

Draft Stormwater Treatment Area-1 West Recover Plan

Introduction

The Everglades is an internationally recognized ecosystem that covers approximately two million acres in South Florida and is the largest subtropical wetland in the United States. However, the biotic integrity of the Everglades ecosystem has been endangered by alterations of hydrologic and nutrient regimes due to urban and agricultural development. Reduction of total phosphorus (TP) from the Everglades Agriculture Area (EAA) runoff is a prerequisite to restoring and protecting the remaining Everglades natural resources. The 1994 Everglades Forever Act (EFA, Section 373.4592, Florida Statutes) requires that water released from the EAA into the Everglades Protection Area (EPA) achieve and maintain compliance with water quality standards, including phosphorus. The use of Stormwater Treatment Area (STA) to intercept TP from the agricultural runoff is a key component of the South Florida Water Management District's (District) Everglades restoration program. Six STAs with a total effective treatment area of approximately 40,000 acres have been constructed in recent years.

Background

Stormwater Treatment Area-1 West (STA-1W), located 25 km west of the city of West Palm Beach, and borders the northwest corner of Water Conservation Area 1 (WCA-1) in western Palm Beach County, is a large (6,670 acres) treatment wetland operated by the District (Figure 1). There are three flow-ways in the STA-1W: the east flow-way consists Cells 1 and 3 with an effective treatment area of 2,516 acres; the west flow-way consists of Cells 2 and 4 with an effective treatment area of 1,299 acres; the northern flow-way consists Cells 5A and 5B with an effective treatment area of 2,855 acres. The east and west flow-ways were originally constructed as a prototype STA, formerly known as the Everglades Nutrient Removal Project (ENR Project) and operated independently from August 1994 through April 1999. The northern flow-way began flow-through operation in July 2000.

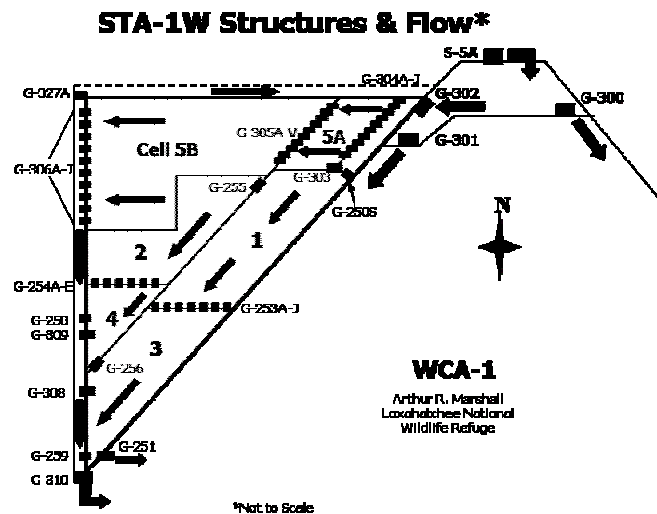


Figure 1. Site map for STA-1W showing flow-ways and flow structures.

Design Envelope vs. Operational Data

Design parameters are summarized in Table 1 and are described in relation to the operational data as follows:

Effective Treatment Area: STA-1W was designed to provide an effective treatment area of 6,670 acres, with the original ENR (Cells 1 through 4) comprising 3,815 acres and the remaining 2,855 acres contained in the northern flow-way (Cell 5A and 5B).

Flow Pattern: STA-1W receives inflow from pump station S-5A via structure G-302. The inflow is distributed to the three treatment flow-ways through respective structures or culverts and the outflow is discharged into WCA-1 via G-251 and G-310. While the inflow volume exhibits significant variability from years-to-year, the long-term average annual inflow volume anticipated during the design of the enhancements is approximately 160,000 acre-feet (221 cfs), and assumed STA-1E was fully operational and receiving a portion of S-5A basin runoff.

