PROJECT DEFINITION REPORT

INVESTIGATION OF PERIPHYTON-BASED STORMWATER TREATMENT AREA (PSTA) TECHNOLOGY, PERFORMANCE, DESIGN, AND OPERATIONAL FACTORS

PS ID 100827

JULY 8, 2013

REVISION #1

sfwmd.gov

Table of Contents

Approvals

The signatures in this section of the project definition report should be revised to represent the various areas providing significant resources to the project.

Temperince Morgan

Temperince Morgan, Division Director, Office of Everglades Policy and Coordination

7/30/13

Date

Terri Bates

Terrie Bates, Division Director, Water Resources

7-30-13

Date

Linda Lindstrom

Linda Lindstrom, Bureau Chief, Applied Sciences

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Marcia Kivett, Section Administrator, Budget Section

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Date

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Date

Jennifer Leeds

Jennifer Leeds, Restoration Strategies Program Manager, OPC

7/30/2013

Date

Document prepared by: Kim M. O'Dell, Extension: 2650

Project Location

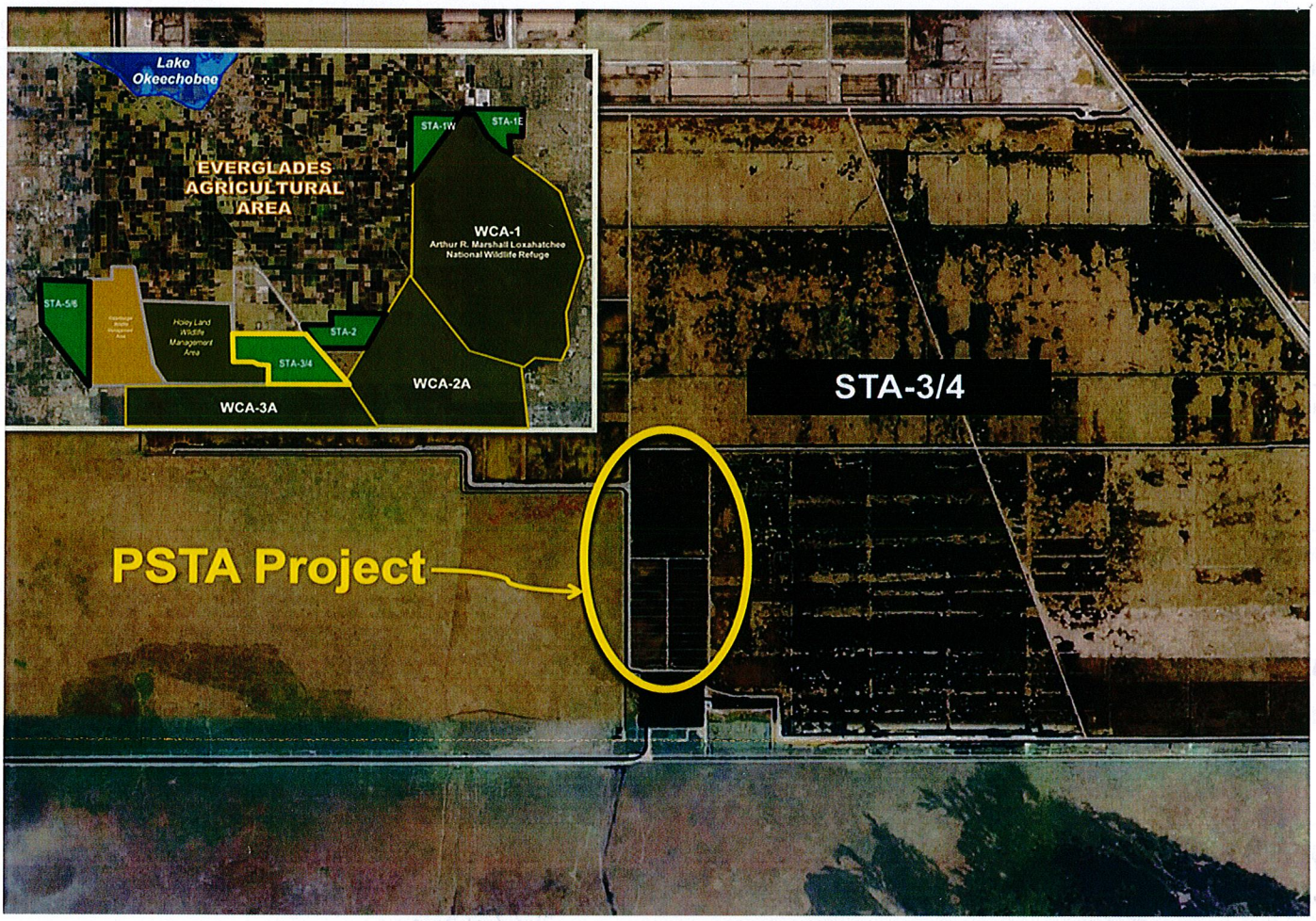

