Reconnaissance Study

Lower Kissimmee Basin Stormwater Treatment Area

OKEECHOBEE COUNTY, FLORIDA

Ecosystem Investment Partners

Lake Okeechobee Water Quality
An EIP Pay for Performance Solution

FINAL REPORT
SFWMD Contract: No. 4600004527

September 2022

RECONNAISSANCE STUDY – FINAL REPORT

LOWER KISSIMMEE BASIN STORMWATER TREATMENT AREA

Okeechobee County, Florida

Prepared For:

South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406
Contract No. 4600004527 (PO 9500009421)

Prepared By:

EIP Florida Water Quality, LLC
5550 Newbury Street, Suite B
Baltimore, MD 21209

Contact: Jeremy McBryan
jeremy@ecosystempartners.com

and

Brown and Caldwell
2301 Lucien Way, Suite 250
Orlando, FL 32751

Contact: Abbi Dorn
adorn1@brwncald.com

Date: September 2022

Prepared by:

In association with:

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List of Abbreviations

BMAP	Basin Management Action Plan
CADD	computer-aided design and drafting
CERP	Comprehensive Everglades Restoration Plan
cm	centimeters
cm/d	centimeters per day
DDR	Design Documentation Report
District	South Florida Water Management District
DMSTA	Dynamic Model for Stormwater Treatment Areas
EAV	emergent aquatic vegetation
EIP	EIP Florida Water Quality, LLC
ESA	Environmental Site Assessment
ESR	Engineering Submittal Requirements
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FEB	Flow Equalization Basin
FDOT	Florida Department of Transportation
FPL	Florida Power & Light
HABs	harmful algal blooms
HDPE	high density polyethylene
H&H	hydrology and hydraulic
HHD	Herbert Hoover Dike
IATD	industry-accepted technical documentation
kV	kilovolt
LKBSTA	Lower Kissimmee Basin Stormwater Treatment Area
LOPP	Lake Okeechobee Protection Permit
LORS 08	Lake Okeechobee Regulation Schedule 08
LOSA	Lake Okeechobee Service Area
LOSOM	Lake Okeechobee System Operating Manual
NAVD88	North American Vertical Datum of 1988
NEEPP	Northern Everglades and Estuaries Protection Program
NG	Natural Gas
NGVD29	National Geodetic Vertical Datum of 1929
O&M	Operations and Maintenance
P	phosphorus
PCSWMM	Personal Computer Stormwater Management Model
PES	phosphorus elimination system
PS	pump station
Project	Lower Kissimmee Basin Stormwater Treatment Area Project
RTU	Remote Terminal Unit
SCADA	supervisory control and data acquisition
SDI	SCADA Design and Installation
SFWMD	South Florida Water Management District
SHPO	State Historic Preservation Office
SSL	Sovereign Submerged Lands
STA	stormwater treatment area
TCNS	Taylor Creek/Nubbin Slough
TM	Technical Memorandum
TMDL	total maximum daily load
TP	total phosphorus
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WCS	water control structure

Applicable Units and Datums	
Length	miles (mi), feet (ft), inches (in)
Area	acres (ac), square feet (sf), square yards (sy)
Volume	acre-feet (ac-ft), million gallon (MG), cubic feet (cf), cubic yards (cy)
Flow	acre-feet per day (ac-ft/d), million gallon per day (MGD), cubic feet per second (cfs)
Mass	metric tons per year (mt/yr)
Concentration	milligrams per liter (mg/L), micrograms per liter (µg/L), parts per billion (ppb)

The project generally utilizes English units and the elevation datum for the project is the NAVD88. The elevation datum for data from other sources, including the SFWMD, is the National Geodetic Vertical Datum of 1929 (NGVD29). At the Project location, the conversion from NGVD29 to NAVD88 is -1.21 ft (per S-154 conversion factor in STRucture Information Verification (STRIVE) 2004).

EXECUTIVE SUMMARY

The South Florida Water Management District (SFWMD or District) has engaged EIP Florida Water Quality, LLC (EIP) in a performance-based contract to deliver the Lower Kissimmee Basin Stormwater Treatment Area (LKBSTA) Project (Project) on EIP-owned property to maximize removal of total phosphorus (TP) loads from priority areas of the Lake Okeechobee watershed.

As documented in this Reconnaissance Study Report, the EIP team has identified an alternative that achieves the Project goals of reducing TP loads from the Taylor Creek/Nubbin Slough (TCNS), Indian Prairie, and Lower Kissimmee subwatersheds as well as Lake Okeechobee, thereby assisting to achieve the Lake Okeechobee total maximum daily load (TMDL) goals and the goals and objectives of the Lake Okeechobee Basin Management Action Plan (BMAP).

The selected alternative (Alternative C) is a 2,640-acre (ac) Stormwater Treatment Area (STA) with 6 cells (configured to operate in parallel) along with a Phosphorus Elimination System (PES), an innovative water quality treatment technology consisting of a vertical engineered media filtration system, that can treat STA discharges during sediment phosphorus (P) re-suspension events. Alternative C includes re-locating a portion of the L-62 canal to the west of its existing alignment to facilitate improved STA cell configurations and construction methods. Alternative C includes an inflow pump station (PS) to direct water to the Project from the re-located L-62 canal and utilizes the existing S-154 structure to convey Project discharges to the C-38 canal.

The EIP team conceptualized numerous alternative designs which were further developed and refined in concert with SFWMD staff during various technical workshops held to promote collaboration between the EIP team and SFWMD. As a result, three alternatives were developed and evaluated during this Reconnaissance Study. EIP's initial approach incorporated the Project site's existing sloped topography into several alternative designs, however, based on robust input from SFWMD staff, all three alternatives documented in this Reconnaissance Study have flat STA cell bottom elevations.

EIP's initial approach also focused on utilizing the entire Project site in an effort to maximize P load reduction, especially considering the Project site's location adjacent to both the L-62 and C-38 canals. To confirm this approach, the EIP team prepared a water availability analysis to address potential regulatory water supply and other constraints that may exist within the region when Lake Okeechobee is below certain water levels under both the current and expected future Lake Okeechobee operational plans. The water availability analysis demonstrated that even when assuming no STA inflows from the C-38 canal when Lake Okeechobee water levels are below the Low sub-band, water is available to the Project and thus the frequency and duration of low STA water depths are not anticipated to be problematic.

The water availability analysis, along with dynamic water quality model simulations, also provided technical information to evaluate the potential impacts of incorporating a Flow Equalization Basin (FEB) with an STA on the Project site. Some slight reductions in the average number of days per year with low water depths and the number of low water depth events were predicted while the projected TP load reduction of the FEB+STA scenario was similar to STA-only scenarios with similar areas. Therefore, the EIP team concluded that reducing the STA size to incorporate an FEB into the Project was not justified.

To evaluate the alternatives, the EIP team developed an evaluation methodology to enable an objective review and assessment of design elements, performance expectations, construction complexity, schedule-related issues and regulatory aspects, among other issues, associated with each of the alternatives. The evaluation methodology includes 12 factors organized into three major categories: a) cost; b) implementation schedule; and c) performance. The cost factors include the cost of proposed structures, energy requirements, treatment capacity, and operations and maintenance (O&M) costs. The schedule factors include permitting, construction, water availability, and start-up. The performance factors include inflow/outflow configuration, TP removal, PES/STA integration, and resiliency.

As a result of the evaluation methodology documented in this Reconnaissance Study Report, Alternative C was identified by the EIP team to be advanced to the Design Documentation Report (DDR) and Preliminary Design phases based on the following (in comparison to Alternatives A and B):

- High effective treatment area acreage and high TP load reduction potential
- Balance between number of structures and operational flexibility
- Minimal construction complexity
- Design expected to enable an efficient transition from construction to start-up operations
- Moderate to complex permitting/authorizations expected
- One PS
- One PES facility
- Ability to fully integrate STA operations with the PES facility
- Ability of STA to withstand intermittent dryout conditions

EIP has accomplished the objective of this Reconnaissance Study which was to engage with SFWMD to efficiently develop and refine an appropriate project alternative to move forward into future design activities and analyze and document the Project's viability and feasibility to enable advancing the design process as efficiently as possible. EIP plans to submit the Draft DDR to the District in November 2022.

SECTION 1

INTRODUCTION

The SFWMD has engaged EIP in a performance-based contract to deliver the Project on EIP-owned property to maximize removal of TP loads from priority areas of the Lake Okeechobee watershed.

The EIP team has identified an alternative that achieves the Project goals of reducing TP loads from the TCNS, Indian Prairie, and Lower Kissimmee subwatersheds as well as Lake Okeechobee, thereby assisting to achieve the Lake Okeechobee TMDL goals and the goals and objectives of the Lake Okeechobee BMAP. Figure 1-1 provides a map of subwatersheds and basins within the Lake Okeechobee watershed.

The Project is expected to be designed, constructed, and operated by EIP in two phases. The objective of Phase One is to complete the due diligence work necessary to determine project viability and analyze the project's feasibility. Phase One is broken into two subphases: Phase One A consists of Task 1: Reconnaissance Study and Task 2: DDR. Phase One B consists of completing the Preliminary Design and preparing initial permit applications. Phase Two is anticipated to include Final Design activities, project construction, land transfer, operations and project turnover. Phase One began December 15, 2021 and this Reconnaissance Study Report is the deliverable associated with Phase One A, Task 1.

1.1 Overview of Project Need

Lake Okeechobee is a shallow, eutrophic lake that provides natural habitat for fish, wading birds, and other wildlife and is a central component of the hydrology and environment of South Florida. Lake Okeechobee has been subject to long-term stressors including excessive nutrient loads, extreme water level fluctuations, harmful algal blooms (HABs), and the rapid spread of exotic and nuisance plants in the littoral zone (Ollis et al., 2022).

In 2001, the Florida Department of Environmental Protection (FDEP) adopted a TMDL for Lake Okeechobee of 140 metrics tons per year (mt/year) of TP, of which 35 mt/year are allocated to atmospheric deposition and 105 mt/year are allocated to the 3.45 million ac Lake Okeechobee watershed. In 2014, a BMAP, the framework for water quality restoration with projects and strategies to reduce pollutant loading, was adopted for Lake Okeechobee and subsequently updated in 2020. In 2016, the Northern Everglades and Estuaries Protection Program (NEEPP), originally adopted by the Florida legislature in 2007, was amended to emphasize BMAPs for the Northern Everglades. The Northern Everglades include the Lake Okeechobee Watershed (Figure 1-1) as well as the Caloosahatchee River and St. Lucie River watersheds. NEEPP's intent is to protect and restore surface water resources and achieve and maintain compliance with water quality standards in the Northern Everglades through a phased, comprehensive, and innovative protection program that includes long-term solutions based upon the state's TMDLs (Ollis et al., 2022).

For Water Year 2016-2020, the TP load to Lake Okeechobee (not including atmospheric deposition) was calculated to be 540 mt/year, which is 400 mt/year above the TMDL target set by FDEP. Of that amount, the TCNS and Indian Prairie subwatersheds contributed 95 mt/year and 80 mt/year, respectively (Olson, 2022). The TCNS subwatershed includes the S-154C and S-154 basins, both of which were selected by SFWMD in 2020 as Lake Okeechobee watershed focus areas as a result of a robust technical and public process. The S-154C and S-154 basins were also identified by the FDEP as TP priority 1 Targeted Restoration Areas in the 2020 Lake Okeechobee BMAP update (Olson, 2022). Several basins within the Indian Prairie subwatershed were also identified by SFWMD in 2020 as Lake Okeechobee watershed focus areas, most of which were also identified by FDEP as TP priority 1 Targeted Restoration Areas in the 2020 Lake Okeechobee BMAP update.

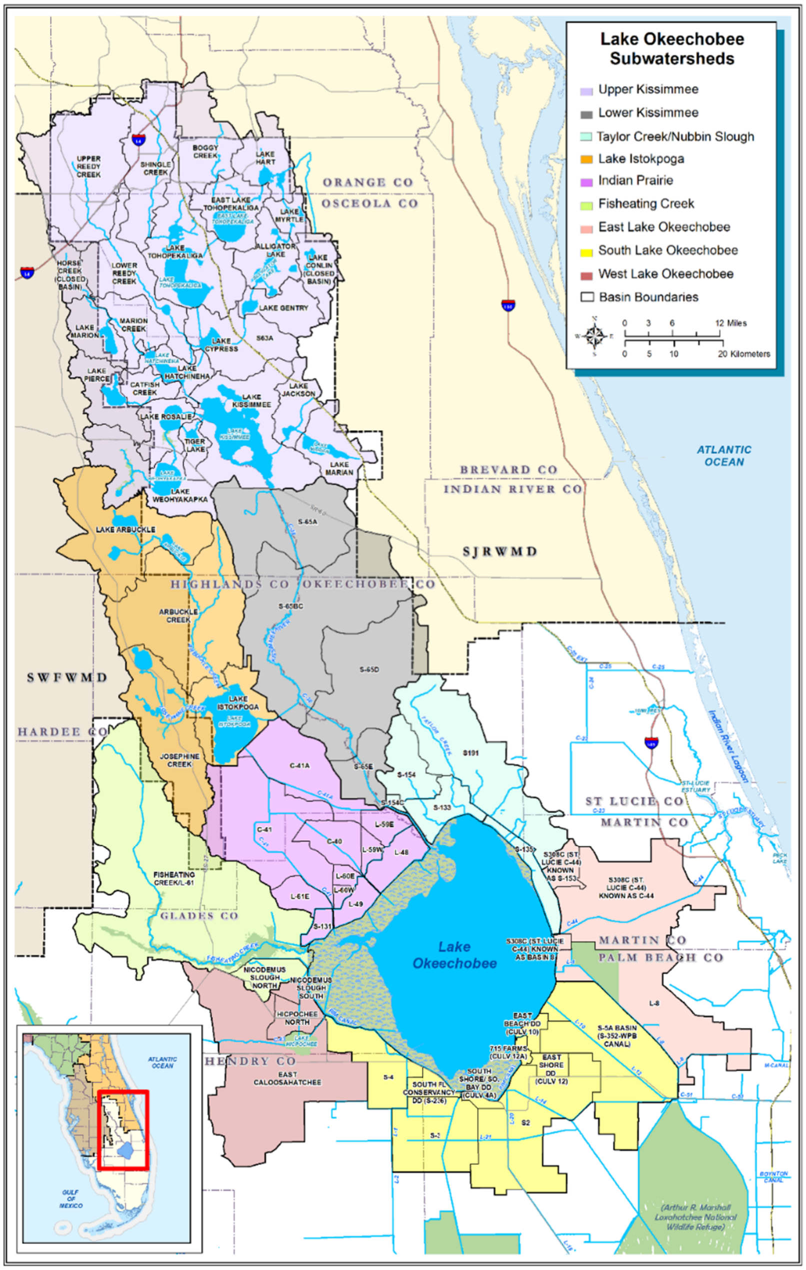

Figure 1-1. Subwatersheds and Basins within the Lake Okeechobee Watershed (Olson *et al*., 2022)

1.2 Objective of Reconnaissance Study

The purpose of the Reconnaissance Study (Phase One A Task 1) was to engage with SFWMD to efficiently develop and refine an appropriate project to move forward with the rest of Phase One. The objective of the Reconnaissance Study was to analyze and document the Project's viability and feasibility to enable advancing the design process as efficiently as possible. Specific objectives of the

Reconnaissance Study include solidifying the overarching Project goals (see Section 2.3), developing and refining alternatives to be reviewed as part of the Reconnaissance Study (see Section 3) and identifying a conceptual design to be used as the basis for the DDR (see Section 4).