During the past year, the 365-day cumulative flow to STA-1W has generally exceeded the maximum design envelope, and the 30-day cumulative inflow volume had experienced a sharp increase beginning in August 2004. The hydrologic loading in September 2004 alone was 109,912 acre-feet, which accounted for more than 65% of the average annual design inflow.

Operation depth: The current target water depth between storm events varies across the treatment cells with a range of 1.25 – 1.75 ft. The long-term average depth is 1.9 ft and the original design operational depth was 2.0 ft.

Total phosphorus loading: Although the annual TP load going into the STA will vary from year-to-year, the average annual TP loading to STA-1W applied during the design of the enhancements was approximately 27,372 kg, and assumes a mean inflow concentration of approximately 139 ppb (Table 1).

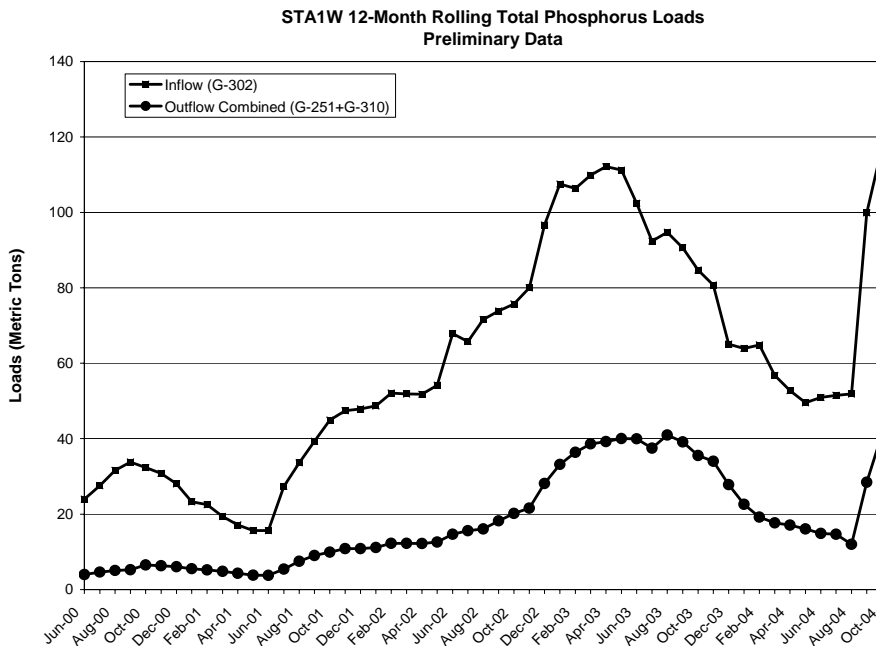
From May 1994 through September 2004, the actual monthly flow-weighted mean inflow TP concentration was 151 ppb at inflow (G-250 and G-302). Preliminary assessment of more recent data indicates that beginning about June 2004, the weekly measured concentrations at G-302 often exceeded 150 ppb, with a peak monthly mean TP inflow concentration during September 2004 of about 296 ppb. This elevated TP concentration, combined with the elevated flows, resulted in 365-day cumulative TP loading rates greater than design. However, the 30-day cumulative loading rates between November 2003 and late August 2004 have generally been at or below the mean design loading rates, but experienced a sharp increase beginning September 2004, primarily as a result of hurricanes Francis and Jeanne.

Table 1. Revised design parameters for STA-1W.

	Peak Flow cfs	Average Flow acre-feet/yr	TP Conc ppb	Average Hydraulic Loading Rate cm/d	Peak Hydraulic Loading Rate cm/d	Average Nutrient Loading Rate g/m ² /yr
Inflow	3,250	159,985	139	2.00	29.46	1.01
Outflow	3,490	188,100	24-30			

Performance

Preliminary results, as reported in the 2004 Everglades Consolidated Reports, indicate that STA TP removal performance is related to TP inflow concentrations and aerial loading rates. More recent data indicates that if loading rates are reduced, the STA TP percent load reduction will increase as the system recovers (Figure 2). Since about November 2003, the monthly TP loading rate into STA-1W has been at or below the mean design envelope and the STA-1W TP reduction performance had been increasing since about December 2003 until September 2004. This most recent decline, beginning in September 2004, may be mainly attributed to the effects of hurricanes Francis and Jeanne. In addition to the increased TP loading, the severe winds and heavy rainfalls during the hurricanes may have reduced plant coverage in some flow-ways, especially in the northern flow way Cell 5B.



