Current State of the Everglades Stormwater Treatment Areas

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STA Locations & Sizes

STA	Treatment Area, hectares
1E	2,021
1W	2,648
2	6,271
3/4	6,607
5/6	5,538
Total	23,084

STA Objective and Mandates

Objective:

Reduce phosphorus in runoff water prior to discharge to the Everglades Protection Area

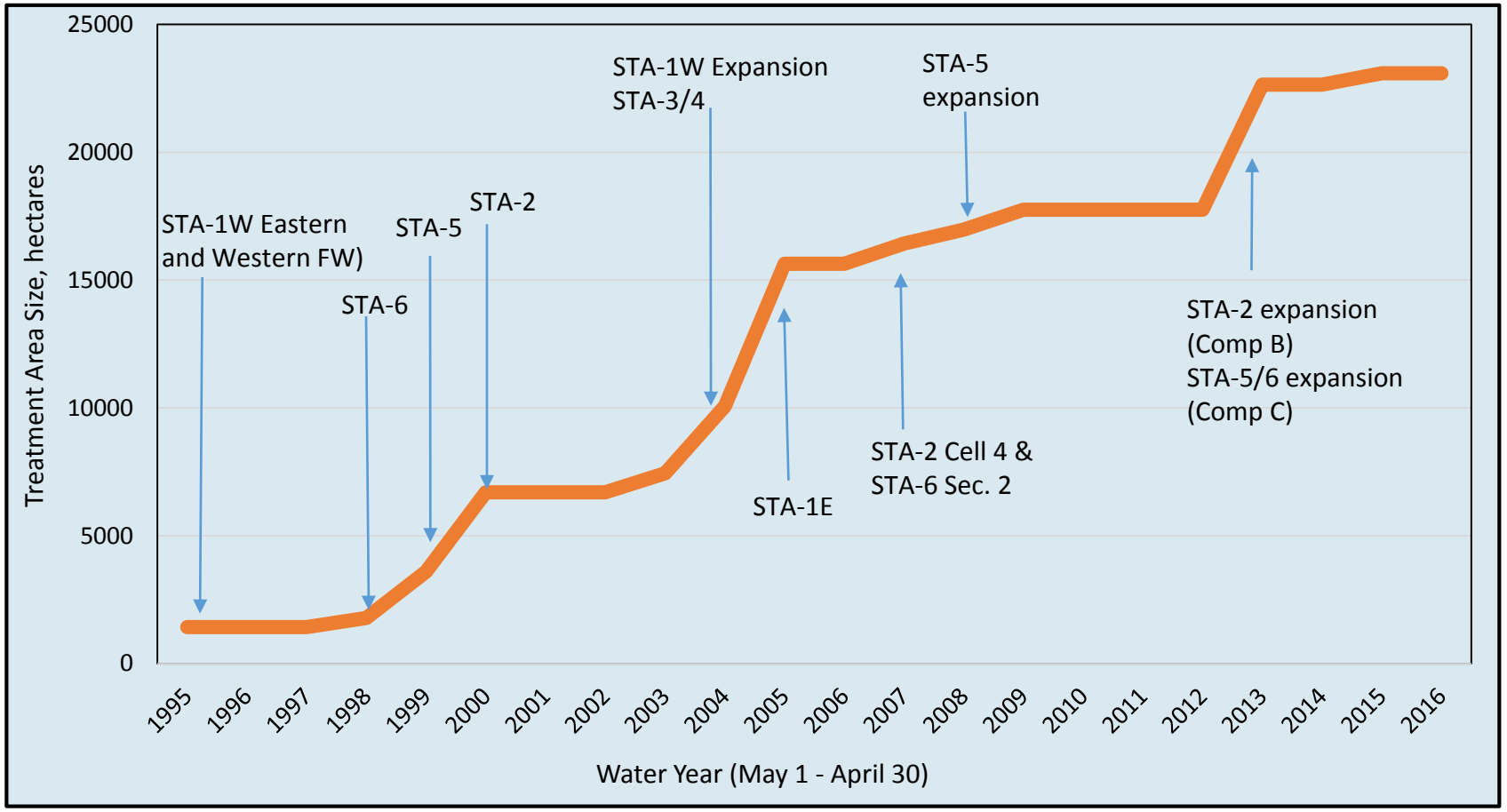
Mandates:

- Everglades Forever Act (EFA)
- National Pollutant Discharge Elimination System (NPDES) and EFA permits
- Consent orders

Water-quality based effluent limit (WQBEL) for TP:

- Maximum of 19 µg L^{-1} Annual Flow-weighted Mean
- Not to exceed 13 µg L^{-1} long-term flow-weighted mean in more than three (3) out of five (5) years.