Figure 1. Location Map of STA-3/4 and PSTA Project

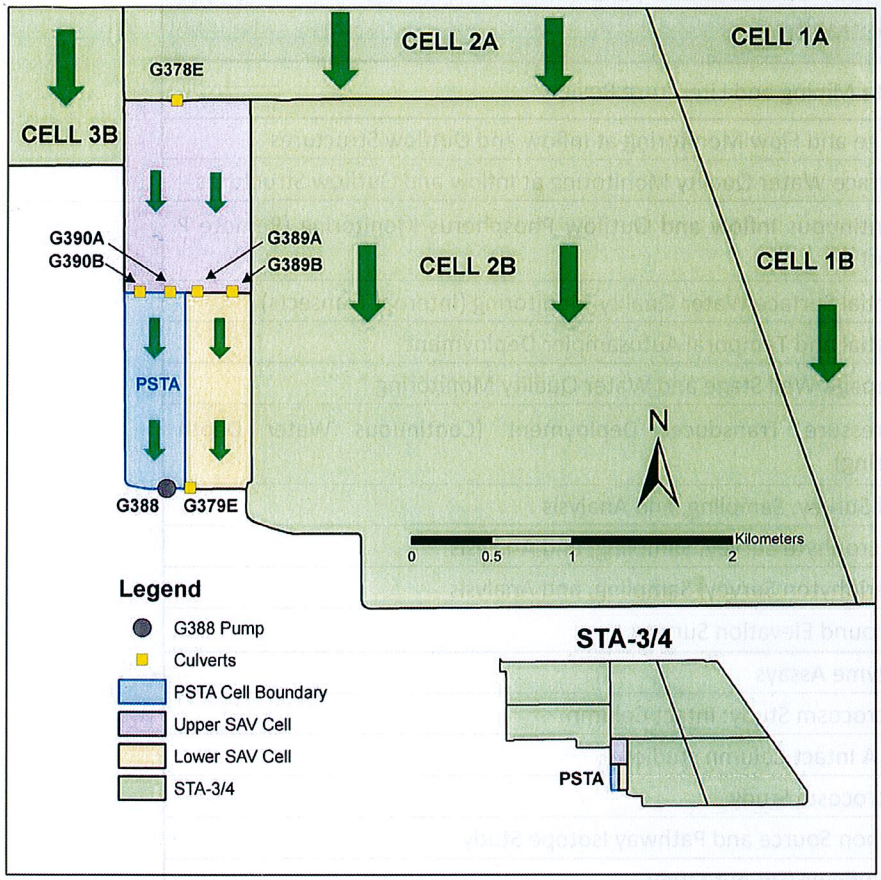

Figure 2. PSTA Project Structures including PSTA Cell, Upper SAV Cell and Lower SAV Cell

Project Description

The STA-3/4 PSTA study's primary objective is to conduct a detailed assessment of PSTA technology performance and to determine design and operational factors that contribute to that performance and opportunities for full scale replication. Aside from addressing the Science Plan key questions listed above, the PSTA study is also intended to achieve the following objectives:

1. Determine the important design elements and biogeochemical characteristics that enable the PSTA cell to achieve ultra-low outflow TP levels
2. Identify the key operational ranges that enable the PSTA cell to achieve ultra-low outflow TP levels
3. Identify management practices that are required to sustain the PSTA cell's performance
4. Consideration of the feasibility of larger scale implementation upon completion of this study. This effort would most likely be initiated as a separate study.