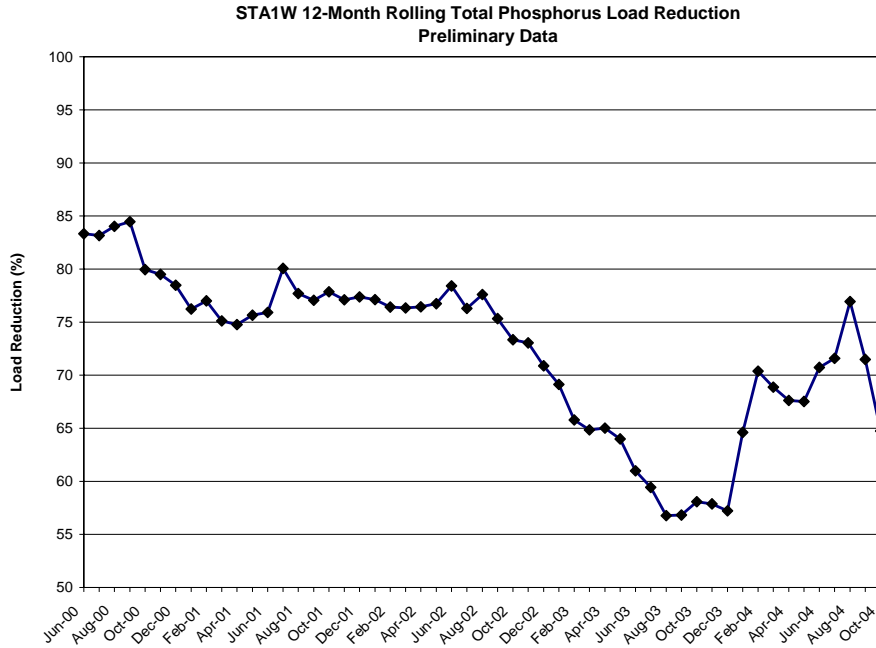


Figure 2. Inflow and outflow TP loads (upper panel) and load reduction (lower panel) in STA-1W.

Objective

The ultimate objective of this recovery plan is to provide a methodology and time scale to restore and enhance the nutrient removal performance of the STA-1W. This objective will be accomplished through hydrologic operation control, construction of enhancements, vegetation management, monitoring and assessment, and continued communication with stakeholders. Monitoring and assessment of the performance data will occur throughout this recovery period in order to provide operational guidelines and promote adaptive management decisions throughout the recovery process.

Proposed Recover Plan

This proposed recover plan is described in the following sections. The timeline for each task is summarized in Appendix 1.

1. Operations

- a. Temporary reduction of inflow volumes at G-302 to a maximum of 150 cfs whenever S-5A is pumping due to a rainfall event. Expected start date: 10/13/04
- b. Lower water levels in all treatment cells to 1.25 – 1.5 ft depth. Expected start date: underway.
- c. To avoid bypass to WCA-1, the District will divert flows to STA-2 as much as practicable. Expected start date: 10/13/04.

- d. Accelerate STA-1E flow-through operations to receive S-5A Basin runoff; this will directly reduce loads from the EAA to the Refuge. Expected start date: as soon as permit start-up conditions are met (January 2005?).
- e. Other basins: L-8 – move as much water to C-51W as possible. Expected start date: underway.