STA Operational Timelines & Costs



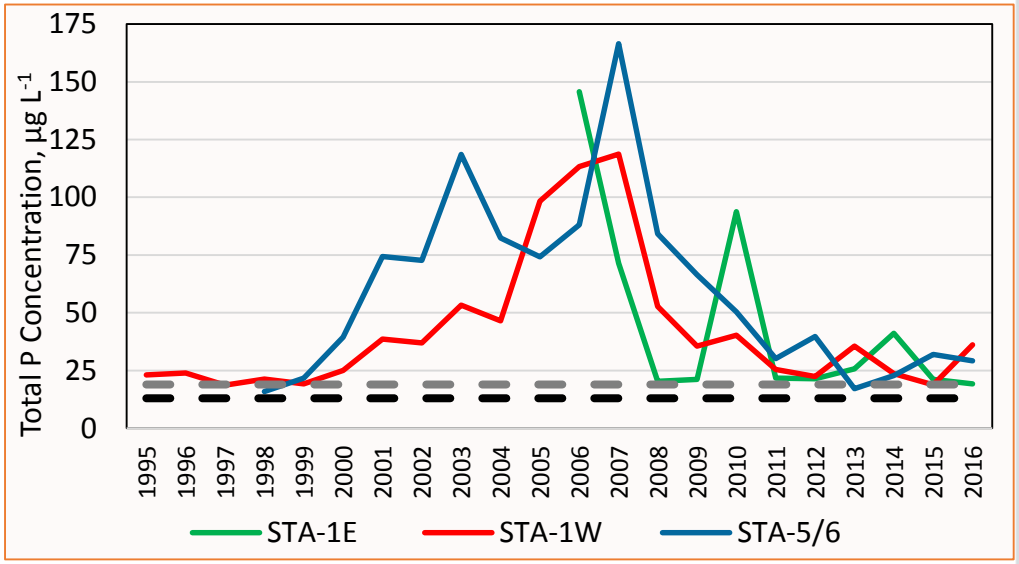
- Total cost (land, design, construction): $1.1 Billion
- Annual operating cost: $25 - 30 Million

