the Northwest Fork of the Loxahatchee River and Estuary in the Northern Estuaries RECOVER Module (NE), the Loxahatchee Watershed between the Northern Estuaries, Greater Everglades RECOVER Module (GE), and the Lake Okeechobee RECOVER Module (LO). LRWRP will not have an impact to the lake stage within the LO. LRWRP will not affect the Southern Coastal Systems RECOVER Module (SCS). In terms of overall ecological and hydrological restoration, Alt 5R outperforms all other alternatives in the final array.

Modeling of the hydrology, salinity, and associated ecology of the NWFLR and associated Loxahatchee Estuary, showed an increase in freshwater flow throughout the NWFLR during both the wet and dry seasons. The increase in dry season freshwater flows ranged from 15% to 30% while the increase of wet season freshwater flows ranged from 20% to 22% across the LRWRP alternatives. Modeling also showed that the increase of freshwater flow throughout the NWFLR and Estuary had a notable positive influence in the "Floodplain Swamp and Hydric Hammock in the Freshwater Riverine Floodplain" Valued Ecosystem Component (VEC) while showing only modest improvements in the "Tape Grass, *Vallisneria americana*" VEC, "Fish Larvae in the Oligohaline Zone" VEC, and "Oysters in the Mesohaline Zone" VEC. Virtually no difference between the future without modeling scenario and project alternatives were noted in the modeling results for the "Floodplain Swamp in the Tidal Floodplain" VEC and "Seagrasses in the Polyhaline Zone" VEC (7-acre difference between FWO [727 acres] and worst performing alternative [Alt 10 = 720 acres) for the Polyhaline Zone. Overall, Alt 10 provides the most improvement in freshwater flow and the most enhancement of salinity conditions throughout the VECs, as a whole, within the NWFLR and Estuary.

- In the Loxahatchee Watershed, general improvement in watershed hydrology was observed in Flow-way 3 (3% - 30%) and Flow-way 1 (15% - 16%). Minimal improvement in watershed hydrology was observed in Flow-way 2 (1% - 3%). Model results indicated alternative performance for the Loxahatchee Watershed was opposite of alternative performance for the NWFLR and Estuary. Alt 13 made the most improvement of LRWRP alternatives in the hydrology of the Loxahatchee Watershed outperforming the future without modeling scenario by 30% in Flow-way 1, 3% in Flow-way 2, and 15% in Flow-way 3. Where Alt 10 performed

best in the NWFLR, it performed the worst of all alternatives with regard to hydrology in the Loxahatchee Watershed, improving hydrology by 3% in Flow-way 1, 15% in Flow-way 2, and 1% in Flow-way 3. Connectivity within the Loxahatchee Watershed was improved by all LRWRP alternatives, ranging from scores of 0.46 (Alt 10) to 0.83 (Alt 13) compared to 0 for the FWO scenario.

- Regarding LO lake stage, Alt 10 includes construction of a deep reservoir associated with C-51. This feature would reduce water deliveries, via the L-8 Canal, from Lake Okeechobee to the LRWRP area. Outflows through the C-10A culvert into the L-8 Canal were analyzed for their impact on Lake Okeechobee lake stage as if the discharges did not occur. The additional water volume in Lake Okeechobee resulting from the lack of discharge through the C-10A culvert into the L-8 Canal scenario showed virtually no increase in Lake Okeechobee lake stage. The largest monthly average release (October 2013) in the past 10 years was 394.5 cfs, which was equivalent to an average of 782.4 ac-ft per day (24,254 ac-ft per month). None of the other LRWRP alternatives in the final array contain features that would impact Lake Okeechobee lake stage.

- The use of a small number of Aquifer Storage and Recovery Wells (ASRs) is not a significant source of uncertainty. The CERP ASR pilot projects and ASR Regional Study provided a substantial reduction in the degree of uncertainty regarding regional implementation of the technology. The CERP ASR reports were reviewed in 2015 by the National Research Council of the National Academies' Committee on Independent Scientific Review of Everglades Restoration Progress (CISRERP). Although some additional follow-up studies were suggested, the CISRERP concluded that they could be accomplished through phased implementation and construction of ASR multi-well clusters (NRC 2015). RECOVER recommends the project pursue ecotoxicological testing of ASR technology to address the uncertainty associated with LRWRP's use of ASR that was identified as part of the CISRERP report on Everglades restoration progress.

- LRWRP is consistent with the ecological restoration targets established throughout the NE PMs. One structure, S-46, can have an impact on the salinity ranges found within the Loxahatchee Estuary. The S-46 structure discharges into the southwest fork of the Loxahatchee River and ultimately into the Loxahatchee Estuary. Most of LRWRP alternatives reduce average wet season flows through the S-46 structure (reduction of 1,520 ac-ft (Alt 2), 140 ac-ft (Alt 10), and 350 ac-ft (Alt 13) compared to the FWO. However, Alt 5R increases average wet season flow by 700 ac-ft compared to the FWO. The magnitude of these changes in flow, increasing or decreasing, are considerably small.

- There was consensus that proceeding with an adaptive management approach can further increase the benefits of LRWRP and positively influence the implementation of LRWRP in ecologically sensitive areas. Adaptive management provides a means to learn during implementation and operations, improves delivery of benefits, and can minimize impacts. Therefore, adaptive management is a significant source of ecological risk buy-down for LRWRP.

