SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Restoration Strategies: Stormwater Treatment Area Science Plan Update

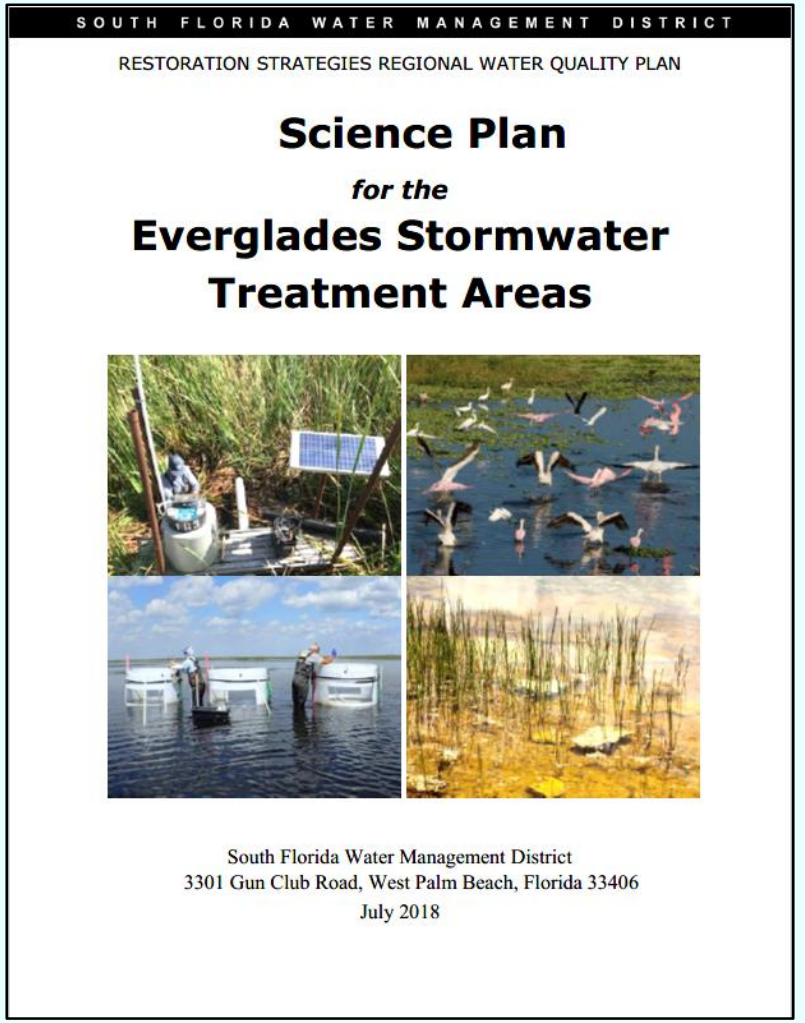
R. Thomas James, Ph.D
Principal Scientist
Water Resources Division

16th Annual Public Meeting on the Long-Term Plan for Achieving Water Quality Goals for Everglades Protection Area Tributary Basins
February 25, 2019

sfwmd.gov

Purpose of the Science Plan

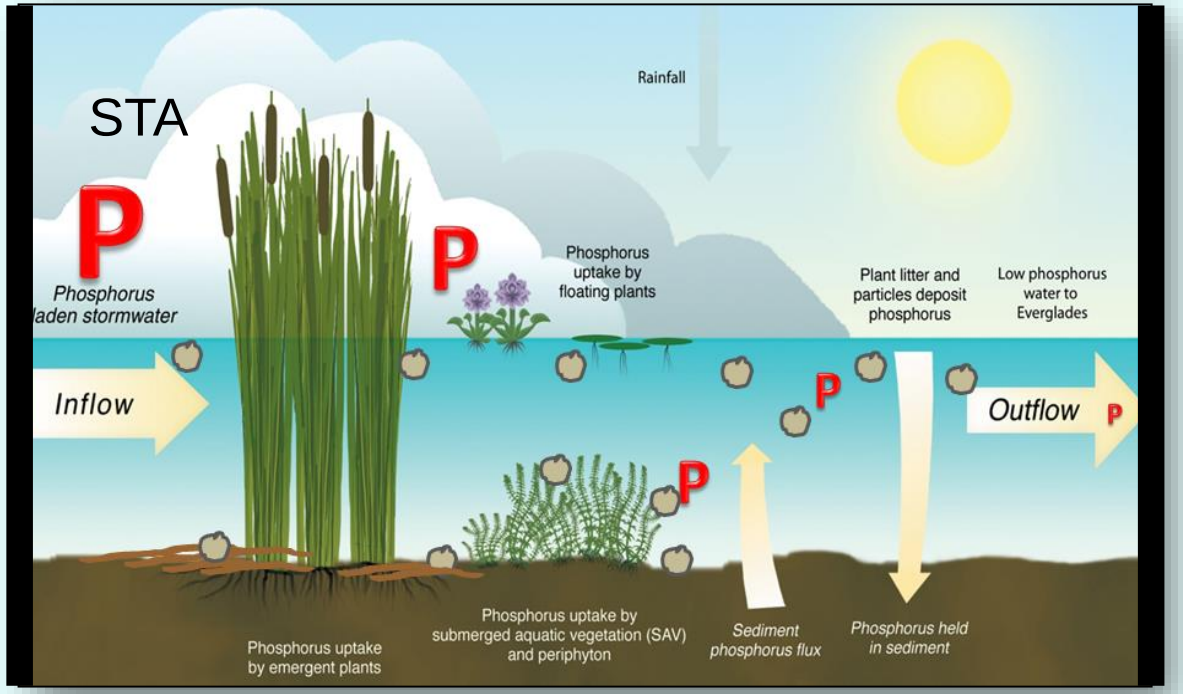
- Specified in Restoration Strategies and required by STA permits and consent orders
- Study key factors and processes that affect phosphorus removal in the STAs
- Use results to aid design, operation, & management of STAs to achieve Water Quality-Based Effluent Limits (WQBEL)
- Originally developed in 2013, updated in 2018