1.3 Reconnaissance Study Decisions

As stated in the Project's Statement of Work (Exhibit A of EIP's contract with SFWMD), decisions to be completed during the Reconnaissance Study are as follows:

1. Project approach, including a determination of the balance between P removal and pumping needs.

Section 4 and Appendix 2 provide information on projected P load removal. Section 3.5 provides information on the anticipated pumping needs.

2. Modeling approach, including software, assumptions, period of record, interpretation of results, and documentation of modeling effort.

Appendices 1, 2, 3, 4 and 11 provide detailed information on the modeling approaches utilized, modeling software used, modeling assumptions, modeling periods of record, interpretation of modeling results, and documentation of the modeling efforts performed to support the Reconnaissance Study.

3. Permit approach, including application schedule, permit application package, and potential for a joint permit application will be examined.

Appendix 17 provides the anticipated permit approach, including application schedule, anticipated elements of permit application package(s), and information on the potential for EIP-SFWMD joint permit application(s).

4. Identification of alternatives to be evaluated.

Section 3 provides a summary of the alternative development process including refinement, descriptions of project elements common to all alternatives, and detailed information on the alternatives evaluated during the Reconnaissance Study.

5. Identification of the chosen alternative to advance through DDR and Preliminary Design.

Section 4 provides a summary of the alternative evaluation methodology, provides the detailed evaluation results and includes the identification of the conceptual design alternative to advance through DDR and Preliminary Design.

1.4 Document Details

This Reconnaissance Study Report generally follows the SFWMD's Engineering Submittal Requirements (ESR), updated March 22, 2016. Historically, the District has utilized traditional design-bid-build contracting practices to construct STAs on state-owned land. However, due to the innovative nature of this Project's delivery model, risks associated with Project implementation are shifted from the District to EIP, as contract payments are tied to EIP successfully meeting Project milestones, including designing, constructing, and operating the Project.

At the conclusion of Phase One of the Project, EIP will submit a proposal for Phase Two (Stipulated Payments and Deliverables Proposal), which is expected to include a detailed fee proposal for final design activities, land transfer, construction, operations and turnover to SFWMD. This approach allows for the establishment of a fixed fee to complete the Project, as opposed to typical design-bid-build practice which relies on cost estimates. As such, an opinion of probable construction costs was not included in this report.

1.5 EIP Team Members

The EIP team, provided below, consists of a diverse group of professionals with broad technical expertise and extensive experience.

Project Management

EIP Florida Water Quality, LLC

Engineering Design

Brown and Caldwell

Geotechnical Engineering

Radise International, LC.

Water Availability

MacVicar Consulting, Inc.

Construction

Phillips and Jordan (Civil Works)

The Haskell Company (PSs/Structures)

Water Quality Treatment

Sustainable Water Infrastructure Group, LLC

Wetland Solutions, Inc.

Environmental Site Assessments

NovelEsolutions, Inc.

Surveying

Pickett and Associates

Craig A. Smith and Associates

Permitting/Threatened and Endangered Species/Cultural Resources

GreenSource Environmental Professionals, Inc.

Archaeological Consultants, Inc.

SECTION 2

PROJECT BACKGROUND

2.1 Project Concept

The Project will be operated as a year-round, flow-through STA system while prioritizing the treatment of water with the highest P concentration to maximize P load reduction. Keeping the STA hydrated during times when there is no stormwater runoff from the S-154 basin will be accomplished by conveying water from the C-38 canal.

In addition to traditional STA treatment methodology, an innovative technology (a PES) is currently proposed within the Project limits, creating a hybrid STA. It is the intention of the EIP team to operate the PES such that flows can be treated by the PES either independently of or in series with the STA cells. An area may be reserved within the project to allow for future expansion of the PES facilities.

2.2 Project Location

The Project site is primarily located in unincorporated Okeechobee County with a small portion of the Project site located in Highlands County. The property has been zoned for agricultural land use for decades, primarily as improved pasture for cattle ranching. It is located approximately 6 miles (mi) upstream of Lake Okeechobee on the C-38 canal, also known as the channelized Kissimmee River (Figure 2-1). The Project site is bisected by the L-62 canal and covers approximately 3,400 ac of existing improved pasture. The Project site is bounded by SW 128th Avenue to the west, State Road 70, the L-62 canal and single-family residential properties to the north, pastureland and a tree farm to the east, and the C-38 canal and pastureland to the south.

The Project site is located at the northernmost boundary of Lake Okeechobee[1] within or directly adjacent to areas that have historically had high P concentrations in stormwater runoff flows (e.g., S-154C and S-154 basins). This location can also receive flows and loads from the C-38 canal, which receives and conveys flows from the Lower Kissimmee subwatershed and part of the Indian Prairie subwatershed.

The Project site is located outside of the proposed footprint of the recommended Tentatively Selected Plan for the Lake Okeechobee Watershed Restoration Project, a Comprehensive Everglades Restoration Plan (CERP) project north of Lake Okeechobee, and complements the proposed CERP features by providing water quality treatment for runoff from priority basins identified by CERP studies: the S-154 and S-154C basins.

[1] The Lake Okeechobee waterbody includes the C-38 canal which connects the main open water area of the lake to the S-65E structure, which is located on the C-38 canal approximately 1.5 mi southeast of State Road 70.

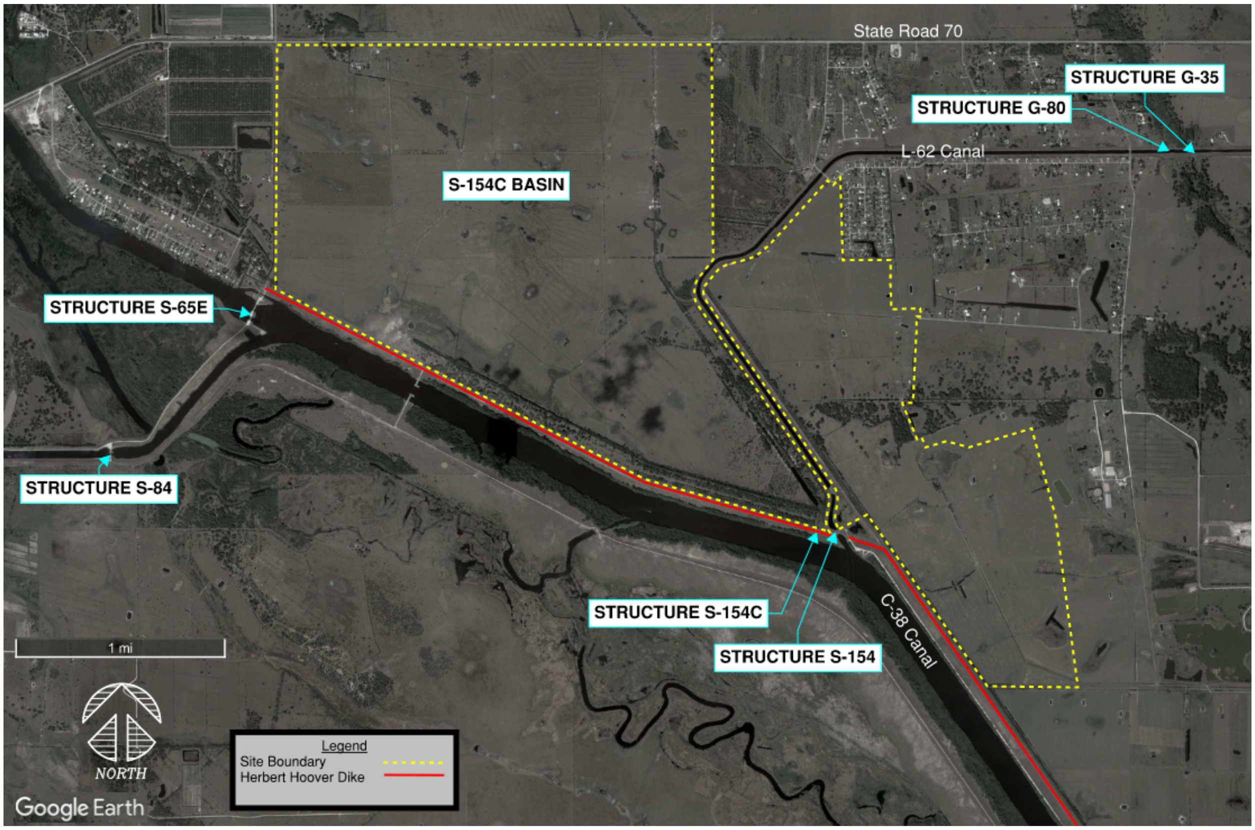

Figure 2-1. Project Location

2.2.1 Existing Site Features

Several existing features were reviewed as part of this Reconnaissance Study effort. These features include the major drainage and surface water infrastructure, general site topography, existing site utilities, various structures, and soils.

The major drainage feature on the Project site is the L-62 canal which divides the east and west portions of the property. The L-62 canal flows west and then bends south toward and through the Herbert Hoover Dike (HHD) to the C-38 canal; its discharges are controlled via the S-154 structure. On the north side of the western portion of the site, two culverts flow under State Road 70. The eastern culvert under State Road 70 flows through an existing drainage easement southward through the western portion of the site before entering L-62 via culverts. The western culvert under State Road 70 acts as an equalization structure, allowing water to transfer between low areas on the north and south sides of the road. A channel running west to east along the northern toe of the HHD drains most of the Project site, including the eastern State Road 70 culvert flow, by flowing through the HHD and S-154C structure into the C-38 canal. The eastern portion of the site generally flows south towards a channel flowing southeast along the eastern toe of the HHD. Within the southern limits of the eastern portion of the site, a drainage easement exists to drain properties further east towards this southeastern channel. Property encumbrances are identified in the Draft Boundary Survey (see Appendix 13).

The G-80 structure, located on the north side of the L-62 canal, east of the site, drains Popash Slough into the L-62 canal. The G-35 structure, which is located approximately 500 feet (ft) east of the G-80 structure on the south side of the L-62 canal conveys flows south to Popash Slough.

Southwest of the site, the C-38 canal flows through the S-65E structure. To the southwest of S-65E, the C-41A canal flows to the C-38 canal via the S-84 structure.

General site topography is flat with slight fall to the south in both the eastern and western portions of the Project site. Surface elevations of the site vary from 15 to 30 ft North American Vertical Datum of 1988 (NAVD88). See Appendix 12 for the Topographic Survey of the Project site.

Soils at the Project site are typical for the region and primarily sand. EIP has initiated a geotechnical investigation program and preliminary results of field and laboratory work is provided in Appendix 3. Based upon review of the Natural Resources Conservation Services Web Soil Survey, the Project site contains a few small pockets of 15-Okeelanta muck. The only other soil type that is not primarily sand is 6-Manatee loamy fine sand, which occurs as a single small pocket.

Existing site utilities include electrical, water wells, irrigation systems, and stormwater culverts. Electrical lines were observed in both the east and west portions of the site near homes, barns, and outbuildings.

Structures were observed on both portions of the site. The west portion has structures related to current cattle ranching practices which house various pieces of farming equipment, as well as two residential structures just south of State Road 70 in the northwest corner of the Project site. The east portion of the Project site has a residential structure and horse stable located near the entrance to the property off of Southwest 67th Drive/Granada Avenue.

2.3 Project Goals and Objectives

The primary objective for this Project is to provide P load reductions in the stormwater flows from the TCNS, Indian Prairie, and Lower Kissimmee subwatersheds prior to discharge into Lake Okeechobee and therefore assist in achieving the Lake Okeechobee TMDL goals. As a secondary objective, due to its location the Project will also be capable of treating Lake Okeechobee water.

2.4 Previous Studies

Due to Lake Okeechobee's importance to the region's water and environmental resources, numerous studies related to its operations, ecology, water quality, and the water quality characteristics of contributing and downstream watersheds have been conducted. In addition, STAs have been thoroughly researched and studied by SFWMD and others. A list of key studies, reports, publications and information that assisted the team during the Reconnaissance Study are listed below:

- Total Maximum Daily Load for Total Phosphorus, Lake Okeechobee, Florida, Prepared by FDEP, August 2001
- Lake Okeechobee Basin Management Action Plan, Prepared by FDEP, January 2020
- Lake Okeechobee Basin Management Action Plan, Prepared by FDEP, December 2014
- Chapter 8A: Northern Everglades and Estuaries Protection Program – Annual Progress Report, In: 2022 South Florida Environmental Report – Volume I, Prepared by SFWMD and FDEP, March 1, 2022
- Appendix 8B-2: Water Year 2021 Lake Okeechobee Watershed Focus Area Assessments, In: South Florida Environmental Report – Volume I, Prepared by SFWMD and FDEP, March 1, 2022
- Chapter 4: Northern Everglades and Estuaries Protection Program Projects, In: 2022 South Florida Environmental Report – Volume III, Prepared by SFWMD and FDEP, March 1, 2022
- Phosphorus Flux in the Taylor Creek Stormwater Treatment Area: Potential Causes and Recommended Control Strategies, Prepared by SFWMD, April 2016

- Appendix 5C-1: Evaluation of Inundation Depth and Duration Threshold for Typha domingensis (Cattail) Sustainability: Test Cell Study, In: 2022 South Florida Environmental Report – Volume I, Prepared by SFWMD and FDEP, March 1, 2022
- Lake Okeechobee Watershed Construction Project, Phase II Technical Plan, Prepared by FDEP, SFWMD and the Florida Department of Agriculture and Consumer Services (FDACS), February 2008
- Treatment Wetlands, 2nd Edition, by Robert H. Kadlec and Scott D. Wallace, 2009
- Development of Design Criteria for Stormwater Treatment Areas in the Northern Lake Okeechobee Watershed, Prepared by Wetland Solutions, Inc., October 2009
- Restoration Strategies Regional Water Quality Plan, Prepared by SFWMD, April 27, 2021

2.5 Project Submittals and Workshops

Table 2-1 provides the interim work products prepared and submitted by EIP to SFWMD as well as technical workshops that have been held to date.