2. Monitoring and assessment

- a. Immediate vegetation survey to assess status of plant coverage within STA-1W. Everglades staff took the lead to complete this survey. This effort will combine with yearly monitoring surveys over time. Start date: October 2004.
- b. Prepare vegetation maps from aerial photos. Expected start date: December-January, 2004-2005.
- c. Vegetation reconnaissance and GIS comparison of vegetation from previous years. Expected start date: underway.
- d. STA- 1W water quality sampling
 - 1. Inflow/outflow to each cell; routine weekly autosamplers and biweekly grab samples (TP and other parameters) will be taken. Expected start date: underway.
 - 2. G-300/G-301 structures: Analysis of weekly water samples. Installation of autosamplers at this site for flow proportional water sampling. Expected start date: underway.
 - 3. Collaborate with data collection/assessment work being done by EAA Environmental Protection District within STA-1W. Expected start date: underway.
- e. WCA-1 water quality sampling
 - 1. Collaborative effort with A. R. M. Loxahatchee National Wildlife Refuge downstream monitoring of G-310/G-251 and G-300/G-301. Expected start date: underway.
 - 2. If bypass to WCA-1 occurs, District will collaborate with Refuge staff on event-based sampling
(Monitoring stations, sampling frequency and parameters for STA-1W and WCA-1 are list in Appendix 2)
- f. DMSTA modeling of STA-1W since WY2002 (collaboration with Bill Walker). Expected start date: underway.

3. Vegetation management

- a. Possible removal of uprooted vegetation deposited on north Cell 5 levee. Expected start date: As soon as feasible considering levee condition.
- b. Consider transplanting from STA-2 into SAV cells. This will be coordinated with STA-1W enhancements schedule. Expected start date: As needed.
- c. Promote discussion regarding if large areas of SAV with little-to-no emergent vegetation (as in Cell 5B) is prone to high storm flows/depths/winds and is the optimal vegetation for large cells or if a mixed marsh or cattail strips should be encouraged.

4. STA-1W enhancement construction

- a. Cell 2/4 – to be taken off-line during the dry season 2004-05.
 - 1. Close G-254 structures to minimize impact to SAV in Cell 4
 - 2. Reshape berm adjacent to center canal to improve flow distribution
 - 3. Evaluate possibility of floc removal during levee construction
 - 4. If needed, possible SAV transplanting from STA-2
 - 5. Construct operable inflow structure (replace G-255)
 - 6. Construct operable outflow structure (G-307)
 - b. Cells 1/3 – during the dry season 2005-06
 - 1. Evaluate possibility of floc removal during levee construction
 - 2. Consider prescribed burning
 - 3. If needed, possible SAV transplanting from STA-2
 - c. Cell 5 to be taken off line. during the FY2005-2006 dry season
 - 1. Automate G-304 gates
 - 2. Convert Cell 5A from open water/SAV to emergent
 - 3. Quantify impact of storms on limerock berm (dry season 2004-05); lower crest by 6-12 inches to reduce flow obstruction
- 5. Continued dialogue with Refuge staff, consultants, and U. S. Army Corps of Engineers**
- a. Initial meeting with refuge staff by November 2004
 - b. Internal monthly meetings beginning November 5 (to follow monthly STA communications meeting) for approximately 6 months
 - c. Initial update at November T.O.C meeting