3.12 Consistency with Restudy Purpose

The purpose of the CERP is to modify structural and operational components of the C&SF Flood Control Project to achieve restoration of the Everglades and the south Florida ecosystem, while providing for other water-related needs such as urban and agricultural water supply and flood protection. The 68 components identified in the Comprehensive Everglades Restoration Plan (Yellow Book or Restudy) will work together to benefit the ecological structure and function of more than 2.4 million acres of the south Florida ecosystem by improving and/or restoring the proper quantity, quality, timing and distribution of water in the natural system. CERP will also address other concerns such as urban and agricultural water supply and maintain existing levels of service for flood protection in those areas served by the project. The CERP components were originally planned for implementation over an approximate 40-year period. The CERP is designed to achieve more natural flows by redirecting current flows that are currently discharged to the Atlantic Ocean and Gulf of Mexico, to a more restored flow of water that is distributed throughout the system similar to pre-drainage conditions.

The project planning for the LRWRP is consistent with the sequencing of projects in the Integrated Delivery Schedule and included in the next generation of CERP project features to provide restoration benefits. The Loxahatchee River Watershed Restoration Project (LRWRP) includes three of the 68 components of the CERP consisting of a surface storage reservoir, aquifer storage and recovery wells, pump stations and other structures to capture and store water that is currently lost to tide and redistribution of that water to increase the volume and improve the timing of water deliveries to the NWFLR.

4 Determination of Project Consistency with Applicable Laws and Regulations

4.1 Compliance with Federal Environmental Laws, Regulations & Executive Orders

Table 4-1 summarizes required compliance with specific Federal acts, Executive Orders, and other applicable environmental laws, and provides a summary of the compliance status associated with each act, E.O., or applicable law. Detailed descriptions indicating the coordination completed to date and the status of any ongoing or compliance issues are located in **Appendix C.4** of the PIR.

Table 4-1. Compliance with Federal Environmental Laws, Regulations, and Executive Orders: Tentatively Selected Plan

Law, Policies and Regulations	Status	Comments
Anadromous Fish Conservation Act	In compliance with this Act.	Proposed action would not adversely affect anadromous fish species.
Archaeological Resources Protection Act of 1979	In compliance with this Act.	Further investigations may be needed within federally-owned lands (once the project is authorized and the Preconstruction, Engineering and Design (PED) phase has started.

Law, Policies and Regulations	Status	Comments
American Indian Religious Freedom Act	In compliance with this Act.	The policy of the U.S. on and after August 11, 1978, is to protect and preserve for American Indians, Alaska Native Groups (Eskimo, Aleut), and Native Hawaiians, their inherent right of freedom to believe, express, and exercise traditional religions, including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites. (Pub. L. 95–341, § 1, Aug. 11, 1978, 92 Stat. 469.)
Bald and Golden Eagle Protection Act	In compliance with this Act.	Proposed action would not adversely affect the bald eagle (the resident eagle in Florida). The project will implement the National Bald Eagle Management Guidelines (2007) as applicable.
Clean Air Act of 1972	In compliance with this Act; will obtain any required permits.	Potential for temporary air quality impacts associated with construction emissions and dust. Contractors will implement BMP's to limit temporary impacts.
Clean Water Act of 1972	In compliance with this Act; will obtain Water Quality Certification (WQC) from the State of Florida and any required National Pollutant Discharge Elimination System (NPDES) permits.	In accordance with the Clean Water Act, a Section 404(B)(1) Evaluation has been completed and is contained within Appendix C.4, Section C.4.32. Comprehensive Everglades Restoration Plan Regulation Act (CERPRA) permit 373.1502 F.S. would be sought from State of Florida for Water Quality Certification.

Law, Policies and Regulations	Status	Comments
Coastal Barrier Resources Act and Coastal Barrier Improvement Act of 1990	This project falls within an exception to these acts.	There are no designated coastal barrier resources in the project area that would be affected by this project.
Coastal Zone Management Act of 1972	In compliance with this Act and obtaining concurrence by the State of Florida.	Florida Coastal Zone Consistency Determination has been prepared in accordance with the provisions of 15 CFR 930 and is located in Appendix C.4, Section C.4.32. The USACE has determined that the proposed action is consistent to the maximum extent practicable with the enforceable policies of Florida's approved Coastal Zone management program. Final Coastal Zone Management Act consistency will be provided by the State Water Quality Certification.
Endangered Species Act of 1973	In compliance with this Act and consulting with NMFS and USFWS as appropriate.	USACE submitted a Biological Assessment to USFWS in September 2018 to initiate consultation for potential project effects to T&E species. The Corps' determination is may affect, but not likely to adversely affect Everglade snail kite but not critical habitat, wood stork, crested caracara, bonneted bat, Florida panther and eastern indigo snake. The Corps entered formal consultation with USFWS on the Everglade snail kite, and its designated critical habitat, West Indian manatee and its designated critical habitat, wood stork, Audubon's crested