Table 2-1. Interim Work Products and Workshops		
Interim Work Product/Workshop	**Type**	**Date Submitted/Workshop Held**
Industry Accepted Technical Documentation (IATD) Draft Report	Interim Work Product	January 18, 2022
Draft Boundary Survey	Interim Work Product	February 8, 2022
IATD Final Report	Interim Work Product	February 28, 2022
Kick-Off Workshop	Workshop	March 9, 2022
Cultural Resource Assessment Survey	Interim Work Product	March 14, 2022
Kick-Off Workshop Draft Minutes	Interim Work Product	March 22, 2022
IATD Workshop	Workshop	March 22, 2022
Modeling Work Plan	Interim Work Product	March 24, 2022
Project Assets Workshop (Recon)	Workshop	March 31, 2022
Permitting and Monitoring Workshop (Recon)	Workshop	March 31, 2022
Operations, Maintenance and Connectivity with District System Workshop (Recon)	Workshop	March 31, 2022
Modeling Work Plan Workshop	Workshop	April 25, 2022
PES Workshop	Workshop	May 2, 2022
Modeling Work Plan Update	Interim Work Product	May 10, 2022
Kick-Off Workshop Final Minutes	Interim Work Product	May 11, 2022
IATD Workshop Draft Minutes	Interim Work Product	May 13, 2022
Permitting and Monitoring Workshop (Recon) Draft Minutes	Interim Work Product	May 16, 2022
Phase II Environmental Site Assessment (ESA) Sampling Plan Development Approach	Interim Work Product	May 19, 2022
Phase I ESA	Interim Work Product	May 23, 2022
Operations, Maintenance and Connectivity with District System Workshop (Recon) Draft Minutes	Interim Work Product	May 23, 2022
Topographic Survey	Interim Work Product	May 24, 2022
EIP Response to SFWMD Title Objection Letter	Interim Work Product	June 9, 2022
Project Assets Workshop (Recon) Draft Minutes	Interim Work Product	June 13, 2022
Phase II ESA Sampling Plan (Version 1)	Interim Work Product	June 15, 2022
Reconnaissance Study Modeling Workshop (Hydrology and Hydraulic (H&H) and Water Quality)	Workshop	June 22, 2022
Phase II ESA Sampling Plan	Interim Work Product	June 24, 2022
Reconnaissance Study Modeling Workshop (H&H and Water Quality) Draft Minutes	Interim Work Product	June 30, 2022

2.6 Schedule and Key Dates

Table 2-2 provides key dates for Phase One of the Project.

Table 2-2. Phase One Schedule and Key Dates

Schedule	Key Dates
Contract Award	December 15, 2021
Draft Reconnaissance Study to District	July 21, 2022
Final Reconnaissance Study to District	September 30, 2022
Draft DDR to District	November 2022
Final DDR to District	February 2023
Draft Preliminary Design to District	April/May 2023
Final Preliminary Design to District	June/July 2023

2.7 Applicable Standards and Codes

For conceptual alternative STA design, the EIP team prepared design calculations, plans, specifications, and other required deliverables for Project features based on the guidance provided by the most current version of the District Engineering and Computer Aided Design and Drafting (CADD) Standards and industry practice for such facilities. Conceptual design of the Project features was performed by EIP consistent with District's Planning and Engineering, Florida Power & Light (FPL), United States Army Corps of Engineers (USACE), FDEP, Florida Department of Transportation (FDOT), and industry standards and procedures, as applicable. The EIP team identified the design criteria, including codes, to be used for design, minimum material strengths, and basic design loads. Review of previous and existing designs and coordination with District staff was performed to ensure the proposed alternatives are in alignment with the District's O&M standards for installation and operation.

Development of the Project alternatives design utilized, but was not limited to, the following guidelines and standards:

- SFWMD Standards for Construction of Water Resource Facilities Design Details and Design Guidelines (latest edition, including updates).
- SFWMD PS Guidelines.
- SFWMD Right of Way Guidelines.
- Applicable USACE requirements.
- Applicable FDOT standards.
- Applicable FPL requirements.
- Other applicable national and industry design codes.

2.8 Available Budget

In December 2021, the SFWMD Governing Board authorized entering into a Project Agreement with EIP Florida Water Quality, LLC for the design, construction, operation, innovative technology, and land acquisition associated with the Project in an amount not to exceed $300 million.

SECTION 3

ALTERNATIVE DEVELOPMENT

The EIP team conceptualized numerous alternative designs which were further developed and refined in concert with SFWMD staff during various Reconnaissance Study technical workshops held to promote collaboration between the EIP team and SFWMD. As a result, three alternatives were developed during this Reconnaissance Study and are described in Sections 3.2, 3.3 and 3.4.

Each alternative design was developed according to the goals and objectives of the project based on the allowable constraints and a series of design factors that impact the design decisions moving forward toward a preferred alternative design. The design factors considered, include construction costs, operational costs, operational flexibility and complexity, and P load reduction efficacy.

The EIP team discussed a variety of opportunities to integrate innovative, proven design elements with SFWMD staff during the Reconnaissance Study. During these discussions, the EIP team coordinated with the District to understand the long-term operation and maintenance impacts of specific project elements. The project elements reviewed and assessed during alternative development included STA cell layout, STA cell topography, STA flow direction and routing (cells in parallel or series), headworks layout, L-62 canal reroute, PES functionality and location, project infrastructure (water control structures (WCSs), inverted siphons, canals and embankments), project discharge, impacts to the HHD, need for additional PSs, offsite impacts, site access and security, potential encumbrances and power source. Section 3.5 identifies and provides detailed information on the various project elements considered during development of the three alternatives. Each alternative identified also contains an area that is reserved for construction of a PES, an innovative water quality treatment technology that consists of a vertical engineered media filtration system augmented with water treatment plant residuals. During future design activities, each project element will be analyzed, and options associated with these elements will be reviewed.

At the conclusion of this Reconnaissance Study, a chosen alternative design is identified as a result of the evaluation methodology and associated metrics described in Section 4.

3.1 Alternative Development Overview

EIP's initial approach to alternative development incorporated the Project site's existing sloped topography into several alternative designs, however, based on robust input from SFWMD staff, all three alternatives documented in this Reconnaissance Study have flat STA cell bottom elevations.

EIP's initial approach also focused on maximizing the area of STA on the Project site in an effort to maximize P load reduction, especially considering the Project site's location adjacent to both the L-62 and C-38 canals. To confirm this approach, the EIP team prepared a water availability analysis to address potential regulatory water supply and other constraints that may exist within the region when Lake Okeechobee is below certain water levels under both the current and expected future Lake Okeechobee operational plans. The water availability analysis demonstrated that even when assuming no STA inflows from the C-38 canal when Lake Okeechobee water levels are below the Low sub-band, water is available to the Project and thus the frequency and duration of low STA water depths are not anticipated to be problematic.

The water availability analysis, along with dynamic water quality model simulations, also provided technical information to evaluate the potential impacts of incorporating a FEB with an STA on the Project site. Some slight reductions in the average number of days per year with low water depths and the number of low water depth events were predicted while the projected TP load reduction of the FEB+STA scenario was similar to STA-only scenarios with similar areas. Therefore, the EIP team concluded that reducing the STA size to incorporate an FEB into the Project was not justified.

3.2 Alternative A

3.2.1 Introduction

Alternative A consists of maintaining the current L-62 canal alignment and mass grading most of the project site to create six STA cells with flat bottom elevations. Cells 1 through 4, west of the L-62 canal move flow east to west, with each cell bottom set at lower elevations moving north to south to align with exiting topography. Cells 5 and 6, east of the L-62 canal, would direct flow from north to south. Cell 6, located south of Cell 5, would be set at an elevation below Cell 5 to align with existing topography.

A layout of Alternative A with graphical representations of the key project features is provided in Figure 3-1. Additionally, process flow schematics and diagrams indicating the conceptual flow of water through the STA cells and PES facilities and are provided in Appendix 7.

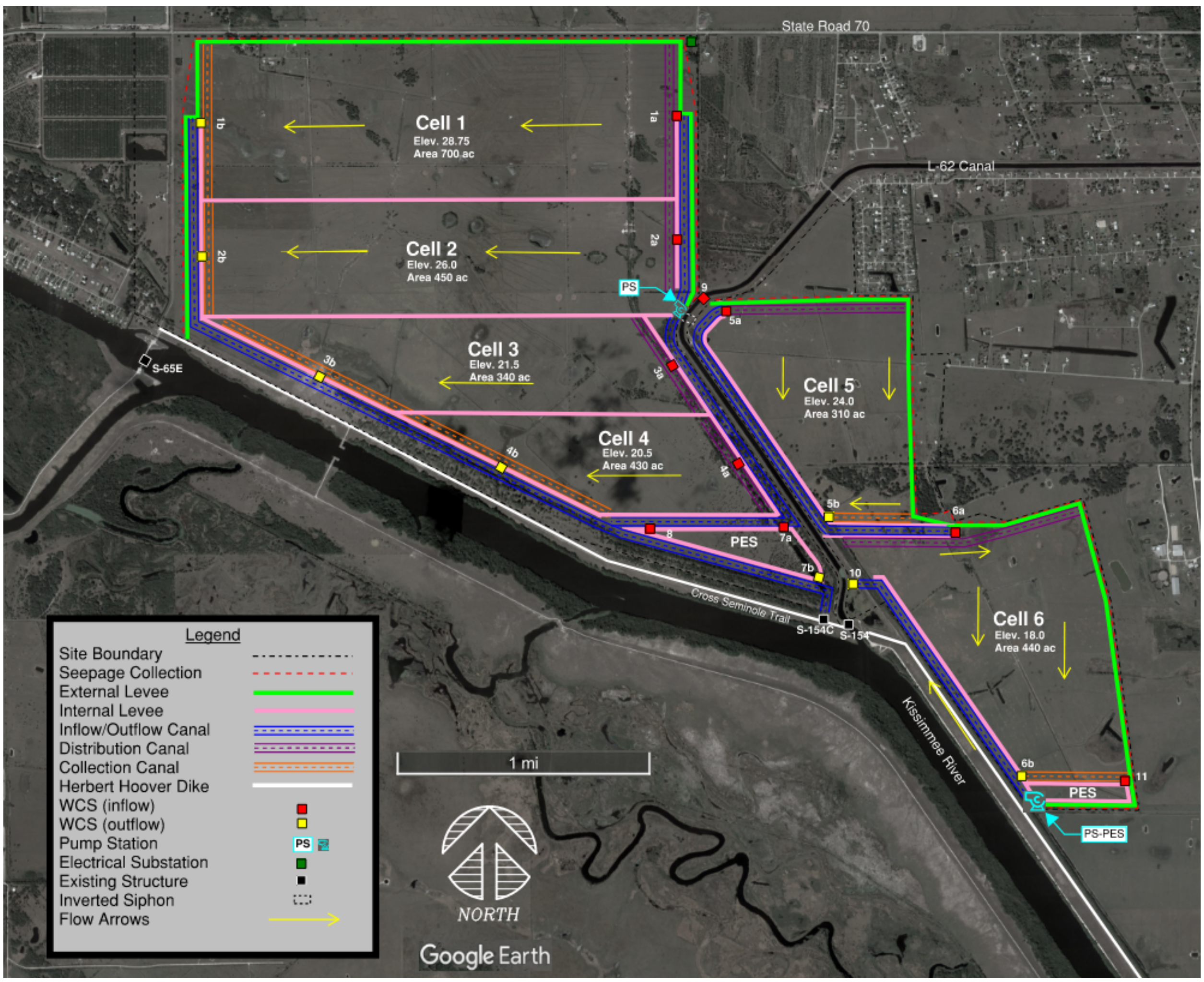

Figure 3-1. Alternative A – Flat Terraces E-W

3.2.2 Headworks System

This alternative to the headworks system utilizes the existing L-62 canal in its current alignment. It consists of placing a new WCS-9 directly upstream of the main PS and would utilize S-154 with modifications to allow for the L-62 canal to discharge into C-38, as well as provide system inflow from Kissimmee River (C-38) to be pumped into the treatment cells.

Currently, an existing WCS (S-154) located at the discharge point of the L-62 canal into C-38 controls the water surface elevation in the L-62 canal using automatically operated sluice gates mounted to a reinforced concrete box culvert structure. The new WCS-9 will be designed to match S-154 operations, maintaining minimum water levels within the L-62 canal upstream of the project site. This provides continued support of private water needs currently derived from the canal.

A Headworks Analysis including modeling based on historical records and evaluation of flows from the L-62 canal is provided in Appendix 1A.

3.2.2.1 PSs

Alternative A requires two PSs. Both the western and eastern cell inflow canals would be fed by a PS in the L-62 canal downstream of WCS-9. A second station is necessary for eastern PES and Cell 6 effluent to be pumped into an outflow structure into the L-62 canal.

3.2.2.2 Inflow System

Both the western and eastern cell inflow canals are fed by pumping systems. On the west side of the site, an inflow canal running north of the PS feeds western Cells 1 and 2 with an inflow canal running southeast parallel to L-62 feeding western Cells 3 and 4. On the eastern side, inflow canals will be fed by conduit under the L-62 canal from the PS. The inflow canal for Cells 5 and 6 will be located parallel to L-62.