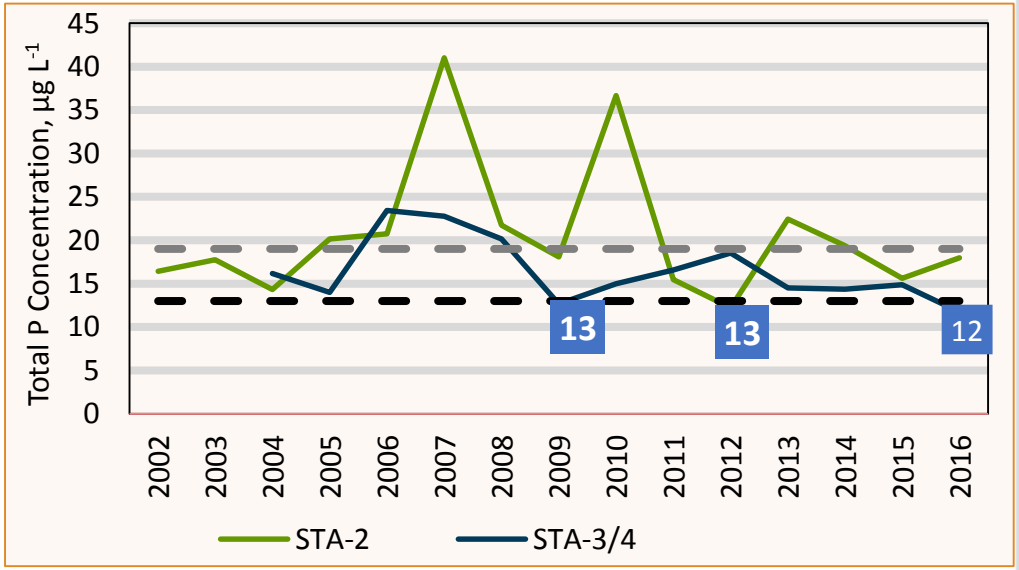
Period of Record STA Performance

Parameter	STA-1E	STA-1W	STA-2	STA-3/4	STA-5/6	All STAs
Inflow Water Volume (ha-m)	151,548	486,685	544,604	686,637	284,254	2,153,728
Flow-weighted Mean Inflow TP ($\mu g\ L^{-1}$)	171	175	98	108	185	135
Flow-weighted Mean Outflow TP ($\mu g\ L^{-1}$)	**43**	**47**	**21**	**16**	**66**	**32**
TP Retained (t)	198	617	413	629	364	2,220
% TP Retained	76	72	77	85	69	76

Temporal Trend in Outflow TP Concentration

- Decreasing trend in concentration and variability
- Highest POR mean concentrations in STA-1E, 1W, & 5
- Lowest concentrations in STA-2 and 3/4
  - Annual FWM concentrations frequently below 19 µg L^{-1}
  - Rarely achieved 13 µg L^{-1}





Concentrations are annual flow-weighted means.

Outflow Total Phosphorus Concentration

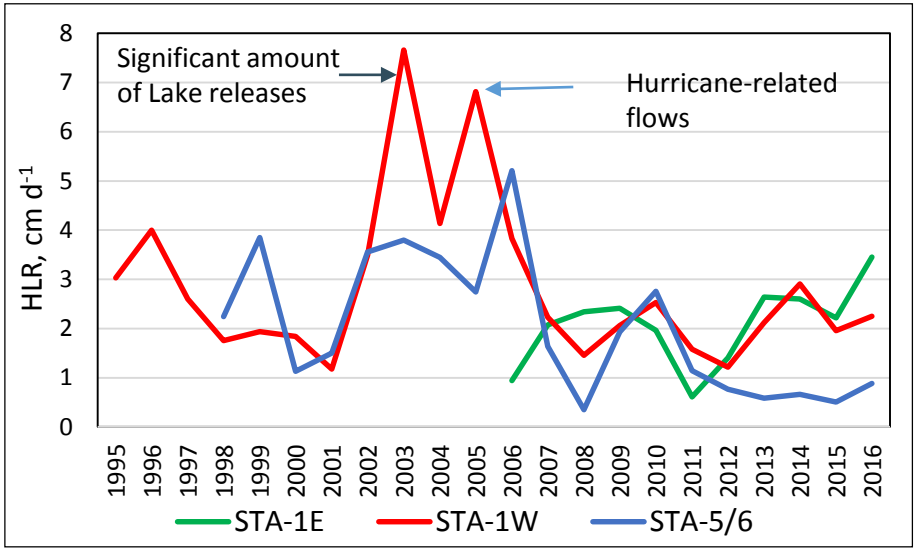
Category	STA-1E	STA-1W	STA-2	STA-3/4	STA-5/6
Total # years in operation	11	22	15	13	19
POR Mean (µg L^{-1})	43	41	20	16	57
Latest 6-yr mean (µg L^{-1})	25	27	17	15	29
# yrs ≤13 µg L^{-1}	0	0	1	3	0
# yrs ≤19 µg L^{-1}	1	3	9	10	2
Total # months operation	139	140	149	145	322*
Monthly Frequency ≤13 (%)	11	6	30	44	8*
Monthly Frequency ≤19 (%)	19	12	56	66	22*