Law, Policies and Regulations	Status	Comments
		caracara, Florida bonneted bat, Florida panther, eastern indigo snake, and Okeechobee gourd. The preliminary conclusion is that the proposed project is not likely to jeopardize the continued existence of the species listed above and is not likely to adversely modify critical habitat, where designated. A programmatic Endangered Species Act Section 7 consultation for the Comprehensive Everglades Restoration Plan (CERP) was prepared on March 15, 2013 to evaluate potential effects of CERP on listed species and designated critical habitat under the NMFS' purview. The Corps provided a Programmatic Biological Assessment for the Comprehensive Everglades Restoration Plan to NMFS on 2 July 2013. NMFS provided a Programmatic Biological Opinion for the Comprehensive Everglades Restoration Plan to the Corps on 17 December 2013.
Estuary Protection Act of 1968	In compliance with this Act.	The proposed action provides the opportunity to redirect water that is currently discharged via the SFWMD canal infrastructure to improve the quantity and seasonal timing to the NWFLR, thus reducing salinity in the river reach, increasing the distribution

Law, Policies and Regulations	Status	Comments
		and quantity of tapegrass, improving floodplain hydrology, increasing the area of available manatee habitat, and expanding suitable oyster and sea grass habitat that benefit water quality and habitat functions within the Loxahatchee estuary. Other benefits also accrue.
Federal Water Project Recreation Act/Land and Water Conservation Fund Act	In compliance with this Act.	Effects of the proposed action on outdoor recreation have been considered in Section 5.2.15.3 and Appendix C.2.15. Recreational opportunities have been considered and the proposed action would not adversely affect existing recreational opportunities.
Fish and Wildlife Coordination Act of 1958, as amended.	In compliance with this Act.	The USACE coordinated with USFWS. USFWS participated on PDT to provide information on fish and wildlife elements on project. The USFWS provided a draft Fish and Wildlife Coordination Act (FWCA) Report included in Annex A. The Corps' responses to the FWCA Report recommendations are in Annex A.3.
Farmland Protection Policy Act of 1981	In compliance with this Act.	USACE coordinated with USDA/NRCS to meet the requirements of the Farmland Protection Act and received a determination on November 15, 2018 stating that restoring wetlands produces grazable pasture and the reservoir will result in farmland loss. NRCS will update their determination of acres of unique farmland that

Law, Policies and Regulations	Status	Comments
		would be affected by the project when detailed design information for each plan component is available.
Magnuson-Stevens Fishery Conservation and Management Act	In compliance with this Act.	An Essential Fish Habitat (EFH) assessment was covered by the Programmatic NMFS NEPA consultation (Appendix C.2.7). To document compliance, the USACE provided a letter to NMFS with the Notice of Availability of the DEIS that includes the EFH assessment.
Marine Mammal Protection Act of 1972	In compliance with this Act upon review of this document by USFWS.	Project construction sites would be isolated from West Indian manatees. Standard manatee construction conditions will be implemented to protect manatees during construction.
Marine Protection, Research and Sanctuaries Act	This Act is not applicable.	Proposed action does not consider ocean disposal of dredged material.
National Environmental Policy Act of 1969	In compliance with this Act upon public and agency review of this document, preparation of Final EIS and signing of Record of Decision.	Initial public coordination for this project began with the distribution of a scoping letter dated January 6, 2015 announcing the preparation of the Draft EIS and inviting public and agency comment (Appendix C.3). On January 8, 2016, a NOI to prepare an EIS was published in the Federal Register (FR Volume 80, Number 5). Public scoping meetings were held on January 12, 2015. The NOA of the LRWRP Draft PIR/EIS was published in the Federal Register and mailed to interested stakeholders to begin the 45-day review period.

Law, Policies and Regulations	Status	Comments
National Historic Preservation Act of 1966	In compliance with this act.	Section 106 of the National Historic Preservation Act allows for a phased approach to compliance with this Act. Once the project is authorized and PED is implemented, further investigations and consultation will be conducted as necessary. Each suite of features will be consulted on as they arise to ensure that the most up to date information will be considered in the subsequent determination of effects. Consultation has been initiated and is ongoing with the Florida SHPO and the appropriate federally-recognized tribes pursuant to the Act.
Native American Graves Protection and Repatriation Act	In compliance with this Act.	This Act applies to Federal owned lands, including Reservation lands. "Human remains and/or funerary objects were not recovered during excavations on Federally owned or managed lands during the course of this feasibility study. Should inadvertent discoveries occur within ENP during PED or construction phases of the LRWRP, procedures established by ENP will be followed. Ground disturbing activities will not occur on Reservation Lands." Neither human remains nor funerary objects were recovered during excavations on federally owned or managed lands during the course of this feasibility study.