3.2.3 STA System

The six cells of Alternative A would be graded at the preliminary elevations shown in Figure 3-1. Elevations shown for each cell represent preliminary estimates intended to limit impacts of disturbance, excavation and fill operations during construction.

Alternative A includes two separate PES locations, on the west and east of sides of L-62. In this alternative, the western PES is located between Cell 4 and the HHD and the eastern PES is located south of Cell 6. Effluent from the eastern PES will be pumped via PS-PES to an outflow WCS into the L-62 canal.

3.2.4 Discharge System

Western Cells 1 through 4 along with the western PES flows into a collection and outflow canals along the west and south side of the site, discharging into C-38 through the existing S-154C. On the east side, Cell 5 discharges into the L-62 canal through WCS-5b. The eastern PES and Cell 6 effluent will be pumped by PS-PES into an outflow canal and routed to an outflow structure into the L-62 canal.

3.2.5 Seepage Collection System

Seepage on both sides of the site is managed with seepage canals. On the west side, a seepage canal is routed along the west and north sides before turning south down to the PS where it can either be recycled to the cells via the PS or discharged to the L-62 canal upstream of WCS-9. On the east side, a seepage canal runs outside the north, east, and south side of the external embankment to PS-PES, where it will be pumped to the outflow canal.

3.2.6 Embankments

For this alternative, all embankments will be located on the perimeter of the STA cells.

3.3 Alternative B

3.3.1 Introduction

Alternative B consists of five treatment cells and a reroute of the L-62 along the eastern side of the site with an inflow canal and interior berm running east to west in the middle of the site. Cells 1 and 4, bisected by the inflow canal, directs flow north and south respectively. Cells 2 and 3 are bisected by an interior berm and also directs flow north and south respectively. Cell 5, located generally along the existing L-62 alignment directs flow to the south.

A layout of Alternative B with graphical representations of the key project features is provided in Figure 3-2. Additionally, process flow schematics and diagrams indicating the conceptual flow of water through the STA cells and PES facilities and are provided in Appendix 7.

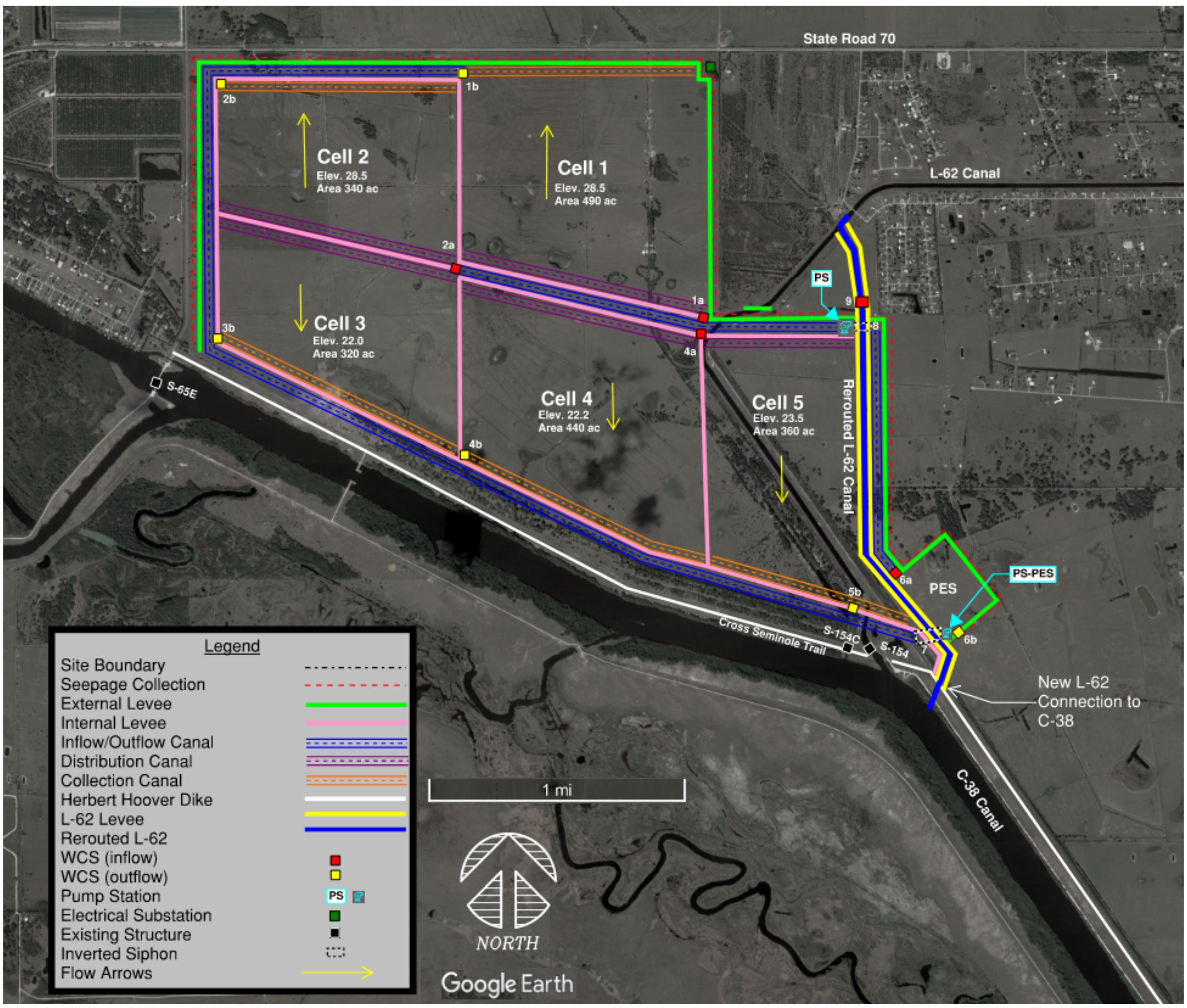

Figure 3-2. Alternative B – L-62 East Reroute

3.3.2 Headworks System

This alternative to the headworks system utilizes the L-62 canal in a relocated alignment along the east side of the STA. In this configuration, the new WCS-9 is constructed within the relocated canal and diverts flow to the PS in a similar manner as Alternative A. For Alternative B, inflow would be provided to all treatment cells by a single inflow canal.

The new WCS-9 in this alternative is also designed to maintain current operations and functionality of the existing L-62 canal as described in Section 3.2.2. For this alternative, the existing S-154 structure would not be utilized to provide additional inflow to the STA given the relocation of L-62.

3.3.2.1 PSs

Alternative B requires two PSs – one for the inflow canal to Cells 1 through 5 and a second PS for discharge from the PES. The inflow canal PS will be located on the northeast corner of Cell 5, downstream of the new WCS-9 in the relocated L-62 Canal. The PES discharge PS is located at the southern corner of the PES.

3.3.2.2 Inflow System

Treatment Cells 1 through 5 are fed by a central inflow canal aligned east to west through the middle of the STA and distribute flow through a WCS designated for each cell. There is a second inflow canal running north to south along the eastern end of the site to provide inflow for the PES. The PS located along the rerouted L-62 will provide inflow for both canals.

3.3.3 STA System

The six cells of Alternative A are graded to near flat-bed slopes at the preliminary elevations shown in Figure 3-2. As with all alternatives, elevations shown for each cell represent preliminary estimates intended to limit impacts of disturbance, excavation and fill operations during construction.

The single PES for Alternative B is located east of the rerouted L-62. The PES will require a discharge PS (PS-PES) for effluent to be pumped via conduit into the outflow canal on the western side of rerouted L-62 canal.

3.3.4 Discharge System

Northern Cells 1 and 2 flow into an outflow canal running east to west along the northwestern side of the site. This outflow canal turns south along the western limits of the site before turning southeast and paralleling the HHD. Cells 3 through 5 discharge into the southern stretch of the outflow canal before flowing into C-38 through the existing S-154C structure. Effluent from the PES east of the L-62 reroute will be pumped by PS-PES via an inverted siphon into the outflow canal west of the L-62 reroute.

3.3.5 Seepage Collection System

Seepage for all treatment cells and the PES are managed with seepage canals routed along the outside of the external embankments. Seepage collection, west side of the L-62 reroute, will collect and direct flow along the west and north sides before turning south and east to the PS where it can be either be recycled to the cells via the PS or discharged to the L-62 Canal upstream of WCS-9.

On the east side of the site, a canal located along the eastern side of the PES and associated inflow canal collects seepage and directs flow via a conduit below the rerouted L-62 and discharged through the existing S-154 structure.

3.3.6 Embankments

For Alternative B, the internal inflow canal and embankment system will be designed to the same standards as external embankment systems described in Section 3.5.

3.4 Alternative C

3.4.1 Introduction

Alternative C consists of a north-south reroute of L-62 west of the existing alignment. A new WCS (WCS-9), PS, and two inflow canals feeding each of the six treatment cells will be located near the intersection of the existing and relocated L-62 systems. On the west side of the reroute, an inflow canal located in the center portion of the STA distributes flow to Cells 1 through 4, while a second canal on the east side of the reroute feeds influent to Cells 5 and 6.

The interior cell layout for Alternative C is similar to that of Alternative B (see Section 3.3.1) with Cells 1 and 2 route treated flows from the center of the site to the north side of the STA and Cells 3 through 5 routing flow to the south side of the site. This alternative features an additional Cell 6 located east of the L-62 reroute on the southeastern corner of the site, expanding the treatment footprint to closely match that of Alternative A.

A layout of Alternative C with graphical representations of the key project features is provided in Figure 3-3. Additionally, process flow schematics and diagrams indicating the conceptual flow of water through the STA cells and PES facilities and are provided in Appendix 7.

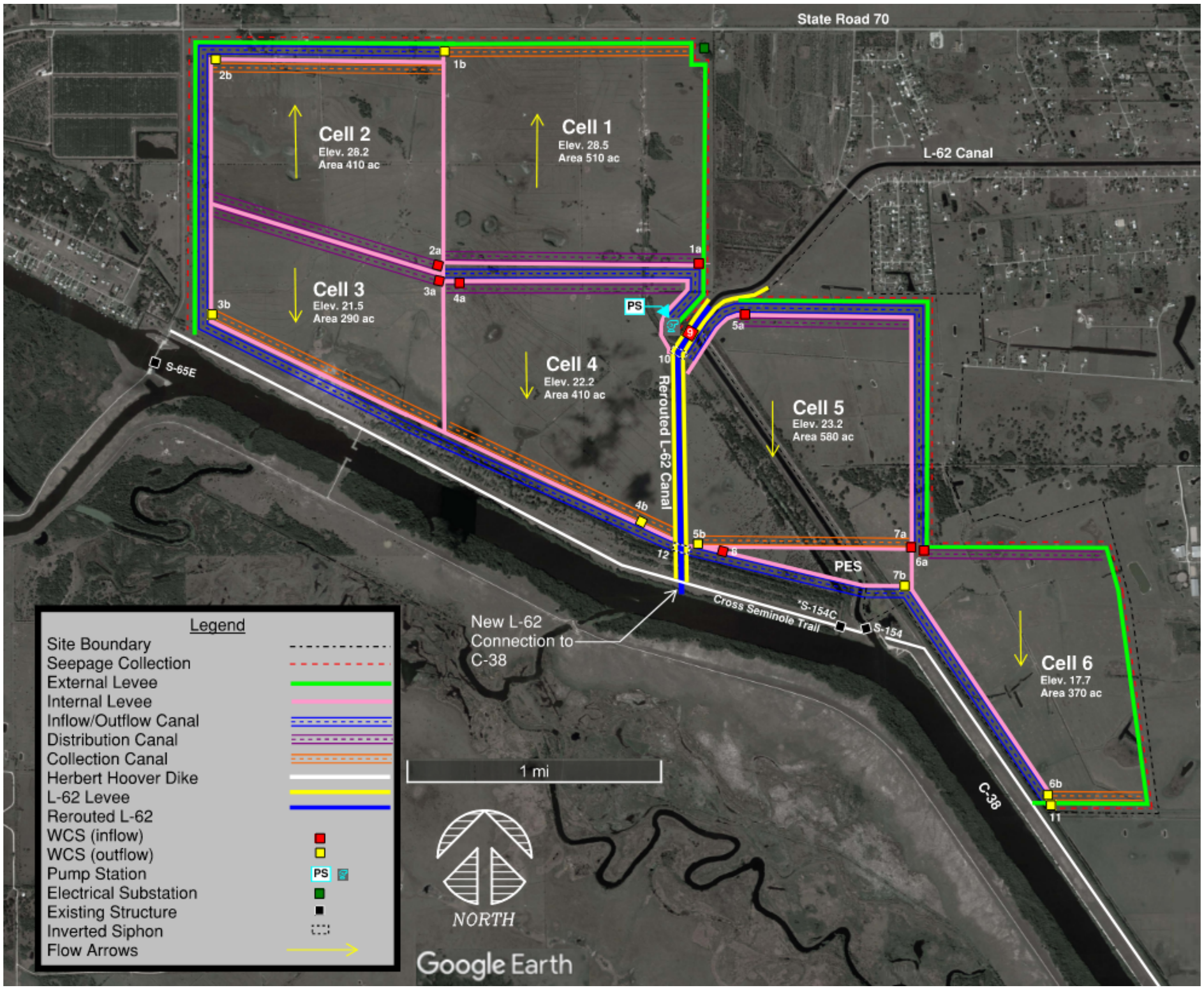

Figure 3-3. Alternative C – L-62 West Reroute

3.4.2 Headworks System

Similar to Alternative B, the influent for Alternative C is obtained from the relocated L-62 canal downstream of the new WCS-9 and distributed by the PS into two inflow canals. The western inflow canal provides influent for Cells 1 through 4, while the eastern inflow canal directs flow to Cells 5 and 6 via a conduit beneath the relocated L-62.

As with all alternatives, the new WCS-9, located near the point of intersection with existing and rerouted L-62 canals, is designed to maintain current operations and functionality of the existing L-62 canal as described in Section 3.2.2. Similar to Alternative B, the existing S-154 structure would not be utilized to provide additional inflow to the STA given the relocation of L-62.

3.4.2.1 PS

Alternative C will require only one PS to draw influent from the relocated L-62 canal for distribution to the inflow canal systems. All other inflow and discharge systems are controlled via gravity and head differential.