Project Scope

STUDY CATEGORIES	STUDY COMPONENTS
A. HISTORICAL DATA ANALYSIS	A-1. Data Mining and Literature Review
B. MONITORING AND SURVEY	B-1. Stage and Flow Monitoring at Inflow and Outflow Structures
	B-2. Surface Water Quality Monitoring at Inflow and Outflow Structures
	B-3. Continuous Inflow and Outflow Phosphorus Monitoring (Remote P Analyzer)
	B-4. Spatial Surface Water Quality Monitoring (Internal Transects)
	B-5. Spatial and Temporal Autosampler Deployment
	B-6. Seepage Well Stage and Water Quality Monitoring
	B-7. Pressure Transducer Deployment (Continuous Water Depth Monitoring)
	B-8. Soil Survey, Sampling, and Analysis
	B-9. Macrophyte Survey, Sampling, and Analysis
	B-10. Periphyton Survey, Sampling, and Analysis
	B-11. Ground Elevation Surveys
C. BIOCHEMICAL ANALYSIS	C-1. Enzyme Assays
	C-2. Microcosm Study: Intact Column
	C-3. PSTA Intact Column studies
	C-4. Microcosm Study
	C-5. Carbon Source and Pathway Isotope Study
	C-6. Drawdown/Dryout Study
D. CONDITION AND PERFORMANCE EVALUATION	D-1. Water Budget (includes seepage estimation)
	D-3. Phosphorus Budget
	D-4. Hydraulic and phosphorus loading rate (HLR and PLR)
	D-5.Settling rate
	D-6. Spatial and temporal distribution in P Concentrations and Other Relevant Parameters
	D-7. PSTA Modeling for Long-term Performance Predictions - **TBD**

Background

To address water quality concerns associated with existing flows to the Everglades Protection Area (EPA), the South Florida Water Management District (SFWMD or District), Florida Department of Environmental Protection (FDEP), and United States Environmental Protection Agency (USEPA) engaged in technical discussions starting in 2010. The primary objectives were to establish a Water Quality Based Effluent Limit (WQBEL) that would achieve compliance with the State of Florida's numeric phosphorus criterion in the EPA and to identify a suite of additional water quality projects to work in conjunction with the existing Everglades Stormwater Treatment Areas (STAs) to meet the WQBEL.

A science plan will be developed and implemented to investigate critical factors that influence phosphorus treatment performance. The science plan will be developed in coordination with key state and federal agencies and experts and

will be designed to increase the understanding of factors that affect treatment performance; in particular factors that affect performance at low phosphorus concentrations (<20 ppb TP). These investigations could include, but are not limited to: effects of microbial activity, phosphorus flux, inflow volumes and timing, inflow phosphorus loading rate and concentrations on phosphorus outflow, phosphorus removal by specific vegetation speciation, and the stability of accreted phosphorus. Results from these studies will be used to inform design and operations of treatment projects which will ultimately improve capabilities to manage for achievement of the WQBEL. Results from these studies will be summarized and reported as part of the annual report (South Florida Environmental Report).

The STA-3/4 PSTA Project, which was constructed in 2005, is a 400-acre project in the western portion of Cell 2B (**Figures 1 and 2**). The total project area consists of an upstream 200-acre cell (Upper SAV cell) and two adjacent downstream 100-acre cells (lower SAV and PSTA cells). Peat was scraped from the 100- acre PSTA cell to the caprock, removing a potential source of upward P flux. Emergent vegetation strips were planted perpendicular to flow with the goal of improving the PSTA cell's hydraulic efficiency. Over the first four water years (WY2008-WY2011) of operation, the PSTA cell achieved an average annual FWM TP concentration of approximately 10 ppb. However, concerns over the quality of hydraulic data prevented an accurate assessment of PSTA cell's performance. Some of these concerns were: (1) high uncertainty in the flow data, (2) the amount of seepage entering the PSTA cell was not known but was Assumed to be quite large based on higher outflow than inflow volumes, (3) the P content of the seepage water was not known, making it difficult to calculate the P budget for the PSTA cell, and (4) over its period of operation, there was only one year (WY2010) during which the PSTA cell was operated year round. Therefore, in WY2012, various efforts were initiated to improve understanding of the PSTA cell's performance, including structural and operational improvements, as well as improvements to data evaluation and research efforts. In addition to the efforts to improve the hydraulic data quality, scientific investigations are being implemented to provide more accurate assessment of PSTA technology.