Law, Policies and Regulations	Status	Comments
Resource Conservation and Recovery Act, as Amended by the Hazardous and Soils Waste Amendments of 1984; CERCLA as Amended by the 5.26.21 Superfund Amendments and Reauthorization Act of 1996; Toxic Substances Control Act of 1976.	In compliance with this Act upon review of this document by the FDEP.	The non-Federal sponsor will comply with applicable requirements. The non-federal sponsor will provide all lands free and clear of any and all environmental issues and the property will have no limitations.
Rivers and Harbors Act of 1899	In compliance with this Act.	Proposed action would not obstruct navigable waters of the United States.
Submerged Lands of 1953	In compliance with this Act.	The proposed project would increase freshwater flows to the Loxahatchee Estuary and provide freshwater overland flow to Loxahatchee River that will ultimately benefit the ecological habitats that occur on submerged lands of the State of Florida. The proposed project does not occur on submerged lands and no construction is expected on submerged lands.
Wild and Scenic River Act of 1968	In compliance with this Act.	The NFLR is a designated wild and scenic river and the beneficiary of the project.
E.O. 11514, Protection of the Environment.	In compliance with this E.O	The objectives of the proposed action are focused on environmental protection.
E.O. 11593 Protection and Enhancement of the Cultural Environment	In compliance with this E.O.	The area of potential effect for cultural resources for this proposed action includes state and private owned lands only. Consultation is ongoing to ensure compliance for this EO.

Law, Policies and Regulations	Status	Comments
E.O. 11988 Flood Plain Management	In compliance with this E.O.	Purpose of E.O. is to discourage federally induced development of floodplains. Commitment of lands to restoration precludes such development.
E.O. 11990 Protection of Wetlands	In compliance with this E.O.	Areas proposed for restoration are categorized as freshwater wetlands. The objectives of the proposed action are focused on environmental protection.
E.O. 12962, Recreational Fisheries	In compliance with this E.O.	Proposed action would have a beneficial effect on recreational fisheries in Loxahatchee river and estuary.
E.O. 12898 Environmental Justice	In compliance with this E.O.	LRWRP does not present any environmental impacts that are high, adverse, and disproportionate to low income, or minority populations. Sufficient scoping and public participation ensured potential impacts were understood by the public. No comments were presented as possible environmental impacts that may be disproportionate to low income or minority populations.
E.O 13007 Indian Sacred Sites	This E.O. is not applicable.	This E.O. is directed towards executive branch agencies with statutory or administrative responsibility for the management of federal lands. The proposed action would not affect lands owned by the Department of Defense or managed by the Corps of Engineers managed lands.

Law, Policies and Regulations	Status	Comments
E.O. 13045 Protection of Children	In compliance with this E.O.	Proposed action is not expected to have environmental or safety risks that may disproportionately affect children.
E.O. 13089 Coral Reef Protection	This E.O. is not applicable	Coral reefs are not affected.
E.O. 13122 Invasive Species	In compliance with this E.O.	A nuisance and exotic vegetation control plan has been prepared to prevent or reduce establishment of invasive and non-native species within the project area. Control plan is located in Annex G.
E.O. 13175 Consultation and Coordination with Indian Tribal Governments	In compliance with this E.O.	Consultation with members and representatives of the Seminole Tribe of Florida and the Miccosukee Tribe of Indians of Florida have been ongoing. See Appendix C.3 and Appendix C.5 for specifics. Pursuant to E.O. 13175, the Corps developed the November 01, 2012 Tribal Policy Memorandum, which dictates Federal responsibilities, including Trust Responsibilities, to federally recognized Tribes.
E.O. 13186, Responsibilities of Federal Agencies to Protect Migratory Birds	In compliance with this E.O.	Proposed action would not adversely affect migratory bird species. Proposed action is expected to benefit species by improving habitat and increasing availability of foraging opportunities.

Law, Policies and Regulations	Status	Comments
Memorandum on Government to Government Regulations with Native American Tribal Governments	In compliance with this Memorandum.	The USACE has consulted with the Miccosukee Tribe of Indians of Florida and Seminole Tribe of Florida throughout the LRWRP planning process (see Appendix C.3 and Appendix C.5).
FAA Memorandum of Agreement – Aircraft – Wildlife Strike Hazards	In compliance with this Memorandum.	The USACE prepared an analysis of NPIAS airports relative to project features as required by the memorandum.
Seminole Indian Claims Settlement Act of 1987	In compliance with the Act.	This Act also involves an agreement known as the Water Rights Compact, which specifically defines tribal water rights.

4.2 Compliance with Florida Statutes

As described in **Section 1** of this report, the State of Florida has enacted several laws pertaining to implementation of CERP projects. These include amendments to Section 373.026 (8) F.S., which establishes a requirement for the SFWMD to submit a State Compliance report pursuant to Section 373.1501 F.S., for review and approval by FDEP prior to formal submission of a request for authorization from Congress and prior to receiving an appropriation of State funds for construction and other implementation activities (except the purchase of lands from willing sellers); the enactment of Section 373.1501 F.S., which establishes the intent of the Florida Legislature with respect to CERP and the criteria for FDEP approval and the procedures to be followed by the SFWMD and FDEP for submitting and reviewing requests for approval; the enactment of Section 373.1502 F.S., which establishes permitting requirements and a process for the submittal, review, and issuance of certain regulatory permits for CERP projects; and the enactment of Section 373.470 and Section 373.472 F.S., establishing the “Save Our Everglades Trust Fund,” funding and reporting requirements, and procedures for distributions from the trust fund.

In addition to the above-described statutory requirements, other sections of Chapters 373 (Water Resources) and 403 (Environmental Control) of the F.S. include requirements that may apply to various aspects of CERP project planning and implementation. In particular, Chapter 403 F.S. and the administrative laws adopted in accordance with Chapters 373 and 403 F.S., contain the requirements for facilities that involve the discharge or potential discharge of pollutants to surface and groundwaters, and the discharge of air pollutants, including facilities regulated under the Federal Clean Water and Safe Drinking Water Acts and the Federal Clean Air Act.