3.4.2.2 Inflow System

The two inflow canals are designed to be fed by the single PS located downstream of the new WCS-9 along the relocated L-62. Cells 1 through 4 are fed by the inflow canal running east to west in the middle of the site. A second inflow canal located on the east side of the L-62 reroute directs flow to Cells 5 and 6.

3.4.3 STA System

The six cells of Alternative C are graded at the elevations shown in Figure 3-3. The grades shown represent a planned balance of material within each cell limits.

Alternative C includes a PES east of the L-62 reroute located between Cell 5 and the HHD. The eastern PES is located northwest of Cell 6.

3.4.4 Discharge System

Northern Cells 1 and 2 flow into an outflow canal running east to west along the northwestern side of the site. This outflow canal runs south along the western limits of the site before turning southeast and paralleling the HHD. Southern Cells 3 and 4 flow into this stretch of the outflow canal before flowing to the outflow canal east of rerouted L-62 via a conduit beneath the canal. Eastern Cells 5 and 6 flow into this outflow canal which parallels the HHD and discharges into C-38 through the existing S-154C.

3.4.5 Seepage Collection System

Seepage management for Alternative C requires only two continuous canal systems (one on each side of the relocated L-62) to collect seepage from the entire STA and route it back to the PS location for recirculation or discharge upstream of WCS-9.

3.4.6 Embankments

As with Alternative B, the internal inflow canal and embankment system for Alternative C is designed to the same standards as external embankment systems as described in Section 3.5.

3.5 Project Elements and Operational Considerations

This section describes the project elements common to each alternative as well as the approach the EIP team implemented to incorporate, modify, or accommodate for the functions of these project elements. Operation and maintenance (O&M) considerations were integrated into every project element to ensure there was an appropriate balance of project elements and operational flexibility. EIP limited the number of structures where feasible to reduce required O&M activities. EIP also incorporated redundancy within each individual structure to reduce impacts on Project operations during necessary structure maintenance activities.

3.5.1 STA System

3.5.1.1 Flow Equalization Basin Assisted STA

In addition to addressing the regulatory aspects of Lake Okeechobee Service Area (LOSA), Lake Okeechobee Regulation Schedule (LORS08) and Lake Okeechobee System Operating Manual (LOSOM), the water availability analysis described above also incorporated several scenarios to evaluate the potential benefits of incorporating a 500 ac FEB with a maximum water depth of 4 ft upstream of an STA. While there were some slight reductions in the average number of days per year of STA water depths less than 0.5 ft and 0.0 ft (i.e., ground surface) and slight reductions in the number of events below these water depth thresholds, the EIP team concluded that reducing the STA size to incorporate an FEB was not justified. As such, none of the alternatives developed and evaluated included an FEB. More information is provided in the water availability analysis which is located in Appendix 4.

3.5.1.2 Cell Layout

While each alternative has different overall treatment cell configurations, the general layout of each treatment cell is similar. Internal inflow canals bring flow to an inflow WCS. The inflow WCS conveys flow from the inflow canal to the STA cell and includes a gate that can control the amount of flow entering a STA cell. The flow routed through the inflow WCS enters a spreader canal which spreads the flow evenly across the full width of the STA cell. The STA cell is flat, is expected to contain emergent aquatic vegetation (EAV) and conveys flows to a collection canal. The collection canal collects and directs the flow to an outflow WCS. The outflow WCS conveys flow from the collection canal to the Outflow canal and includes a gate that can control the amount of flow leaving the STA cell. Each cell's water depth and processing flow rate will be managed by remote operation of these outflow WCSs. Access to the STA cell areas for operations, monitoring, and maintenance activities will be provided by the construction of maintenance benches on embankments adjacent to canals (see Section 3.5.4) and boat ramps. It is anticipated that each cell will have two boat ramps, located at both the inflow and outflow sides of the cells. The boat ramps will be located away from inflow and outflow structures to reduce disturbances that have the potential to cause nutrient spikes in water quality samples collected at or near the inflow and outflow structures. Public access for recreation is proposed to occur after the project is transferred to the District, however, areas suitable for future public access and recreational facilities will be identified and incorporated into the design of the STA.

3.5.1.3 Flow Direction

Cells are orientated to have flow move from east to west, north to south, or south to north. Existing landform and earthwork requirements are considered when identifying flow direction. The cell orientation was also balanced based upon the project's goal of maximizing P removal while processing a high volume of water. This balance was informed by the water quality model sensitivity testing, which is provided in Appendix 2A.

3.5.1.4 Cells in Series vs Cells in Parallel

Two treatment cell configurations were considered during the development of alternatives: cells in series and cells in parallel. These two configurations were evaluated assuming that the pumping capacity and all other project infrastructure were similar. It was identified that parallel cell configurations are advantageous for the Project due to increased operational flexibility (e.g., individual cells can be taken offline for maintenance without interrupting other cells), lower hydraulic loading, lower flow rates and reduced velocities. Operational flexibility was identified early by the EIP team as a way to react to changing environmental conditions that may impact the capability of the Project to meet its P removal goals. On the other hand, treatment cells in series are prone to higher inflow rates and hydraulic loading per treatment cell, which could exacerbate head loss, water depth, and scouring issues during high flow periods. Although operating the treatment cells in series may result in increased TP removal, it was determined that this potential performance increase was not sufficient to outweigh the cost of additional embankments and structures needed and the operational flexibility benefits provided by cells in parallel. Therefore, all alternatives developed and evaluated during the Reconnaissance Study included parallel treatment cell configurations.

3.5.1.5 PES Function/Location/Operation

The PES is a P removal system intended to complement the STA, creating a hybrid project. The PES technology is an intermittently saturated, vertical engineered media filtration system, where runoff is treated as it flows through an engineered media. The PES media has a high capacity for adsorbing

TP, thus capable of discharging low TP concentrations, even after accumulating a large amount of TP over its lifecycle. More information is provided in the PES H&H Modeling Technical Memorandum (TM), PES Water Quality Modeling TM, and Innovative Technology Overview TM (Appendices 1B, 2C, and 6, respectively).

Each alternative evaluated during the Reconnaissance Study incorporated the ability to send some or all of the post treated flows from the STA cells to the PES, as well as providing raw, untreated water to the PES. The primary driver for inclusion of the PES is to address the potential for elevated TP present in outflows from the STA when vegetation is being established during startup and after STA dry-out events, which have been known to result in sediment P re-suspension. Therefore, one of the evaluation metrics is PES/STA integration, see Section 4. When the PES is not used to address legacy P within the soil or fluxing P, during normal STA operations, the PES operates in parallel with the STA, which increases TP removal for the overall project.

As an innovative technology, the EIP team understands the need for clarity regarding the PES component design and associated O&M requirements. During the DDR and Preliminary Design phases, additional details will be discussed with the District staff to incorporate their experience.

3.5.1.6 Cell Topography

Treatment cells for all alternatives will be graded flat to encourage evenly distributed flow and sufficient hydraulic residence time for treatment. The existing site generally slopes from a higher elevation of approximately 28 ft along State Road 70 on the north side, to lower elevations ranging from approximately 15-20 ft along the southern boundary at the foot of the HHD. There is a notable depression in the center portion of the southwestern end of the site that requires fill to balance elevations for any selected alternative. This portion of the site is the historic Kissimmee River riverbed and is located in Highlands County. This low elevation area is proposed to be incorporated into the STA footprint to help meet the project's goals for effective treatment area and phosphorus load reduction performance.

This site-wide elevation difference requires tiered or terraced cells at higher elevations on the north end and lower elevations on the south for any alternative considered, in order to limit mass excavation and potential groundwater conflicts across the north end of the site. Interior berms are used to separate neighboring cells. All flow entering and exiting the cells will be managed with WCSs.

3.5.2 WCS

There are four types of WCSs included in the Project. First, a large WCS located in the existing L-62 canal, identified as WCS-9 in all three alternatives considered. Since the proposed project utilizes a portion of the L-62 canal as a PS forebay and raw water influent source, a new WCS within the L-62 canal is needed to replicate the functions of the existing S-154 structure upstream of the project. This WCS is described in more detail in Section 3.5.5 below. Second, STA cell inflow and outflow WCSs convey water in and out of each treatment cell. Each cell has one inflow and outflow WCS located in a corner of the cell. These locations were determined based upon a balance between maximizing cell hydraulics and minimizing inflow/outflow infrastructure needs. It was identified that the operational flow rates supplying each STA cell WCS was small enough to present an opportunity to reduce the WCS design from a cast-in-place concrete box culvert to High Density Polyethylene (HDPE) butt-welded culvert. In addition to the conduit type, the EIP team plans to provide a generator plug-in at each cell WCS to allow for operations during a power outage. The operational flexibility of these cell WCSs was a core component discussed by the EIP team when considering this alternative WCS design. Specifically, dual conduits for each WCS were incorporated in order to mitigate the need to shut down the entire treatment cell when maintenance on the WCS is required. In May, the EIP team discussed this alternative WCS design with the District and received positive feedback.

Therefore, each of the alternative layouts considered during the Reconnaissance Study incorporate this HDPE WCS. Third, the PES technology contains a series of small WCSs which convey and manage water within the PES facility. Additional information regarding these PES WCSs is provided in Appendix 1B and 6. Finally, two District WCSs (S-154C and S-154) will be impacted by the Project. Both of these structures are located within the HHD and manage runoff from the Project site and the L-62 canal drainage basin, respectively. These structures are incorporated into each alternative as follows:

- Alternative A – The S-154C structure will be utilized as the outflow WCS from Cells 1 through 4. Modifications to this structure are limited to operational gate operations only. The S-154 structure contains a structural weir upstream of the gate. To allow for bi-directional flow through this structure, modifications to the physical structure to remove this weir is required. In addition, the gate operations will need to be modified is required.
- Alternatives B and C – The S-154C structure remains untouched by these alternatives. The drainage area contributing to this structure would be minimal post project construction. However, during start-up operations, this structure may be utilized in some capacity. Modifications to the S-154 structure is limited to gate operational changes.

Although the Project is not required to mitigate flood risk by accepting flood waters, the Project design will effectively route onsite flood events through the use of passive overflow weirs incorporated into the WCS and embankment elements.

3.5.3 Inverted Siphons

The Project site is bisected by the L-62 canal and it was determined that re-routing the L-62 canal around the entire project space was infeasible. This situation required the EIP team to plan for the construction of inverted siphons to transfer water to and from each side of the L-62 canal. Following discussions with the District, during the Kick-Off and Project Assets Workshops, it was determined that siphons are acceptable, as long as appropriate O&M safety measures incorporated. Each end of the siphons needs to have a gate structure where maintenance crews can safely clear the conduits of wildlife or dewater the entire structure space. In addition, it was identified that a second conduit would be installed to allow for maintenance activities without a partial project shut-down. All alternatives evaluated during the Reconnaissance Study include at least one inverted siphon.

3.5.4 Canals and Embankments

Canals, or open channels, are the primary conveyance infrastructure used by the Project to deliver raw water to the STA cells and PES technology as well as capture treated water and discharge that treated water back into the District canal system (C-38 and L-62). Six types of canals are included in the Project, inflow, distribution, collection, outflow, seepage, and PES distribution. Inflow canals deliver raw water to the STA cells, distribution and collection canals are located within the STA cells area and run perpendicular to the treatment cell flow, outflow canals convey treated water to the project's discharge point, and seepage canals manage offsite impacts by capturing and conveying seepage water to a collection point.

The first five canal types are earthen, with permanent erosion control measures (i.e., riprap) installed where erosive velocities are present. Each earthen canal will be analyzed to determine minimum water depths based upon the required hydraulic conveyance capacity and the littoral zone requirements to limit the growth of nuisance vegetation below the water surface elevation. The bottom width of each canal will be determined by balancing the hydraulic needs for the project, construction earthwork quantities, and the limitations of maintenance equipment. Earthen side slopes for the canals are 3H:1V (horizontal to vertical) as recommended by the Geotechnical Engineer (see Appendix 3). Accommodation for maintenance of the earthen canals is provided by the construction of a 20-ft-wide maintenance bench along each canal. Unlike the earthen canals, the PES distribution canals are concrete lined and are sized to convey water to each PES cell space. More information regarding the PES distribution canals is available in Appendices 1B and 6.

Embankments are used to separate project features that have a water surface elevation, provide an elevated access path for O&M activities, and separate the project operational space from the seepage canals. Two types of embankments are proposed for the Project, internal and external embankments. Internal embankments are internal to the project area and are used as a physical barrier that separates the distribution/collection canals from inflow/outflow canals and divides the project space into individual STA cells. It is anticipated that the design for the internal embankments will be lower in elevation than the external embankments. External embankments are located along the STA perimeter, where a seepage canal is proposed. Side slopes for all embankments are 3H:1V and a preliminary seepage rate through these embankments have been provided by the Geotechnical Engineer (see Appendix 3). During the Reconnaissance Study, height of all embankments are assumed to be 4 ft above the highest neighboring water surface elevation. During design, the height of each embankment will be identified as a balance between the wave run-up/run-on calculations, freeboard needs, and construction earthwork quantities. It is anticipated that passive onsite flood control measures will be incorporated into the embankment design as noted above. Maintenance benches will be incorporated to accommodate access for maintenance equipment for canal O&M activities. In addition, boat ramps and vehicle turn-around areas will be included at strategic points along the embankment alignments to allow for cell O&M activities.

3.5.5 Headworks System

The headworks system refers to the system that brings raw influent flow from the L-62 and C-38 canals and into the STA system. The major elements within the headworks system are the supply canal and PS.

3.5.5.1 Supply Canal

The Project proposes to utilize the L-62 canal as the raw water supply. When there are no L-62 canal flows, the Project proposes to treat the C-38 canal flows. Operational parameters for the various basins supplying water to the Project are informed by the water availability analysis (see Appendix 4). To capture water from the C-38 canal, improvements to the L-62 canal's conveyance capacity is required. Alternative A does not include modifications to the existing alignment of the L-62 canal. Instead dredging of the canal is needed to increase the conveyance capacity of the L-62 canal to supply water from the C-38 canal to the proposed PS. In addition to the canal capacity improvements, Alternative A also requires structural modifications to the S-154 structure to allow for bi-directional flow. Alternatives B and C reroute the L-62 canal and relocate the confluence between the L-62 and the C-38 canals. These rerouted alignments also include the construction of embankments along the L-62 canal alignment that meets the standards of the HHD. Alternatives B and C do not propose a new WCS at the confluence with the C-38 canal.