Permitting (N/A)

Right of Way (N/A)

Real Estate (N/A)

Public Use (N/A)

Hunting is allowed in STA ¾, cells 1A, 2A, 3A, 3B. No hunting is allowed in the PSTA area.

Stakeholder Considerations

Who are the stakeholders for this project? Are there any stakeholder considerations, legal or regulatory mandates?

Public Outreach

Fact sheets on the PSTA project have been available from the District in the past.

Operations

Normal operational changes are expected during the study for testing purposes. Staff will make specific recommendations of operational modifications for testing purposes and this would normally be conveyed to the operations staff via email.

Operations and Maintenance

Any modification in or issues with STA operation will be communicated to the control room engineer. Pump and structure maintenance and troubleshooting is done by the Clewiston field station. The site installation of new equipment (i.e. Rapid Phosphorus Analyzers), and the site maintenance will be coordinated with the Field Station and STA site coordinator. Vegetation control is done by Vegetation Management Section. Electricity will be installed by the Field Station, and they also absorb the electrical costs generated by the RPAs through their budgets. The costs associated with the equipment and operation of the RPAs is handled by the Analytical Services section.

SCADA, Instrumentation, Telemetry

The RPA instrument comes with a software package (Analyzer 32) that is used for programming the instrument, checking status and downloading data. When staff is on site with the instrument they can connect a standard serial cable from the laptop with the software directly to the communication port on the instrument. In order to communicate with the instrument remotely, a cellular modem is connected to the communication port on the instrument. That modem is connected to the ATT cellular network and has been provisioned with a static IP address. Using the same laptop with the software package, a communication port redirector application and an air card installed, a virtual communications port is established through which staff can connect to the instrument as though it were connected directly through the standard serial cable. The laptop we use is dedicated for use with the instruments only and is never connected to the District networks or servers. The costs include the initial purchase and provisioning of the modem (~$400) as well as monthly charges for a data plan from ATT. The District receives a government rate for the data plan which runs about $40/month per modem, and the pays the bill directly each month. The air card on the laptop is supplied through the District and also incurs a monthly charge which is paid for by IT.

Security

No extra security will be needed for the site.

Information Technology (N/A)

Environmental

There will no additional impacts to any existing wetlands or sensitive areas. The avian protection plan governs this area and will affect the project if birds nest. The study will be shut down when birds are found nesting.

Monitoring (N/A)

Commissioning (N/A)

Lessons Learned

The STA ¾ PSTA Project was constructed in 2005, and achieved an average annual Flow-Weighted Mean (FWM) TP concentration of approximately 10 ppm. Due to the large uncertainty in flow data collected prior to WY2012, an accurate assessment of PSTA cell performance has been challenging. In WY2012, various efforts were initiated to improve understanding of the PSTA cell's performance and this Restoration Science effort attempts to provide a more accurate assessment of PSTA technology from the lessons learned in previous years.

Another lesson learned was the fact that the lower SAV (100-acre cell adjacent to the PSTA cell) cannot be used to provide a direct comparison of SAV versus PSTA performance. The lower SAV flow data quality also has large uncertainty. While the historical muck has been removed in the PSTA cell, this was not removed from the lower SAV cell The resulting water depth is also very different between the two cells. Since WY2012, the PSTA team has designated STA-3/4 Cells 3B and 2B as the SAV comparison cells.

Conceptual Alternative Options (N/A)

Cost Estimates

- $1,829,000 for all 5 Fiscal Years FY13-FY17

Recommendations

In order to fully assess PSTA performance and understand better the factors, operating condition, and mechanisms that results in ultra-low P concentration at the PSTA outflow, the scientific investigations should continue in accordance with the PSTA project research plan and as summarized in the project schedule/deliverables table in this PDR. A preliminary comprehensive analysis of data that has been collected to date will be conducted to help ensure that the study questions are being addressed. Additional experimentation with varying operating conditions (water depth and loading) will be conducted.

Results from this study should be used as input to existing ecological models or any new analytic models related to the STAs.