Areas of Investigation

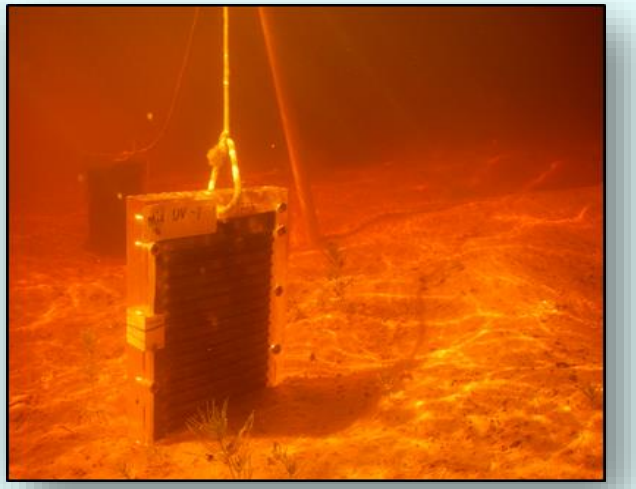
6 Key questions and 18 subquestions on these topics

FEB



1. Design and operation of FEBs
2. Design and operation of STAs
3. Vegetation improvement
4. Internal loading of phosphorus
5. Biogeochemical or physical mechanisms
6. Role of fauna

First 5 Years of Implementation 2013-2018

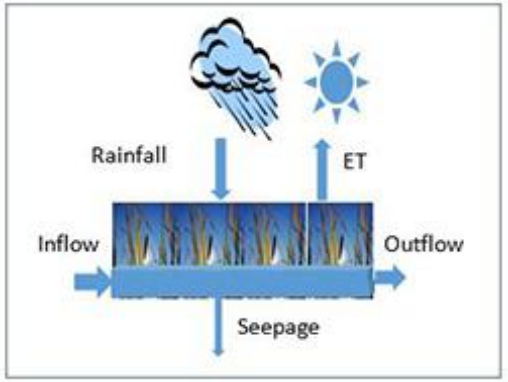


What We Have Learned

Study	Description
Rooted floating aquatic vegetation	**Completed**. In outflow regions of the STAs, rooted floating aquatic vegetation does not enhance P reduction compared to submerged aquatic vegetation.
STA-3/4 PSTA	**Completed**. Soils were scraped to bedrock in this PSTA cell. Annual flow weighted mean discharge of TP was 13 ppb or less for over 10 years. Cells of this type could be constructed for specific STA conditions. Limerock capping of muck soils were tested in mesocosms as part of this study and were found to reduce overlying water column P.
Developing modeling and other tools to enhance STA operation	**Completed**. Models and tools have been developed to support operations of FEBs and STA structures to enhance P reduction.
Influence of canals on inflow and outflow TP concentrations	**Completed**. Some canals appear to be sinks while others exported TP (primarily as particulate P) most likely related to high flow events. Reducing peak flows through use of FEBs should reduce TP export in canals.
Evaluation of sampling methodologies for TP	**Completed**. Time-based autosampler and grab sample methods are more reliable and contain less bias than flow-based autosampler methods. Bias occurs in flow-based autosamplers in low velocity systems. Autosamplers also are vulnerable to plant and animal contamination.