To maintain the current operations of the L-62 canal upstream of the project, a new WCS (WCS-9 in all Alternatives) is proposed approximately 1.25 mi upstream of the L-62 and C-38 canals confluence. This new WCS would effectively replace the operational function of the current S-154 structure and manage water surface elevation in the L-62 canal for other users. Design of a new WCS structure on the L-62 canal for any of the alternatives would conform to the parameters of the existing S-154 structure, maintaining current operability. For reference, the current S-154 design parameters are as follows:

- Discharge Rate: 1,000 cubic feet per second (cfs) (Structure Book, SFWMD, 1997)
- Structure Type: Reinforced Concrete Box Culverts

- Number of Barrels: 2
- Size of Barrels: 8 ft high by 10 ft wide
- Type of Gates: Vertical Lift
- Number of Gates: 2

3.5.5.2 PS

A single inflow PS is proposed for the Project. This PS is located immediately downstream and adjacent to the new WCS in the L-62 canal and was assumed to have a high flow capacity of 500 cfs for this Reconnaissance Study. This planning level capacity was based upon a review of the range of inflows available to the Project in non-drought years (see Appendix 4). It was determined by calculating the 80th percentile flow rate of the 1980-2021 annual average inflow, with some rounding. To simulate a variety of operational schemes, in addition to the high flow capacity, the PS was modeled with a low, medium, and high flow for the Reconnaissance Study (Appendices 1, 2, and 4). During the subsequent DDR phase of work, an analysis of pumping capacity, energy requirements of pumping, and treatment performance will be completed to estimate preferred operational flow rates.

The inflow for this PS is directly connected to the L-62 canal and is expected to capture flows from the State Road 70 drainage area and the western seepage canal. Discharge from the PS will be conveyed to STA cells and PES area via an inflow canal at sufficient head to allow the project to operate effectively. This PS is expected to include a variety of pumps at different capacities. In combination, these different pumps will allow for the Project to operate at various flow rates. At a minimum, it is anticipated that the PS would operate at a high flow rate when water is available from the L-62 canal, at a mid-level flow rate, when water is readily available for treatment in the C-38 canal, and at a low flow rate, which is the minimum flow rate needed to keep the STA cells wet.

Further refinement of the inflow PS capacity and operational schemes will be analyzed in DDR.

3.5.5.3 Ownership and Operational Considerations

The Project is proposed to construct or modify existing SFWMD structures that will follow two operational schemes following construction. Regardless of the operational schemes considered, the EIP team is cognizant of the District IT Security and supervisory control and data acquisition (SCADA) Operations requirements. First, the ownership and operational responsibility of the new WCS in the L-62 canal and any embankments along the L-62 canal will be transferred to the District immediately after construction is complete. To effectively operate the Project, EIP will have monitoring access to the operations of the new WCS in L-62 canal. A secure, one-way connection is being considered to allow EIP access to monitor and respond to the District's operational decisions of the infrastructure within the L-62 canal. This connection incorporates a firewall to reduce the risk of a security breach.

Second, the PS, STA WCSs, PES WCSs, STA/PES canals and embankments will be owned and operated by EIP during EIP's operational period and the District will have monitoring access to the operations of the Project. One EIP Remote Terminal Unit (RTU) with site monitoring of all structures will be fully available for District monitoring via internet connection. Provisions will be made to accommodate for installation of a future District standard Motorola ACE RTU at the project turn-over mark. This approach avoids end-of-life obsolescence issues, zero maintenance of District equipment during the 5-7 year prove out period.

Additional information will be further discussed in the DDR.

3.5.6 Project Discharge

During the Reconnaissance Study, there were four options considered regarding discharge of treated water from the project area. The first option was a gravity outlet to the southeast, using an existing drainage easement shared by three properties. This drainage easement directs runoff from the immediate vicinity to a drainage easement that follows along the dry side of the HHD to the south. Based on the historical function of the drainage easement and conversations with neighboring property owners, this option was not pursued during the Reconnaissance Study. The second option reviewed involved the creation of a new WCS through the HHD at the southern end of the project space. This option was eliminated from consideration following the Project Assets Workshop with the District and internal EIP team discussions. The construction and O&M of a large WCS through the HHD, in addition to the new L-62 canal WCS and modifications to the S-154 structure appeared to be cost prohibitive with limited project benefits. As such, this option was also eliminated from consideration during the Reconnaissance Study.

The third discharge option is to utilize the existing S-154 structure as the outflow from the entire project. The S-154 structure, as noted in Section 3.5.5, has sufficient capacity to convey the project's peak flow rates to the C-38 canal. Using the S-154 structure as the outflow WCS is not expected to require structural modifications, since the flow direction will continue as currently designed and operated. The only modifications to this structure include changes to the gate operations. The installation of discharge siphons is needed to transfer treated water under the new L-62 canal alignment to the S-154 structure. Additional information regarding the siphons is provided in Section 3.5.3. This option does necessitate the re-routing of the L-62 canal, which is part of Alternatives B and C. Within Alternative B, the new connection between the L-62 and C-38 canals is downstream of the S-154 structure, which creates the potential for short-circuiting of treated flows re-entering the project space. Alternative C eliminates this potential for short-circuiting by locating the new connection between the L-62 and C-38 canals upstream of the S-154 structure.

The final discharge option is incorporated into Alternative A, which consists of separating the discharge point along the L-62 canal alignment. For the west side of the project, the S-154C structure would be used as the discharge point for STA Cells 1 through 4, while two new WCS would be constructed within the east embankment along the L-62 canal to provide an outflow point for the east side of the project. This discharge option assumes that the S-154 structure is modified to allow for bi-directional flow. The plumbing for this alternative creates a short-circuiting opportunity for all of the discharge flows from the east side, since they will enter the L-62 canal directly and the flow through the S-154C structure is immediately upstream of the S-154 structure.

3.5.7 Impacts to HHD

It is anticipated that some modifications to the HHD will be required regardless of the selected alternative. Potential modifications include the following:

- If the existing alignment of the L-62 canal is utilized, modifications to the existing S-154 structure will be required. The modifications would include removing the weir on the upstream side of the structure. The weir has a sill elevation of approximately 10.0 (NAVD88). To allow water to be pumped north from the C-38 canal and into the STA system for a range of C-38/Lake Okeechobee water levels, the L-62 canal would also be dredged from a bottom elevation of approximately 9.0 (NAVD88) to 4.0 (NAVD88) from the S-154 structure upstream approximately 1.25 mi to the location of the proposed PS and new WCS on the L-62 canal that would replace the functionality of the existing S-154 structure. As a result, the HHD would effectively be extended 1.25 mi upstream to the proposed WCS.
- Under this configuration, flow is pumped from the L-62 canal and into the STA. Discharge from the STA is conveyed to the C-38 canal via S-154C, which would serve as the primary outlet of the

STA system. This would significantly increase the typical flow regime for S-154C and may require lowering the weir elevation to allow discharge at lower elevations.

- Through a collaborative process with the SFWMD, it was determined that any modifications to the S-154 structure may require full replacement of the structure. As a result, realigning the L-62 canal has been considered if the S-154 structure would have to be replaced. The realignment would be based on a more advantageous layout in relation to the STA system and the configuration of discharge into the C-38 canal from both the STA system and the L-62 canal itself. Specifically, this includes realigning the L-62 canal and constructing a new opening through the HHD for the realigned L-62 canal discharge. One realignment alternative shifts the discharge location approximately one quarter mi east and the other approximately three-quarter mi west. As a result, although the S-154 structure would be part of the HHD, a new structure would replace the S-154 structure approximately 1.25 mi upstream of the discharge. The HHD is anticipated to be extended up the L-62 canal approximately 1.25 mi to the new control structure.

3.5.8 Additional PS

Alternatives A and B include the need for an additional PS. This PS is anticipated to be required to recover head loss associated with the gravity discharge functions of the PES and seepage infrastructure identified in those alternatives. The hydraulic differential between inflows and outflows of the PES is greater than 4 feet. Within Alternative B, it is expected that an additional PS would be needed to allow for post-STA treated water to be lifted into the PES and then outflow will discharge from the project via gravity. The required capacity of this PS was estimated to be between 50-70 cfs. An additional PS is expected to be needed for the southeastern PES and seepage flows within Alternative A. This PS will lift the outflow from the PES and seepage flows to overcome high water levels in Lake Okeechobee. The required capacity of this PS was estimated to be between 70-90 cfs. The design of these discharge PSs was assumed to follow the District's standards (SFWMD, 2020) for a Small PS. The preliminary hydraulic profile of Alternative C indicates that a discharge PS is not needed.

3.5.9 Offsite Impacts

3.5.9.1 Offsite Drainage

All alternatives will be designed to manage stormwater runoff on the perimeter of the STA. The preferential form of management will be to properly divert runoff around the site; however, there may be some instances where offsite drainage will need to be incorporated into the STA system. Figures provided in Sections 3.2-3.4 show general flow direction of offsite drainage surrounding the STA site for each alternative.

Areas of specific focus include two drainage channels that cross under State Road 70 on the north side of the STA; these can be seen in each of the alternative figures. These two channels include continuous, concentrated flows that may require additional appurtenances beyond diversion or rerouting. Given the location of these culverts on the north side of the STA and the relative similarity of outer cell configurations in these areas, it is expected that management designs for these culverts will be similar for all three alternatives.

Expected appurtenances to manage offsite drainage include diversion berms and channels, culvert systems, erosion protection and pumping systems (as required).

3.5.9.2 Adjacent Properties/Landuses

The northern portion of Alternatives A and C in the proposed Cell 5 is adjacent to the southern edge of a neighboring subdivision. The proposed STA cell will have an external embankment and seepage canal running along the cell perimeter. Although this canal's purpose is not to act as site security, it should help mitigate potential unauthorized public access to the site. Additionally, the existing District access security gates in the northwest corner of the subdivision would also remain in place to help restrict unauthorized public access to the existing L-62 canal. The northeast corner of the proposed Cell 5 on Alternative B would also have a seepage canal and external embankment along the cell perimeter which will also assist in mitigating unauthorized public access but would require modifications to the existing security gates in the northwest corner of the subdivision to prevent unauthorized public access to the new proposed rerouted L-62 canal. For all alternatives, site access from neighboring ranch land to the east of the easternmost cells would be limited by the seepage canal running along the project perimeter.

3.5.9.3 State Road 70

All three alternatives will have the primary secured access at State Road 70, located at the northeastern corner of Cell 1 adjacent to the proposed onsite substation. An automated gate, along with guardrails extending beyond the access road footprint to prevent unauthorized public vehicles from driving around the access gate is included with an additional nonautomotive gate incorporated in this same gate, similar to the Lakeside ranch primary secured access gate. There are both an external embankment and seepage canal that run parallel to State Road 70 which will also help deter any unauthorized public access by foot.

3.5.9.4 Seepage Collection System

Seepage management will be provided by typical and standard collection canal systems located generally on the perimeter of the STA for all alternatives. The canal systems will be sized to adequately collect and convey anticipated flows as determined by seepage modeling efforts. Note that for all alternatives, no additional seepage management systems will be implemented along the HHD and will only be located on the perimeter of new STA sections.

During DDR and Preliminary Design, groundwater modeling will be completed to verify that the seepage management system is adequately sized to maintain the existing groundwater elevations of adjacent properties (both public and private).

3.5.10 Power

A power availability analysis was performed as part of this Reconnaissance Study. It considered options such as electrical power from the utility to run the inflow PS electric pumps, versus electrical power locally generated (with Natural gas (NG) engine generation) onsite to drive the pumps, as well as directly driving pumps with NG powered engines. The analysis also considered peak-time cost factors being the inflow PS is anticipated to run almost continuously, as well as equipment costs, life cycle costs, and maintenance costs associated with the options. The analysis recommended that the inflow PS be powered via electricity from the utility, being it is the most cost-effective approach with less maintenance impact.

A new electric service is proposed to operate the proposed project. This electric service will be provided by FPL from a transmission line located along State Road 70. It is anticipated that a new substation will be required to reduce the voltage from 69 kilovolt (kV) to 12kV at the point that the service enters the project area. At this time, the substation is planned to be located at the northeast corner of the STA Cell 1 in each alternative. Overhead electric power lines will be constructed to deliver 12kV to the PS(s), where a transformer will reduce the voltage from 12kV to 480 volts. The existing 480 volts overhead power servicing the gates at the S-154 structure will be connected to the transformer at the new Inflow PS. Overhead electric power lines will be installed throughout the project to service each of the proposed WCSs. It is anticipated that the WCS gate operators within proximity to the PS will be line powered as described. The operator voltage and number of phases will be determined based on the available power at each Culvert site. Consideration will be given to low horse-power solar powered gate operators for those WCS gates that are small, remote, and un-practical for line power.

3.5.11 Encumbrances

Limitations associated with the use of the project property were examined during the creation of the alternatives. A variety of property encumbrances are identified on the Draft Boundary Survey which is provided in Appendix 13. Prior to EIP's purchase, the project space was primarily owned by two entities with a series of easements and parcels.

These encumbrances include property ownership, easement ownership, and the physical and legal limitations associated with each property encumbrance. Each alternative was created using the same limitations or boundaries.

The property covered by the project contains several easements and encumbrances. There is a small inholding owned by SFWMD along the western embankment (see Appendix 13). Due to the unique nature of the project and parcel characteristics, as well as the District's ultimate ownership of the project at the conclusion of EIP's operational period, it was assumed that all easements or property ownership shared or associated with the District or the federal government would be areas available for project improvements. Property encumbered by private interest, such as the drainage easement located in the southeast edge of the project space (see Section 3.5.6), was assumed to be unavailable when identifying the alternatives under consideration.

3.5.12 Access

Access requirements and design elements (i.e., fencing and gates) are similar for all alternatives. Pedestrians would have access to most of the site with potential fencing limited to areas around the PSs. All buildings would be locked. Vehicular public access would be limited by locked gates at all roadways up to external perimeter embankments.

The primary private secured access for all three alternatives would be constructed at the northeast corner of Cell 1, located at the proposed site substation. The secondary private secured access location for all three alternatives is at the end of SW 21st Parkway off Granada Avenue. This secondary location had enough space for potential public access in the future. The primary and secondary gates are used for both temporary access during construction and permanent access after the project is complete.