The SFWMD will need to obtain a Section 404 Clean Water Act Permit prior to being allowed to perform work in jurisdictional wetlands, or within other Waters of the United States. The decision

to issue the required permit will be based on a public interest review which will include coordination with other Federal agencies such as USFWS, NMFS and SHPO.

The SFWMD will also need to obtain a) and Coastal Zone Consistency Determination, both of which are prerequisites to issuance of the Section 404 Permit, and both of which will be included within applicable State permits.

In addition to the requirements described above, prior to construction, contractor will need to obtain coverage under the Generic Permit for Stormwater Discharge from Large and Small Construction activities pursuant to Chapter 62-621.300 (4) F.A.C. from the FDEP and will also need to obtain any Consumptive Use permits for temporary Construction dewatering activities.
All required Federal and State permits and/or modifications to existing permits would be acquired prior to construction activities.

4.3 Compliance with Applicable Water Quality Standards and Permitting Requirements

Based on the information contained in this document, the TSP complies with the applicable provisions of the F.S. Detailed explanation of how the project complies with the applicable requirements for CERP projects contained in the F.S. can be found throughout this document, and documents referenced herein.

4.4 Pre-Application Conference

Under Section 373.1501(5)(c) the SFWMD “shall convene a pre-application conference with all state and federal agencies with applicable regulatory jurisdiction.”
In accordance with this Section, a pre-application conference was held on February 15, 2019 at the SFWMD B-1 Richard Rogers Conference Room in West Palm Beach, Florida and via webinar. Representatives from the following agencies were invited to attend the conference:

- SFWMD
- FDEP
- USFWS
- USACE
- FDACS
- Palm Beach County
- EPA
- NMFS
- FWC
- FDOT
- Martin County
- Local Utilities and Municipalities
- Tribes & Indian Affairs
- SHPO
- USDA/NRCS
- NOAA
- FP&L

The meeting summary, and a list of attendees, can be found at the end of this report. Information gained at the pre-application conference was considered by the SFWMD in preparing the LRWRP PIR.

5 Reasonable Assurances

Under Section 373.1501(5)(d), F.S. the SFWMD shall “provide reasonable assurances that the quantity of water available to existing legal users shall not be diminished by implementation of project components so as to adversely impact existing legal users, that existing levels of service for flood protection will not be diminished outside the geographic area of the project component, and that water management practices will continue to adapt to meet the needs of the restored natural environment.”

5.1 Water Supply Assurance

Federal law and regulation implementing the Comprehensive Everglades Restoration Plan (CERP) require Project Implementation Reports (PIRs) to address certain assurances as part of the project being recommended for approval and implementation.

The identification of water for the natural system associated with the CERP involves an analysis of four different aspects of ecological responses to hydrologic changes: 1) responses to the change in the quantity of water received by the natural system; 2) responses to the timing of those deliveries; 3) responses to the distribution of water delivered to the natural system; and 4) responses to the quality of the water received by the natural system. In a project specific sense, however, the relative importance of each of these aspects (quantity, timing, distribution, and quality) will vary from project to project depending upon the specific objectives established for the project.

The TSP achieves the project objectives by changing the timing, distribution, and volume of water conveyed, to the natural system. The regional scale of the TSP results in water moving between ecosystems and basins consistent with the project's objectives. The water made available for the natural system is the water required for the protection of fish and wildlife within natural systems, including water that contributes to meeting hydrologic, water quality, and ecologic targets for natural system restoration. The Savings Clause and project assurances analyses for this TSP will focus on whether these regional-scale changes meet the requirements of WRDA 2000 and the Programmatic Regulations.

Implementation of the TSP will not cause existing legal water sources to be eliminated or transferred. The project maintains existing water supply performance for agricultural and municipal water users in the Lake Okeechobee Service Area (LOSA) and North Palm Beach Service Area within the LRWRP project area. Therefore, the recommended plan fulfills WRDA 2000 Savings Clause requirements which, in part, ensure existing legal sources of water supply such as water for municipal, agricultural, and fish and wildlife uses continue to be available with project implementation.

5.2 Flood Protection Assurance

Under Section 373.1501(5)(d), F.S. the SFWMD shall "provide reasonable assurances that the quantity of water available to existing legal users shall not be diminished by implementation of project components so as to adversely impact existing legal users, that existing levels of service for flood protection will not be diminished outside the geographic area of the project component, and that water management practices will continue to adapt to meet the needs of the restored natural environment."

Flood protection is evaluated by a combination of best professional judgment interpreting model results and engineering analyses. Consistent with the Draft Guidance Memoranda, the same models and results used for plan formation were applied for the LRWRP Savings Clause assessment. This varies from typical storm event analyses by using a long period of record simulation and focusing on the wet events included within the 1965–2005 simulation period. Profiles and stage duration curves for various areas of interest were reviewed to compare TSP relative to FWO and ground elevations to determine if the TSP may impact flood protection.