Appendix 1. Timeline of STA-1W Recover Plan

Operation	Participants	Start date
a. Temporal reduction of inflow to 150 cfs	Operation	10/13/2004
b. Reduce water depth to between 1.25 to 1.5 ft	Operation	10/13/2004
c. Divert flows to STA-2	Construction	Jan-05
d. Accelerate STA-1E flow-through operations	Operation	10/13/2004
e. L-8 – move as much water to C-51W as possible	Operation	underway
Monitoring and assessment		
a. Immediate vegetation survey	STA group	10/27/2004
b. Prepare vegetation maps from aerial photos	STA group	December-January,04-05
c. Vegetation reconnaissance and GIS plots	STA group	underway
d. STA- 1W water quality sampling		
1. Inflow/outflow to the cells: analysis fo water samples	EMA	underway
2. G-300/G-301 structures: installation of autosamplers	EMA	underway
3. Collaborate with data collection/assessment	District/EAA/APD-APD	October, 2004
e. WCA-1 water quality sampling		
1. Collaborate with Refuge on WCA-1 sampling	STA/Refuge	underway
2. Collaborate with Refuge on event-based sampling	STA/Refuge	underway
f. DMSTA modeling of STA-1W	District/B. Walker	underway
Vegetation management		
a. Possible removal of uprooted vegetation from Cell 5	Operation/site managers	As soon as possible
b. Transplanting from STA-2 into SAV cells	Operation/site managers	As needed
c. Promote discussion on large SAV STA	Operation/STA group	On-going
STA-1W enhancement construction		
a. Cell 2 and 4 taken off-line	Operation	04-05 dry season
1. Close G-254 structures	Operation	
2. Reshape berm adjacent to center canal	Construction	
3. Evaluate possibility of floc removal	Construction	
4. Possible SAV transplanting from STA-2	Construction	
5. Construct operable inflow structure (replace G-255)	Construction	
6. Construct operable outflow structure (G-307)	Construction	
b. Cells 1 and 3		dry season 2005-06
1. Possible floc removal during levee construction	Construction	
2. Consider prescribed burning	Construction	
3. Possible SAV transplanting from STA-2	Construction	
c. Cell 5 taken off line		2005-2006 dry season
1. Automate G-304 gates		
2. Convert Cell 5A from open water/SAV to emergent	Construction	underway
3. Quantify impact of storms on limerock berm ; lower crest by 6-12 inches to reduce flow obstruction	Construction	2005-2006 dry season
Dialogue w/ Refuge staff/consultants/Corps		
a. Initial meeting with Refuge staff	ECP	December, 2004
b. Internal monthly meetings		as soon as possible
c. Initial update at T.O.C. meeting		November, 2004

Appendix 2. STA-1W Recover Monitoring

STA-1W Monitoring Stations:

1. STA-1W inflow: S-5A, G-300, G-301, G-302
2. Northern flow-way (Cell 5A and 5B): G-306
3. East flow-way (Cell 1 and 3): G-255, G-253
4. West flow-way (Cell 2 and 4): G-254, G-256 and G-309
5. STA-1W outflow: G-251, G-310

Water quality monitoring parameters in STA-1W will be collected on biweekly basis.

STA-1W Recovery Downstream Monitoring for WCA-1

The downstream water quality monitoring plan covers potential inflow sites of STA-1W hydrologic bypass into the northwest and northeast portion of WCA-1 during recovery. Existing water quality stations will be utilized and grouped into transects located in three downstream areas. Three separate transects, identified by the downstream area, are recommended to capture any potential nutrient changes in the water column associated with STA-1W bypass. These stations are split between the District and Refuge staff. All parameters are collected on monthly basis.

1. G-251: LOXA sites - 104,105,106,107, 108
2. L-7: LOXA sites - 112,111, 113, 128, LOX10
3. STA-1E: LOXA sites - 101, 140, 135,136, 137, 139

The table below lists the current and recommended water quality parameters for collection. No new station locations or additional lab analysis is required for this monitoring effort.

Parameters	units	Parameters	units
temperature	°C	TDPO4	mg/L
DO	mg/L	TD organic C	mg/L
sp conductivity	µhos/cm	Tot. organic C	mg/L
pH	pH units	SO4	mg/L
NOX	mg/L	SiO2	mg/L
NO2	mg/L	Na	mg/L
NO3	mg/L	K	mg/L
NH4	mg/L	Ca	mg/L
TKN	mg/L	Mg	mg/L
TDKN	mg/L	Cl	mg/L
OPO4	mg/L	Alkalinity	mg/L
TPO4	mg/L	Tot. suspended solids	mg/L
		Tot. dissolved solids	mg/L