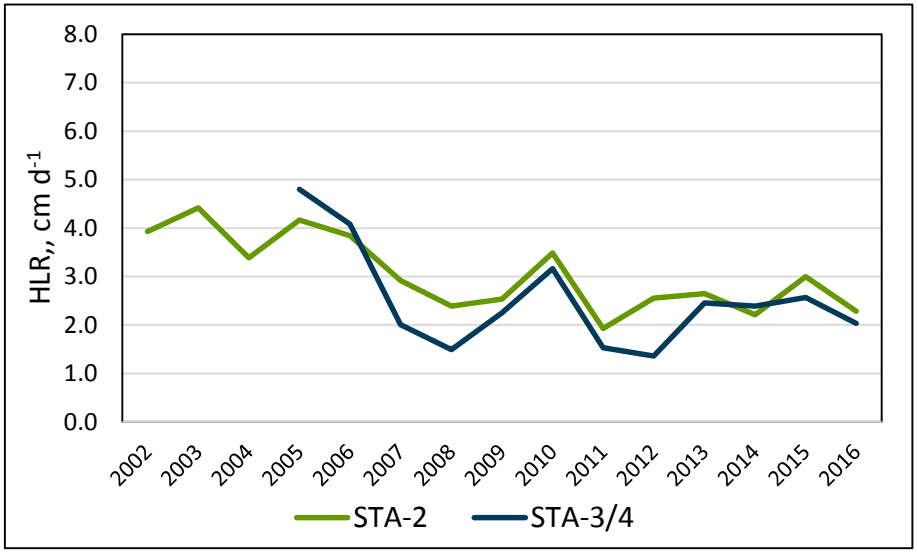
*Pooled data from STA-5, STA-6, and STA-5/6

All concentrations are flow-weighted mean values.

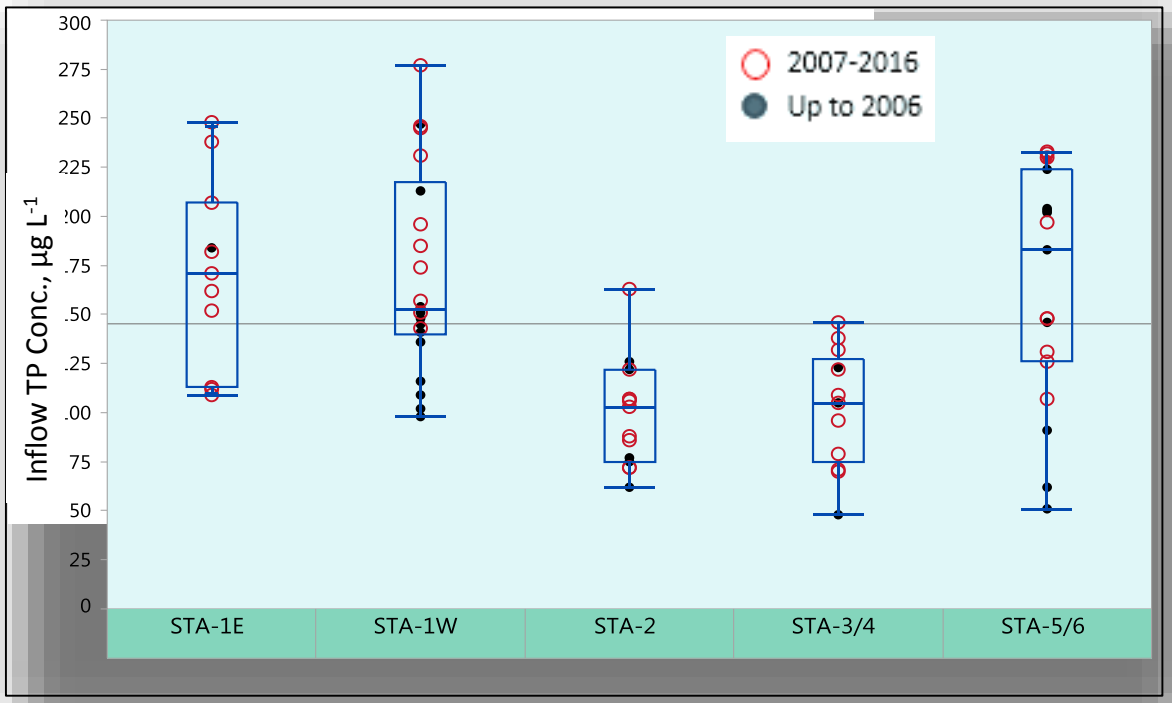
Hydraulic Loading Rates (HLR)