Several areas within the project area that were analyzed include 1) the Hobe St. Lucie Conservancy District Unit 2 Agricultural Area, 2) the three geographical sections in Martin County that include the Ranch Colony, Old Trail and other residential developments, and 3) Indian Trail Improvement District residential areas. Groundwater levels in the Flow-way 3 area are significantly depressed as a result of a canal system that does not have any substantial control structures. This results in excessive discharges to the Cypress Creek Tributary in the wet season and little or no available water during the dry season. The alternatives, including the TSP result in an increase in groundwater levels, in some cases by greater than two (2) feet.

In southern Martin County, several residential developments (Old Trail, Ranch Colony, the Links, Colony Park) drain to Cypress Creek via the Cypress Creek Canal. This canal also provides drainage for areas to the west (Culpepper, Pal-mar) via a series of culverts that discharge into the canal. In the existing condition, all the drainage to Cypress Creek flows unimpeded, resulting in excessive storm water flows and excessively reduced area groundwater levels. Complaints of depleted groundwater stages, resulting in excessive interior lake drawdowns in the dry season, are common. Control elevations for the communities are variable, ranging from 14.5' NGVD to 17.0' NGVD.

The LECSR model results indicate that implementation of the TSP will not reduce the levels of service for flood protection within the areas affected by the project. Additionally, storm specific HEC-RAS modeling will be performed to inform the design and operations of key Flow-way 3 project features. For example, the Cypress Creek control structure will likely be operable to provide maximum flexibility to maintain consistency with pre-project high stages in accordance with the findings of additional modeling.

5.3 Adaptive Management to Meet the Needs of the Natural Environment

The LRWRP PIR provides four separate plans: Adaptive Management Plan, Hydromerterological Monitoring Plan, Water Quality Monitoring Plan and Ecological Monitoring Plan. The Adaptive Management Plan is required by USACE implementation guidance for WRDA 2007 Section 2039[1], the 2003 Programmatic Regulations for the Comprehensive Everglades Restoration Plan (CERP) and CERP Guidance Memorandum 56[2]. The remaining three monitoring plans are required to address various laws, regulations, and permits necessary to implement LRWRP. The plans are based on knowledge formed from extensive scientific work on Everglades ecology and restoration, some initiated several decades ago, as well as USACE guidance and regulatory agency permit requirements. In particular the long-term, system-wide monitoring and modeling conducted by Comprehensive Everglades Restoration Plan's (CERP) interagency science group (the REstoration COordination and VERification group or RECOVER) informed the planning of LRWRP and the development of the adaptive management plan.

The monitoring plans were guided in part by two principles. First, they needed to be complete from a LRWRP perspective by providing all monitoring required to address LRWRP-specific

[1] USACE, 2009. USACE HQ Implementation Guidance on Section 2039 of Water Resources Development Act. http://cw-environment.usace.army.mil/pdfs/09sep2-wrda-monitor.pdf

[2] USACE and SFWMD 2011. CERP Guidance Memorandum 56: Integration of Adaptive Management into Program and Project Management. http://www.cerpzone.org/documents/cgm/CGM_56_Adaptive_Management.pdf

needs. Second, they must be integrated with other Everglades monitoring to take advantage of existing monitoring efforts, knowledge, and information and thereby leverage dollars committed and spent elsewhere to avoid redundancies and insure cost-effectiveness. These two principles have been accomplished in the adaptive management plan, hydrometeorological monitoring plan, water quality monitoring plan, and the ecological monitoring plan. It is expected that document reviews and future reassessments of LRWRP monitoring needs will identify additional monitoring to address regulatory and consultation needs, as well as additional efficiencies that can be gained. Where possible, LRWRP monitoring relies on existing monitoring resources including physical instrumentation, stations, locations, servicing, and analysis efforts funded by RECOVER, CERP sponsors, and partner agencies and assumes these other monitoring efforts will continue at least for the period required by LRWRP. Therefore, the monitoring requirements described and budgeted in the LRWRP monitoring plan are limited to the additional, marginal increase in monitoring resources and analysis efforts needed to address LRWRP-specific questions. The monitoring plans are located in Annex D of the draft PIR.

6 Coordination with Existing Utilities and Public Infrastructure

Paragraph 373.1501(5)(e) F.S., requires the SFWMD to “Ensure that implementation of project components is coordinated with existing utilities and public infrastructure and that impacts to and relocation of existing utility and public infrastructure are minimized.”

6.1 Summary of Utilities and Coordination with Utilities and Public Infrastructure

Appendix D of the PIR identifies the utilities easements that are located within the lands that have been acquired for the project. The PDT will undertake specific outreach efforts to coordinate implementation of the project components with existing utilities and will minimize impacts to and relocation of existing utilities and public infrastructure to the extent possible. In areas where drainage facilities are proposed to be modified, specific Memoranda of Understanding or Agreement will be developed and executed with the responsible entities to reconfigure remaining drainage features as necessary to maintain the existing function.

Furthermore, a comprehensive list of utilities, agencies and/other entities responsible for public infrastructure services will be developed. This list will be used for coordinating with these entities during the pre-construction, engineering and design phase of the project. This will further aid the team in identifying utilities for removal or relocation, and ensure the project design, construction and operation appropriately considers utility concerns and minimizes impacts.