What We Have Learned

Study	Description
STA Water and P Budget Improvements	**Ongoing**. Improve flow data and calculations for water and phosphorus budgets for more accurate performance evaluations.
Soil Amendments/ Management	**Ongoing**. Soil amendments can potentially reduce P in STA surface water discharges; however, these were not pursued due to uncertainties in costs, scaling up and producing marsh ready water downstream. A process of soil inversion to replace high P concentration surface soils with lower P concentration subsurface soil in STAs may lead to reduced P loads to water column. The feasibility of soil inversion as a management tool is being evaluated in STA-1W Expansion area #1.
Cattail sustainability	**Ongoing**. Field observations indicate that prolonged high water depths (76 cm for more than 50 consecutive days) in STAs affect cattail health. Field experiments beginning this year will evaluate various depths and durations on cattail sustainability.
P Storage and Release within the flow-ways	**Ongoing**. Field observations under various flow events have found decreasing P concentrations (primarily of SRP and PP) along the flow path of STAs in water column. P concentrations also declined in vegetation, and floc. Lower outflow TP concentrations occurred under low to moderate flows, compared to no flow periods.



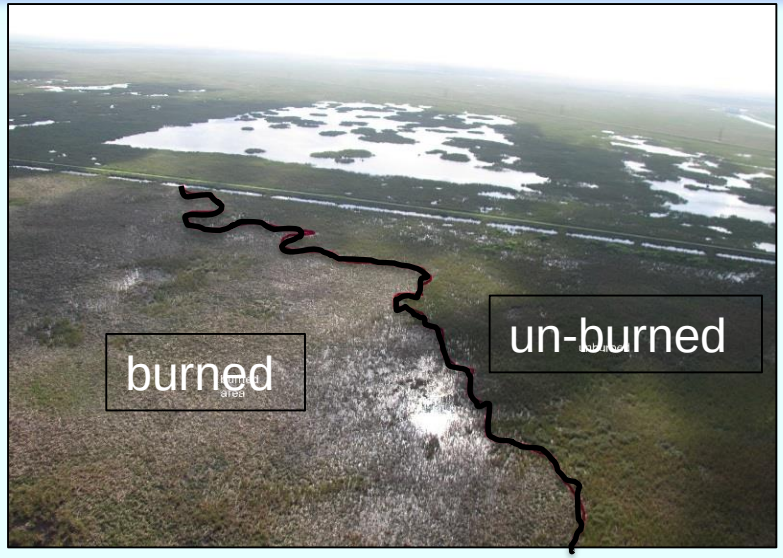
New Studies Initiated in 2018 and 2019

Study	Description
Abundant Faunal Species	Evaluate fish biomass, bioturbation, and excretion effects on phosphorus cycles in the STAs
Submerged Aquatic Vegetation Resilience	Evaluate factors that may affect sustainability of SAV (e.g. nutrient loads, marl sediments)
Floating Tussock Formation	Evaluate potential causes for tussock formation and develop management strategies to reduce their occurrence in STAs
Periphyton	Evaluate the phosphorus processes through the microbial communities in both Emergent and Submergent Aquatic Vegetation cells in the STAs
L-8 FEB Operational Guidance	Evaluate the relationship of L-8 FEB water quality with stage, flows, and potential groundwater interactions

Current Projects and Status

Study	Activity	Date
Soil Amendments	Field testing in STA-1W Expansion #1 expansion 1	9/2019
P Storage and Release within the flow-ways	Complete field experiments and reporting	7/2019
Cattail sustainability	Test cell study initiation	6/2019
STA water and P budget improvements	Improve inflow and outflow estimates	through 2020
Submerged Aquatic Vegetation Resilience	Study Plan and Mesocosm experiments	9/2019
Abundant Faunal Species	Experiments to quantify fauna bioturbation, excretion and biomass through	6/2019
Floating Tussock Formation	Assessments of floating tussocks coverage, data mining, and reporting	6/2019
Periphyton	Literature Survey	6/2019
L-8 FEB Operational Guidance	Water quality sampling inside L-8 FEB (monthly) and in surrounding groundwater wells (quarterly), and reporting	9/2019

Additional Studies - Next 5 Years



- STA & FEB Operation
  - Downward advective P transport
- Vegetation Sustainability
  - Evaluate benefits of prescribed burns on EAV resilience
- Biogeochemistry
  - Marl consolidation
  - Challenges in STA performance
- Fauna
  - Potential fauna management strategies

Questions?

Tom James

tjames@sfwmd.gov