- Highest loadings experienced in STA-1W & STA-5/6
  - Less spikes starting in WY2007
- Generally lower HLR in STA-1E, STA-2, & STA-3/4





Inflow Total P Concentrations

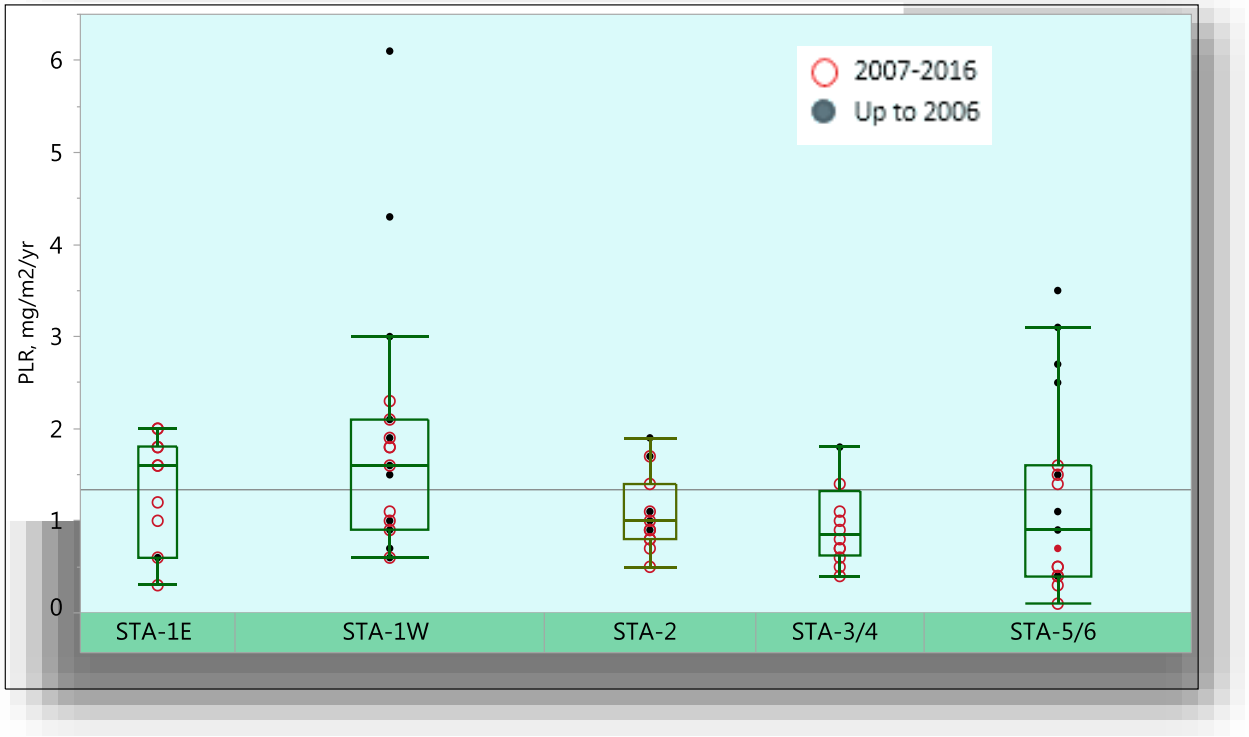


All concentrations are flow-weighted mean annual values.

Inflow TP Conc., µg L^{-1}

- Concentrations generally lower in STA-2 & 3/4
- Highest median concentrations in STA-1E and 5/6
- Highest variability in concentrations in STAs 1E, 1W, & 5/6

Phosphorus Loading Rates (PLR)