7 Increased Water Supply Available from Project

The Tentatively Selected Plan (TSP) improves wet season and dry season flows to the NWFLR and the Loxahatchee River estuary by capturing excess freshwater lost to tide and sending flows to meet dry season flow targets. The timing of tributary creek flow and ground water is improved with the TSP. This results in improvements to downstream freshwater river and estuarine salinity conditions important to various habitat zones and flora/fauna species. The TSP improves watershed hydrology by decreasing ponding and drainage through removal of berms, filling of ditches, connecting surface water and ground water flows between natural areas where they were cut off, moving water as sheetflow via spreader canals and natural flow-ways across parcels. A summary of the anticipated hydrologic effects of the alternative actions. A detailed discussion of the anticipated hydrologic effects of the alternatives is provided in Appendix C.2 of the PIR.

Loxahatchee River Watershed Restoration Project
1501 Pre-Application Meeting Minutes
February 15, 2019 – 2:00pm to 3:30pm

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1. Welcome & Introductions

Beth Kacvinsky, South Florida Water Management District (SFWMD), opened the meeting at 2:05 PM, welcomed everyone, completed the roll call (attached), and reviewed the agenda (attached).

2. Requirements of 373.1501 F.S.

Laura Reilly, SFWMD, explained 373.1501 F.S., which authorizes the District to act as the Local Sponsor for the Loxahatchee River Watershed Restoration Project, and reviewed the specific requirements of 373.1501(5) F.S., which states the District's is required to:

- Analyze and evaluate needs in a comprehensive matter and to consider all applicable water resources,
- Determine that components are feasible, efficient, and cost effective,
- Determine that project components are consistent with laws and regulations, and can be operated as proposed,
- Provide reasonable assurances regarding existing legal users and existing levels of flood protection, and
- Ensure that components are coordinated with utilities and public infrastructure and impacts minimized.

3. Project Study, Scope and Schedule

Ms. Kacvinsky reviewed the Loxahatchee River Watershed Restoration Project timeline, explaining the Draft Project Implementation Report (PIR) schedule has been revised. The Draft PIR will be published when the cost share language has been finalized.

Ms. Kacvinsky, presented the Loxahatchee River Watershed Restoration Project goals and objectives; which are natural system objectives to:

- Restore wet and dry season flows to the NW Fork to rehydrate river floodplain and restore salinity regime
- Restore oysters, seagrass and other estuarine communities
- Increase natural area extent of wetlands
- Restore watershed connections
- Restore native plant and animal species abundance and diversity

Ms. Kacvinsky reviewed the project constraints. In addition to being 1501 compliant the project will not cause or contribute to degradation of existing water quality and provide reasonable assurance that adverse impacts on flora and fauna will not occur.

4. Performance Measures and Project Benefits

Ms. Kacvinsky explained to meet the project objectives a number of alternatives were considered which included both deep and shallow water storage reservoirs, flow-ways as well as aquifer storage and recovery (ASR) wells

5. Array of Alternatives

Ms. Kacvinsky provided a description of the top performing alternative and presented the benefits that can be achieved in Alternative 5R.

Ms. Kacvinsky reviewed the Project Delivery Team's proposed Tentatively Selected Plan (TSP): Alternative 5RB. The project area is ~480,000 acres, and the TSP includes three flow-ways.

- Flow-way 1 reduces over-drainage in the Loxahatchee Slough with the addition of the G-160 structure, provides connectivity with the G-161 structure and the GWP Triangle restoration and includes conveyance at the M-1 pump station.
- Flow-way 2 includes the C-18 Reservoir a 9,500-acre foot reservoir and four ASR wells.
- Flow-way 3 includes restoration and hydration to Kitching Creek, reduces over-drainage by the Cypress Creek Canal, restores Gulfstream West and provides attenuation of flows from upstream areas and provides restoration and connectivity of Pal-Mar east.

Ms. Kacvinsky explained Alternative 5R restores flows to 91 percent of target for dry season, and to 98 percent for wet season. Restores 27,000 acres of wetlands, reconnects an additional 51,000 acres, improves habitat for fish and wildlife and also improves habitat for listed species, including Everglade Snail Kite & manatee.

6. 1501 Compliance

Ms. Kacvinsky restated the Loxahatchee River Watershed Restoration Project TSP is in compliance with 373.15 01 F.S.,

- Existing Legal Uses – urban, agricultural and tribal water supply not diminished
- Flood Protection – no reduction in level of service
- Water Quality – existing water quality maintained

7. Next Steps

Ms. Kacvinsky presented the next steps related to the Loxahatchee River Watershed Restoration Project TSP;

- Release Draft Project Implementation Report (PIR)– has been postponed, however; the Final PIR is scheduled to be released on October 29, 2019.

8. Discussion

Matt Morrison, SFWMD, explained the current schedule for completion of the PIR/EIS is aggressive and the USACE and the SFWMD are striving to meet the current schedule.

Chad Kennedy, Florida Department of Environmental Protection (DEP), asked if coordination with CMX had been place.

Beth Kacvinsky, SFWMD, thanked Mr. Kennedy for his comment.