Design accommodations will be made to provide space for future recreational facilities such as informational kiosks, picnic shelters, signage, etc. The design, construction, and maintenance of the specific infrastructure associated with public access to the project and future recreational facilities will be determined by the District following turn-over of the project.

3.5.13 Security

Physically securing the project's facilities from un-authorized persons, as well as safety monitoring, is accomplished by using electronic security systems. The criterion is discussed here as its components impact the PSs. Some aspects overlap from the Access section above. The security systems at each PS will be evaluated and integrated into the system-wide SCADA and communications system.

There will be an access control/security system for all buildings on the project. The system shall be compatible with the existing SFWMD-wide security system and coordinated with the SFWMD for the latest hardware and software requirements. With vehicular access limited to structures but pedestrian access unimpeded, building materials will be selected to have long term durability, low maintenance requirements, and resistant to vandalism.

There are three major areas of concern regarding site security from unauthorized access by the public: Neighboring residents, access from State Road 70, and the existing HHD.

With regard to site security from neighboring residents, it is assumed that fencing and gates, are needed for features directly adjacent to neighboring residents (i.e., substation). It is assumed due to the remoteness of the site's internal features (inflow/outflow structures, PS, PES) along with the seepage canal running the site perimeter that fencing and gates will be limited around these features.

Access along most of the south side of State Road 70 will be limited by the seepage canal running along the northern perimeter within all alternatives. The primary site access from State Road 70 off the northeast corner of Cell 1 in all alternatives will have a locked gate.

For securing the existing HHD along the west side of the project site, an existing District gate currently used for maintaining structure S-65E will remain in place for site security. District access to the HHD will remain the same for Alternative A but Alternatives B and C will require additional security measures along the proposed extended portions of the HHD.

SECTION 4

ALTERNATIVE EVALUATION METHODOLOGY AND RESULTS

The EIP team developed an evaluation methodology to enable an objective review and assessment of design elements, performance expectations, construction complexity, schedule-related issues and regulatory aspects, among other issues, associated with each of the alternatives. Many of these factors are anticipated to be used during preliminary and final design activities when determining the alternative design elements and configurations. This section of the report identifies those factors and describes the methodology used to evaluate each alternative.

4.1 Evaluation Methodology and Results Overview

The evaluation methodology includes 12 factors organized into three major categories: a) cost; b) implementation schedule; and c) performance. The cost factors include the cost of proposed infrastructure, energy requirements, treatment capacity, and O&M costs. The schedule factors include permitting, construction, water availability, and start-up. The performance factors include inflow/outflow configuration, TP removal, PES/STA integration, and resiliency.

These factors were reviewed to identify key metrics to rate or score each alternative. Each metric's score could range from 1 to 5, with 5 being the highest/best score and 1 being the lowest/worst score. Depending on the specific metric, the score was identified qualitatively, quantitatively, or the alternatives were ranked from best to worst. Appendix 8 contains the complete evaluation matrix of results which provides the scoring guidance used for each metric and the scores for each alternative. The EIP team aggregated the scores and the alternative with the highest total score is the recommended alternative to advance to DDR and Preliminary Design phases.

4.2 Cost

4.2.1 Infrastructure

The proposed infrastructure associated with each alternative impacts operational flexibility as well as capital and O&M costs. Due to this Project's unique delivery method, capital costs for each alternative are not presented in this document. However, the EIP team understands that the number of structures, embankment length, and area to be mowed affects the long-term maintenance efforts that will ultimately be the District's responsibility. This issue was discussed during the Kick-Off, IATD, and Project Assets Workshops. Therefore, this quantitative criterion was included to evaluate the number of structures, length of embankment, and area to be mowed that is proposed for each alternative (see Table 4-1).

During review of this criterion, the EIP team also reviewed the relative complexity of the proposed structures, including capacity/size and effort to construct. Since it was determined that the complexity of each alternative's structures were similar, a portion of this metric was analyzed by quantifying the number of water control structures (WCSs) and siphons, their complexity, and their effort to construct. Additionally, the length of embankment and area that will require mowing were calculated for each alternative. The alternative with the least infrastructure would receive a score of 5 and the alternative with the most infrastructure would receive a score of 1.

Table 4-1. Infrastructure			
Metrics	**Alt. A**	**Alt. B**	**Alt. C**
Number of Cell WCS	13	10	13
Number of PSs	2	2	1
Number of Inverted Siphons	1	2	2
Number of Structures in L-62 Canal	2	1	1
Number of PES WCS	4	2	3
Total Number of Structures	22	17	20
Length of Embankment			
Seepage Collection (linear ft)	44,000	32,500	43,000
External (linear ft)	43,400	32,500	42,700
Internal (linear ft)	89,900	62,300	78,500
Inflow/Outflow Canal (linear ft)	50,600	43,400	47,000
Spreader/Distribution Canal (linear ft)	19,700	24,000	28,500
Collection Canal (linear ft)	18,900	25,600	27,500
L-62 Canal Reroute (linear ft)	0	10,550	6,300
Total Length of Embankment (linear ft, (mi))	266,500 (50.5)	230,850 (43.7)	273,500 (51.8)
Embankment Area			
Embankment Sloped Area (ac)	129.5	92.2	118.0
Embankment Flat Area (ac)	145.3	102.6	130.6
Total Embankment Area (ac)	274.8	194.8	248.6
Excavation (cy)	1,645,000	1,355,000	1,607,000
Grading (cy)	3,237,000	3,040,000	3,801,000
Sod (sy)	1,330,000	825,000	1,053,000
Infrastructure Rating	1	5	3

4.2.2 Energy Requirements

The energy requirements were analyzed by determining the amount of water (volume) expected to be pumped annually, and the anticipated elevation lift from the pumps to the hydraulically most remote STA treatment cell.

This criterion relates to the amount of energy required to pump water from through the STA system. In addition to the anticipated elevation lift from the pumps to the hydraulically most-remote treatment cell, the head loss associated with the length of the inflow canal and the associated head loss within this canal reach from the hydraulic model for each alternative was reviewed (see Table 4-2).

This metric is scored with the alternative with the lowest elevation of the highest STA cell and shortest pump length receiving a score of 5 and the alternative with the highest elevation of the highest STA cell and longest pump length receiving a score of 1.

Table 4-2. Energy Requirements			
Metrics	**Alt. A**	**Alt. B**	**Alt. C**
Elevation of Highest Cell (ft NAVD88)	29.2	28.5	28.5
Pumped Inflow Canal Length (mi)	~1	~3	~2
Approximate Hydraulic Head Loss (ft)	~3	~3	~3
Energy Requirements Rating	5	1	3

4.2.3 Treatment Capacity

As identified through the water quality modeling completed during the Reconnaissance Study, the factor having the greatest impact on the project's ability to maximize P removal is the STA effective treatment area (see Table 4-3).

This criterion was quantified based upon the footprint of STA effective treatment areas calculated for each alternative.

Table 4-3. Treatment Capacity			
Metrics	**Alt. A**	**Alt. B**	**Alt. C**
Effective Treatment Area (ac)	2,710	2,080	2,640
Treatment Capacity Rating	5	3	5

4.2.4 O&M

This criterion relates to the anticipated O&M costs associated with the STA system. For this Reconnaissance Study-level estimate, a range of O&M costs were calculated, as many Project elements have not yet been designed (see Table 4-4). A *low* annual O&M cost estimate was calculated using a per ac cost (escalated to 2022 dollars) derived from 2019 information provided by SFWMD for 57,000-ac of STA operated by SFWMD. A *high* annual O&M cost estimate was calculated using EIP-prepared costs developed specifically for each alternative.

Alternative-specific information such as levee lengths/areas, the number of WCS and associated operable gates, STA cell areas, and anticipated operations were incorporated to estimate alternative-specific costs associated with structure maintenance, vegetation management, site management, telemetry, electricity, and compliance monitoring of water levels, flows, and water quality. Estimated annual and 50-year O&M costs are provided in Appendix 9. All alternatives evaluated are expected to result in annual O&M costs that are in line with other similar projects, therefore all received a rating of 3.

Table 4-4. Operation and Maintenance			
Metrics	**Alt. A**	**Alt. B**	**Alt. C**
Estimated Annual O&M Cost per ac ($)	$416 - $691	$416 - $805	$416 – $636
Estimated Annual O&M Cost ($)	$1,127,000 - $1,872,000	$865,000 - $1,674,000	$1,098,000 - $1,680,000
Estimated 50-year O&M Cost ($)	$31,964,000 - $53,094,000	$24,533,000 - $47,479,000	$31,142,000 - $47,649,000
O&M Rating	3	3	3

The size of the PES facility has not yet been finalized, therefore estimated annual and 50-year O&M costs were prepared for a 6-acre PES module and are provided in Appendix 9.

4.3 Implementation Schedule

4.3.1 Permitting

This criterion relates to the required permitting, its complexity, number of agencies involved, and required timeline. The three Alternatives being evaluated for the LKBSTA are similar with regards to the complexity and length of time to obtain permit approvals (see Table 4-5). All Alternatives will have to acquire a NEEPA/Lake Okeechobee Protection Permit (LOPP) from the FDEP. Various subcomponents of the NEEPA/LOPP will address wetlands, species, archaeological/historical resources, and use of Sovereign Submerged Lands (SSL). Additionally, a 408 Authorization from the USACE, submitted by the SFWMD, for activities occurring in areas with federal jurisdiction such as the L-62 canal will be necessary for all Alternatives.

The 408 Authorization has the longest lead time and has the most complicated approval process of all permits required for this project. Based upon the complexity of this process and length of time anticipated for approval, the main difference identified between Alternatives A, B, and C are the relocation and extent of relocation of the L-62 canal. Alternative A does not propose to relocate the L-62 canal, and therefore all potential impacts to wetlands and/or surface waters are contained within *assumed* waters of the U.S., which have been delegated permitting authority to FDEP through the State 404 program. However, in proposing to relocate the L-62 canal for both Alternatives B and C, there is the potential that this canal may affect the *retained* waters of the U.S. located along the C-38 canal. If it is determined that the relocation of the L-62 canal will affect these retained waters in the C-38 canal, then the 404 permitting authority is retained by the USACE, and subsequently the 404 permit would have to be obtained from USACE instead of FDEP through the State 404 program. The main difference between Alternatives B and C is the extent of the L-62 canal reroute. The proposed reroute of the L-62 canal on Alternative B is significantly longer than the proposed L-62 canal reroute for Alternative C.

Because the State 404 program has adopted timeframes consistent with the FDEP permitting process, the State 404 permit approval time is typically shorter than the USACE 404 permit approval time. If the USACE is responsible for the 404 permit, then certain subcomponents, such as Section 7 Endangered Species Act consultation with U.S. Fish and Wildlife Service (USFWS) and coordination with State Historic Preservation Office (SHPO) for Section 106 Historical Preservation, would be coordinated through USACE instead of through FDEP. The Section 408 Authorization would also be coordinated with USACE instead of FDEP. Because USACE does not have mandated permit review timeframes, it is likely that the USACE 404 permit would take longer to acquire than the FDEP State 404 permit. In addition, relocation of the L-62 canal would likely be considered more complex and require more intensive review through the 408 Authorization process, increasing the time to acquire the 408 Authorization.

Table 4-5. Permitting

Metrics	Alt. A	Alt. B	Alt. C
Complexity and Length of Time	Moderate	Complex	Moderate/Complex
Permitting Rating	3	1	2

4.3.2 Construction

This criterion relates to the complexity of construction and associated impacts, with the least complex and most flexible conceptual construction being scored highest (see Table 4-6). Alternative C has the least complex construction as the shortest new L-62 canal reroute along with allowing for building in the dry for PS and siphons. Alternative C also has the simplest cell construction access with the simplest earth moving concept and shortest hauls. Alternative A is moderately complex as it includes dredging of and siphon construction under the existing L-62 canal, construction of WCS-9 within the existing L-62 canal, along with having two separate PES. Alternative B is considered to require the most complex construction activities of the three, as it includes the longest new L-62 canal reroute with a new connection to C-38. Unlike Alternative A, Alternatives B and C allow for building a PS and siphons in the dry.

Table 4-6. Construction

Metrics	Alt. A	Alt. B	Alt. C
Complexity and Level of Effort	Moderately Complex	Highly Complex	Minimally Complex
Construction Complexity Rating	3	1	5

4.3.3 Water Availability

This criterion relates to the potential complexity and level of effort needed to obtain stakeholder acceptance and associated permit approvals, especially considering the regulatory water supply-related constraints that exist within the LOSA when Lake Okeechobee water levels are below specific elevations (see Table 4-7). Based on the results of the water availability analysis (Appendix 4) and upon review and evaluation of the design elements for each of the Alternatives, it was determined that Alternatives A, B and C all had similar issues to be addressed and could therefore be considered to have significant complexity related to water availability.

Table 4-7. Water Availability

Metrics	Alt. A	Alt. B	Alt. C
Complexity and Level of Effort	Significant Complexity	Significant Complexity	Significant Complexity
Water Availability Rating	2	2	2

4.3.4 Start-Up

This criterion relates to the required start-up operations, coordination with stakeholders, and approvals for full scale operations. The alternative with the fastest and most flexible path to initiating start-up has the highest score (see Table 4-8). Alternative B has standard start-up operations and low risk for meeting Water Year 0 due to having the shortest conceptual construction time along with flexible construction sequencing. For use during start-up procedures though, Alternative B does have difficult PES construction and connection. Alternative C has moderate start-up operations and low risk for meeting Water Year 0 due to having flexible construction sequencing along with allowing the outflow to be plumbed differently during start-up. Alternative C will not allow for use of the entire PES area during early start-up. Alternative A has complicated start-up operations and high risk for meeting Water Year 0 due to having the longest conceptual construction time to get growth started in STA cells along with the largest cell area. Alternative A does allow the outflow to be plumbed differently during start-up in addition to PES usage during start-up procedures.