Project Milestones

- Data mining (including a review of data collected to date)
- Data collection (water quality, flow, transects, vegetation, soil, periphyton) – June 2015
- Core and mesocosm studies – June 2015
- Biomarkers and/or stable isotopes – June 2015
- PSTA dryout/re-flooding study– July 2016
- Final report – June 2017

Resource Requirements

List Functions	Skill of Functional Employees	Identify Employees	Total FTEs Required for Complete Project
Scientific Project Lead	PSTA project experience; field monitoring	Felipe Zamorano	0.5
Technical Project Manager	PSTA project experience, Wetland biogeochemistry	Delia Ivanoff	0.2
Lead Engineer	Water and nutrient budget analysis; PSTA performance analysis	Hongying Zhao	0.1
Modeler	Ecological modeling	TBD	0.1
Lead Scientist	Data analysis	TBD	0.5
Scientist 4	Microbial support	TBD	0.25
Business lead	Project Systems Support	Kim O'Dell	0.1
Hydrogeologist	Seepage analysis	TBD	0.1
Principal Engineer - Operations	Coordination of PSTA structure operations	TBD	0.1
Total Resource Requirements			**1.75**

Contractual support

Scientific and engineering support

Contractual laboratory

Many analyses are conducted in DB Environmental as part of the current EAA-EPD contract. Additional contracting will be needed for specialized testing (biomarkers/stable isotopes).

Equipment

Remote P analyzer (RPAs), 2 existing and 2 replacement; YSI field meter + logger (1 existing; 2 new units), pressure transducers (4 existing units), airboat (existing), truck (existing)

Facilities

Primarily at PSTA project facility; also some surveys and sampling at STA-3/4 Cells 2B, 3B. Laboratory analyses are being done at the District lab and DB Environmental lab. Microcosm studies are conducted at DB Environmental facilities.

Project Deliverable and Schedule

Fiscal Year	Deliverable	Schedule
13	Review current study plan/design and findings to date (data mining); revise plan/design if necessary	June-Sept. 2013
13-15	Continuation of data collection (water quality, flow, transects, vegetation, soil, periphyton)	July 2013-June 2015
13-15	Continuation of core and mesocosm studies	July 2013-June 2015
14-15	Biomarkers and/or stable isotope study	July 2014-June 2015
15-16	PSTA dryout/re-flooding study	June 2015-July 2016
17	Final report	June- 2017

Project Funding Sources

Funding source for this project will be from the Restoration Strategies Science Plan budget within the B199 functional area and multiple fund types.

References

What references are available and found during research of this project?

Photographs

Project Schematic Diagram

Appendix A

Cost Estimate

Fiscal Year Cost Breakdown

Costs	FY13	FY14	FY15	FY16	FY17	Total
Consulting Scientist	$ -	$ 336,154	$ 336,154	$ 336,154	$ 168,077	$ 1,176,539
Eng. Analysis contract		$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 80,000
Supplies		$ 5,000	$ 5,000	$ 5,000		$ 15,000
Equipment	$ 120,000					$ 120,000
Survey	$ 15,384					$ 15,384
Total	**$ 135,384**	**$ 361,154**	**$ 361,154**	**$ 361,154**	**$ 188,077**	**$ 1,406,923**
G-378HW & G-379TW sensors- costs have been captured and expended through PS #100820- PSTA Enhancements ($76,000).						
Costs w/ 30% contingency	FY13	FY14	FY15	FY16	FY17	Total
Consulting Scientist	$ -	$ 437,000	$ 437,000	$ 437,000	$ 218,500	$ 1,529,501
Eng. Analysis contract	$ -	$ 26,000	$ 26,000	$ 26,000	$ 26,000	$ 104,000
Supplies	$ -	$ 6,500	$ 6,500	$ 6,500	$ -	$ 19,500
Equipment	$ 156,000	$ -	$ -	$ -	$ -	$ 156,000
Survey	$ 20,000	$ -	$ -	$ -	$ -	$ 20,000
Total	**$ 176,000**	**$ 469,500**	**$ 469,500**	**$ 469,500**	**$ 244,500**	**$ 1,829,000**

* Highlighted task is being executed through PS#100820 – PSTA Enhancements