Jeremy McBryan, Palm Beach County, asked if the SFWMD's Governing Board had approved the TSP and how the ASRs impact the LRWRP achieving project goals.
Mr. Morrison explained the Governing Board has approved the TSP and will be asked to provide the letter of support on the final PIR prior to releasing it again for public review.
Bob Verrastro, Scott Thourot and Ms. Kacvinsky addressed Mr. McBryan's question regarding ASR wells, explaining the TSP includes four ASR wells which will be utilized after the C-18 Reservoir has reached capacity and would later return the water to the reservoir when the elevation is low.

Dave Gillings, Palm Beach County, asked if Flow-way 3 provided any change in base flow improvements as is seen in Flow-way 2. Ms. Kacvinsky explained there is not a significant change in timing, as Flow-way 3 is a rainfall driven area.

Mr. McBryan asked how feasibility is assessed.
Ms. Kacvinsky went over the definition of project feasibility. Is the project permittable, cost effective and can be built to the Standards of Technology.

Poonam Kalkat, City of West Palm Beach inquired as to whether the M Canal will experience any increased flows from the proposed 75 cfs pump station.
Ms. Kacvinsky stated that the proposed pump station could increase flows but will deliver water when both upstream and downstream stages are appropriate.

Sandy Mann, Palm Beach County inquired as to the next steps.
Ms. Kacvinsky discussed SFWMD's staff is drafting the Draft PIR and reviewed project schedule that defines the next project steps that will take place prior to the release of the Final PIR, scheduled for release in October 2019.
Nimmy Jeyakumar, SFWMD, explained the 1501 Compliance Report review and submittal process to DEP.

Chris Jones, Lewis Longman and Walker, asked what the next steps are if the Loxahatchee River Watershed Restoration Project feasibility review changes the project components. Andy Loschiavo, US Army Corps of Engineers, explained the public has 45 days for review and comment on the Draft PIR, those comments are addressed.

In response to a question from James Foy, Indian Trail Improvement District, Ms. Kacvinsky provide the project manager's contact information.

Ms. Kalkat further inquired as to the expected time frame of resolution to the cost share language.
Ms. Kacvinsky explained all parties are actively seeking a resolution.
Bob Verrastro explained why resolution is important to SFWMD and other CERP projects are also awaiting resolution to the cost share language
Mr. Loschiavo reiterated resolution to the cost share language is a priority for the USACE.

Ms. Mann asked what the next steps are once the cost share language is worked out.

Ms. Kacvinsky explained the SFWMD's Governing Board will receive an update the at future Governing Board meeting.

Mr. McBryan inquired to project components X, Y and K found in the Integrated Delivery Schedule that do not appear to be include in the TSP.
Ms. Kacvinsky and Mr. Loschiavo thanked Mr. McBryan for his comments.

In response to a request by several attendees, Ms. Kacvinsky will email the presentation to those who may not have received it.

Jeff Giddings, SFMWD, discussed the percent of benefit received from the ASR wells.

Ms. Kacvinsky adjourned the meeting at 3:05 PM.

LRWRP 1501 Agency Meeting – February 15, 2019
Attendee List

Agency	Name	Present
FDEP		
FDEP	Natalie Barfield	☐
FDEP	William C. Kennedy	☐
FDEP	Frank Powell	☐
FDEP	Ed Smith	☐
FDEP	Inger Hansen	☐
FDEP	Ed Cambiero	☐
FDEP	Jordon Pugh	☐
FDEP	Katie Wallace	☐
FDEP	Victoria Coraci	☐
FDEP	Rhapsodie Osborne	☐
Tribes & Indian Affairs		
Michelle Diffenderfer	Lewis Longman & Walker	☐
Chris Johns	Lewis Longman & Walker	☐
FWC		
FWC	Carol Rizkalla	☐
USFWS		
USFWS	Andrew Eastwick	☐
FDACS		
FDACS	Rebecca Elliot	☐
Counties		
Palm Beach	Jeremy McBryan	☐
Palm Beach	Dave Gillings	☐
Palm Beach	Sandy Mann	☐
USACE		
USACE	Ann Hodgson	☐
USACE	Andy Loschiavo	☐
EPA		
EPA	Jamie Higgins	☐

Agency	Name	Present
NMFS		
	Kurtis Gregg	☐
SFWMD		
SFWMD	Jennifer Leeds	☐
SFWMD	Brenda Low	☐
SFWMD	Nimmy Jeyakumar	☐
SFWMD	Brenda Mills	☐
SFWMD	Matt Morrison	☐
SFWMD	Armando Ramirez	☐
SFWMD	Robert Verastro	☐
SFWMD	Anushi Obeysekera	☐
SFWMD	Jeff Giddings	☐
SFWMD	Mark Elsner	☐
SFWMD	Karin Smith	☐
SFWMD	Scott Thourot	☐
SFWMD	Greg Coffelt	☐
SFWMD	Tim Harper	☐
SFWMD	Dave Colangelo	☐
SFWMD	Kathy LaMartina	☐
SFWMD	Beth Kacvinsky	☐
SFWMD	Laura Reilly	☐
SFWMD	Emily Canney	☐
Others - Utilities - Municipalities and 298 Districts		
Pal-Mar & HSLCD	Bob Higgins	☐
ITID	Jay Foy	☐
City of West Palm	Poonam Kalkat	☐