Table 4-8. Start-Up

Metrics	Alt. A	Alt. B	Alt. C
Complexity and Level of Effort	Complicated Start-Up	Standard Start-Up	Moderate Start-Up
Start-Up Rating	1	5	3

4.4 Performance

4.4.1 Inflow/Outflow Configuration

This criterion relates to the ability for each alternative to separate the inflow waters from the outflow waters (see Table 4-9). An ideal inflow/outflow configuration will help minimize short circuiting of the system when inflow is being pulled from the C-38 canal. This is accomplished by having the L-62 canal discharge into the C-38 canal upstream/west of the STA system discharge location into C-38. Alternative C has the ideal inflow/outflow configuration as its rerouted L-62 canal ties into C-38 upstream/west of the system discharge through S-154. Alternative A has the most problematic inflow/outflow configuration as its discharge through S-154C is directly upstream/west of the L-62 canal tie into C-38 at S-154. Alternative A also has the easternmost cells discharging directly into L-62. Similarly, Alternative B has its discharge upstream/west of the rerouted L-62 canal tie into C-38, but there is more distance between the L-62 inflow and S-154 discharge than in Alternative A.

Table 4-9. Inflow/Outflow Configuration

Metrics	Alt. A	Alt. B	Alt. C
Alternative Rank	3rd	2nd	1st
Inflow/Outflow Configuration Rating	1	3	5

4.4.2 P Removal

This criterion relates to the projected P load reduction. Both steady state and dynamic water quality model simulations, using the Dynamic Model for Stormwater Treatment Areas (DMSTA) (Walker and Kadlec, 2008), were performed for each alternative (see Table 4-10). Appendix 2A provides a TM summarizing the steady state DMSTA modeling assumptions, approach, simulation details, and results. Appendix 2B provides a TM summarizing the dynamic DMSTA modeling assumptions, approach, simulation details and results. Since the size of the PES facilities has not yet been determined, a projected range of annual P load removal was provided per ac of PES for each of the alternatives. The size of PES facilities considered for the alternatives ranges from 26-40 ac. Appendix 2C provides a TM summarizing the water quality modeling conducted for the PES.

Table 4-10. P Removal

Metrics	Alt. A	Alt. B	Alt. C
Projected Range of P removal (mt/yr) – STA*	12.2 - 15.2 (Dynamic) 10.5 - 17.1 (Steady State)	9.5 - 11.8 (Dynamic) 8.5 - 13.8 (Steady State)	11.9 - 14.9 (Dynamic) 9.6 - 17.1 (Steady State)
Projected Range of P Removal (mt/ac/yr) – PES*	0.16 – 0.30	0.16 – 0.30	0.16 – 0.30
P Removal Rating	5	3	5

* *P removal values provided are long-term average annual projections. Annual variability in P load reductions is anticipated.*

4.4.3 PES/STA Integration

This criterion relates to the level of integration between the STAs and PES system, with full integration defined as PES being able to treat both raw water from the PS and post-treat 100% of the STA flow (see Table 4-11). All three alternatives allow for cell outflow to be routed to a PES, but only Alternatives B and C are fully integrated and allow for both raw water from the PS and STA treated water to be routed to a PES. Alternative A is only partially integrated as its Western PES can only receive water from Cells 1 through 4 and Eastern PES only receiving water from Cells 5 and 6. Additionally, the Eastern PES cannot receive raw water from the PS.

Table 4-11. PES/STA Integration

Metrics	Alt. A	Alt. B	Alt. C
Level of PES Integration	Partial	Fully	Fully
PES/STA Integration Rating	3	5	5

4.4.4 Resiliency

This criterion relates to the STA system's ability to withstand periodic dry-out conditions (see Table 4-12). Both the water availability analysis results (Appendix 4) and the dynamic DMSTA water quality model simulation results (Appendix 2B) provide information to enable an evaluation of the frequency, magnitude and duration of low water depths for each of the alternatives. Both analyses utilized a 42-year period of analysis (1980-2021). Reducing the frequency and duration of dryout conditions in an STA is expected to minimize the potential for sediment P re-suspension and resultant water column P spikes upon rehydration that have been observed in other STAs. All alternatives had low frequencies and durations of low water depths and were rated accordingly.

Table 4-12. Resiliency

Metrics	Alt. A	Alt. B	Alt. C
Average Number of Days per Year with Water Depths < 0.5 ft (~15.2 cm) (Water Availability Analysis)	25.3-51.7	Not Analyzed	25.3-51.7
Average Number of Days per Year with Water Depths < 0.0 ft (i.e., Ground Surface) (Water Availability Analysis)	12.7-26.9	Not Analyzed	12.7-26.9
Frequency of STA Water Depths < 10 cm (DMSTA)	2.1-2.7%	2.0-2.6%	2.1-2.7%
Frequency of STA Water Depths < 20 cm (DMSTA)	4.8-7.2%	4.8-7.1%	4.8-7.1%
Mean STA Water Depth (DMSTA)	41-44 cm	41-44 cm	41-44 cm
Maximum STA Water Depth (DMSTA)	51 cm	49-50 cm	51-52 cm
Resiliency Rating	5	5	5

4.5 Potential Barriers to Efficient Project Implementation

Each alternative was reviewed to identify potential barriers to efficient project implementation or fatal flaws that could either stop the project or negatively impact the viability of constructing the Project. As with most large-scale water quality improvement or ecosystem restoration projects in Florida, a number of permit approvals and authorizations are expected to be needed in order to implement this Project. While there is the potential for excessive or unanticipated costs to obtain regulatory approvals, no fatal flaws have been identified for any of the alternatives at this time.

4.5.1 Excessive and/or Unanticipated Costs to Obtain Regulatory Approval

Construction of Project infrastructure will require regulatory review and approval of the detailed design and proposed conceptual operations. The Project area includes both public and private lands with a variety of encumbrances, so modifications to the existing public infrastructure will be necessary to create a project that is able to capture and treat surface water. In addition, as with most large environmental restoration projects in Florida, there are a variety of threatened and endangered species issues that will require planning and coordination. Within Appendix 17, the expected permitting requirements and considerations for the Project are identified. These permits are the avenue for local, state and federal regulatory agencies to provide input and approve the Project.

4.6 Summary and Next Steps

The SFWMD engaged EIP in a performance-based contract to deliver the Project to maximize removal of TP loads from priority areas of the Lake Okeechobee watershed. Phase One A of the Project includes Task 1: Reconnaissance Study and Task 2: DDR.

The objective of this Reconnaissance Study was to analyze and document the Project's viability and feasibility to enable advancing the design process as efficiently as possible. This Reconnaissance Study Report documents EIP engagement with SFWMD and the process to efficiently develop and refine an appropriate alternative to advance through additional design activities.

Beginning in February 2022, the EIP team held numerous technical workshops and meetings with SFWMD staff to engage with experts and obtain technical input related to STA design and operational issues discovered during the District's 20 plus years of experience designing, constructing, and operating STAs.

As a result, the EIP team conceptualized, refined, and evaluated three STA alternatives that are documented in this Reconnaissance Study Report. The STA treatment cells in all three alternatives are assumed to be graded to obtain flat cell bottom elevations. Alternative A is a 2,710 ac STA that consists of six treatment cells and maintains the existing L-62 canal alignment. Alternative B is a 2,080 ac STA that consists of five treatment cells and includes relocating a portion of the L-62 canal to the east side of the Project site. Alternative C is a 2,640 ac STA that consists of six treatment cells and includes relocating a portion of the L-62 canal to the west.

The EIP team developed an evaluation methodology to enable an objective review and assessment of design elements, performance expectations, construction complexity, schedule-related issues, and regulatory aspects, among other issues, associated with each of the alternatives. The evaluation methodology was developed to evaluate the alternatives and was organized into three major categories: a) cost; b) implementation schedule; and c) performance. Table 4-13 provides a summary of the evaluation metrics and ratings for each of the alternatives.

As a result of the alternative evaluation process documented in this Reconnaissance Study Report, the EIP team identified an alternative that achieves the Project goals of reducing TP loads from the TCNS, Indian Prairie and Lower Kissimmee subwatershed as well as Lake Okeechobee, thereby assisting to achieve the Lake Okeechobee TMDL goals and the goals and objectives of the Lake Okeechobee BMAP.

Selected Alternative C is a 2,640-ac STA with six cells (configured to operate in parallel) along with a PES, an innovative water quality treatment technology consisting of a vertical engineered media filtration system, that can treat STA discharges during P flux events or treat inflows in parallel with the STA cells. Alternative C includes relocating a portion of the L-62 canal to the west of its existing alignment to facilitate improved STA cell configurations and construction methods. Alternative C includes an inflow PS to direct water to the Project from the re-located L-62 canal and utilizes the existing S-154 structure to convey Project discharges to the C-38 Canal. Alternative C was identified by the EIP team to be advanced to the DDR and Preliminary Design phases based on the following (in comparison to the other alternatives):

- High effective treatment area acreage and high TP load reduction potential

- Balance between number of structures and operational flexibility
- Minimal construction complexity
- Design expected to enable efficient transition from construction to start-up operations
- Moderate to complex permitting/authorizations expected
- One PS
- One PES facility
- Ability to fully integrate STA operations with the PES facility
- Ability of STA to withstand intermittent dryout conditions

In August 2022, a workshop was held to review and discuss SFWMD comments on the Reconnaissance Study Draft Report and review and discuss EIP's draft responses to SFWMD comments (see Appendix 18 for draft minutes). The primary topics of the workshop discussion were related to water availability and additional water storage. In September 2022, a Reconnaissance Study Technical Review Briefing (TRB) was held to enable additional discussion on these topics and achieve consensus on a path forward (see Appendix 18 for TRB draft minutes). Following the TRB, SFWMD directed EIP as follows: 1) no further water availability analyses are necessary, 2) move to the DDR phase to start optimizing the STA design assuming inflows from the C-38 canal are available to maintain STA vegetation health during dry periods, and 3) evaluate flexibility in the design to hold water slightly deeper in the event it is available (see Appendix 18 for post-TRB direction from SFWMD). Alternative C, which was identified by the EIP team in this Reconnaissance Study, will be advanced to the DDR and Preliminary Design phases. In summary, EIP has accomplished the objective of this Reconnaissance Study and plans to submit the Draft DDR to the District in November 2022.

Table 4-13. Evaluation Metrics and Ratings			
Metrics	**Alt. A**	**Alt. B**	**Alt. C**
Infrastructure			
Number of Cell WCS	13	10	13
Number of PSs	2	2	1
Number of Inverted Siphons	1	2	2
Number of Structures in L-62 Canal	2	1	1
Number of PES WCS	4	2	3
Total Number of Structures	22	17	20
Total Length of Embankment (mi)	50.5	43.7	51.8
Total Embankment Area (ac)	274.8	194.8	248.6
Excavation (cy)	1,645,000	1,355,000	1,607,000
Grading (cy)	3,237,000	3,040,000	3,801,000
Sod (sy)	1,330,000	825,000	1,053,000
Infrastructure Rating	1	5	3
Energy Requirements			
Elevation of Highest Cell (ft NAVD88)	29.2	28.5	28.5
Pumped Inflow Length (mi)	~1	~3	~2
Approximate Hydraulic Head Loss (ft)	~3	~3	~3
Energy Requirements Rating	5	1	3
Treatment Capacity			
Effective Treatment Area (ac)	2,710	2,080	2,640
Treatment Capacity Rating	5	3	5
O&M			
Estimated Annual O&M Cost per ac ($)	$416 - $691	$416 - $805	$416 – $636
Estimated Annual O&M Cost ($)	$1,127,000 - $1,872,000	$865,000 - $1,674,000	$1,098,000 - $1,680,000
Estimated 50-year O&M Cost ($)	$31,964,000. - $53,094,000	$24,533,000 - $47,479,000	$31,142,000 - $47,649,000
O&M Rating	3	3	3
Permitting			
Complexity and Length of Time	Moderate	Complex	Moderate/Complex
Permitting Rating	3	1	2
Construction			
Complexity and Level of Effort	Moderately Complex	Highly Complex	Minimally Complex
Construction Rating	3	1	5
Water Availability			
Complexity and Level of Effort	Significant Complexity	Significant Complexity	Significant Complexity
Water Availability Rating	2	2	2

Table 4-13. Evaluation Metrics and Ratings			
Metrics	**Alt. A**	**Alt. B**	**Alt. C**
Start-Up			
Complexity and Level of Effort	Complicated Start-Up	Standard Start-Up	Moderate Start-Up
Start-Up Rating	1	5	3
Inflow/Outflow Configuration			
Alternative Rank	3rd	2nd	1st
Inflow/Outflow Configuration Rating	1	3	5
P Removal			
Projected Range of P Removal (mt/yr) – STA*	12.2 – 15.2 (Dynamic); 10.5 – 17.1 (Steady State)	9.5 – 11.8 (Dynamic); 8.5 – 13.8 (Steady State)	11.9 – 14.9 (Dynamic); 9.6 – 17.1 (Steady State)
Projected Range of P Removal (mt/ac/yr) – PES*	0.16 – 0.30	0.16 – 0.30	0.16 – 0.30
P Removal Rating	5	3	5
PES/STA Integration			
Level of PES Integration	Partial	Fully	Fully
PES/STA Integration Rating	3	5	5
Resiliency			
Average Number of Days per Year with Water Depths < 0.5 ft (~15.2 cm) (Water Availability Analysis)	25.3 – 51.7	Not Analyzed	25.3 – 51.7
Average Number of Days per Year with Water Depths < 0.0 ft (Water Availability Analysis)	12.7 – 26.9	Not Analyzed	12.7 – 26.9
Frequency of STA Water Depths < 10 cm (DMSTA)	2.1 – 2.7%	2.0 – 2.6%	2.1 – 2.7%
Frequency of STA Water Depths < 20 cm (DMSTA)	4.8 – 7.2%	4.8 – 7.1%	4.8 – 7.1%
Mean STA Water Depth (DMSTA)	41 – 44 cm	41 – 44 cm	41 – 44 cm
Maximum STA Water Depth (DMSTA)	51 cm	49 – 50 cm	51 – 52 cm
Resiliency Rating	5	5	5
TOTAL	37	37	46

* *P removal values provided are long-term average annual projections. Annual variability in P load reductions is anticipated.*

SECTION 5

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Prepared For:

South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL, 33406
Contract: No. 4600004527 (PO 9500009421)

Prepared By:

EIP Florida Water Quality, LLC
5550 Newbury Street, Suite B
Baltimore, MD 21209

Contact:
Jeremy McBryan
jeremy@ecosystempartners.com

Ecosystem Investment Partners