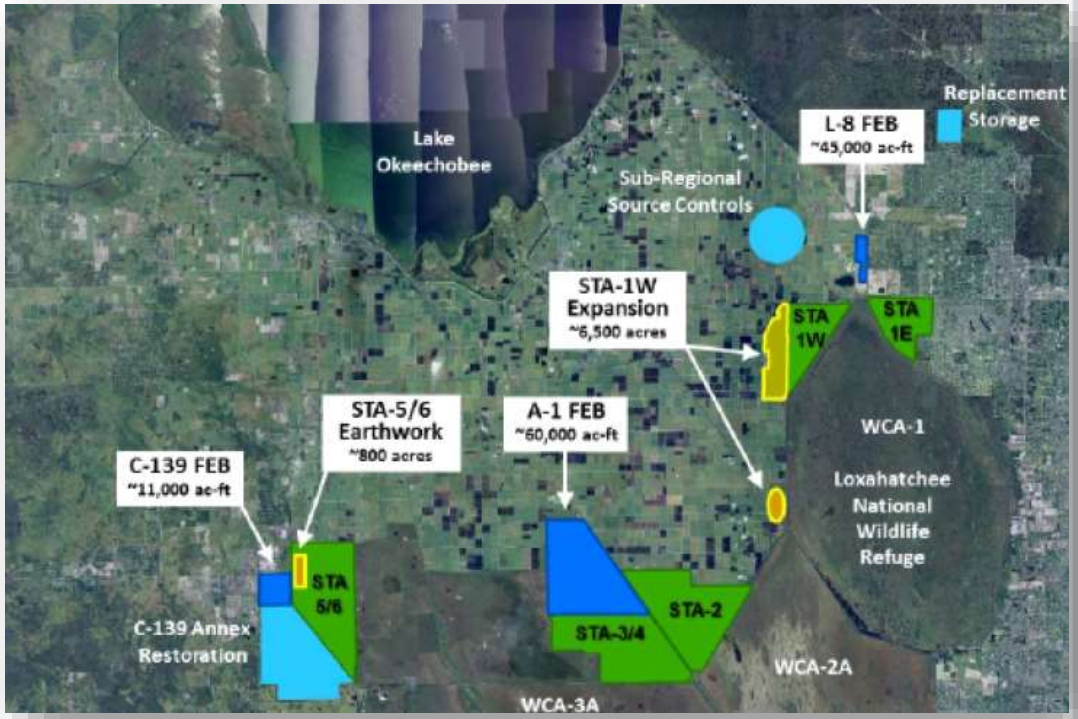


- PLRs generally lowest in STA-2 & STA-3/4 (POR mean: 1.1 & 1.0 g m^2 yr^{-1}, respectively)
- POR PLRs highest in STA-1W (1.8 g m^2 yr^{-1})
- Greatest variability in STA-1W & STA-5/6

Restoration Strategies
Ongoing and Planned Improvements

Flow Equalization Basins

- A1 FEB benefits STA-2 and STA-3/4 (operational)
- L8 FEB will benefit STA-1E and STA-1W (2017)
- C139 Annex FEB will benefit STA-5/6 (2024)



- Additional treatment cells in STA-1W Expansion (2019)
- Earthwork improvements in STA-5/6 to expand effective treatment area (2024)
- Total budget: $880 million

Flow Equalization Basins

A1 FEB - Benefits
STA-2 & STA-3/4

L8 FEB - Benefits
STA-1W & STA-1E

Restoration Strategies Science Plan Implementation

Objectives:

- Investigate the critical factors that collectively influence ultra-low treatment performance and phosphorus reduction in the STAs
- Inform the design and operation of water quality projects

Key Areas of Investigation

- Internal STA processes and understanding the factors related to TP reduction
  - P cycling and internal loading
  - Role of vegetation, microrganisms, and fauna
- Sustaining vegetation-based treatment
- Engineering & operational factors
  - PLR, HLR
  - Role of FEBs

Summary

- All STAs have been very effective in reducing TP concentrations and TP loads.
- HLR, PLR, and inflow TP concentrations are generally lowest and least variable in STA-2 & STA-3/4.
- On an annual basis, STA-2 & STA-3/4 frequently achieved ≤19 ppb; neither STA has yet achieved ≤13 µg L^{-1} for two consecutive years.
- Restoration Strategies, including FEB operations, are expected to improve and sustain STA performance through reduction in peak flows, P concentrations, and P loading into the STAs
- Scientific studies would provide information for further enhancing STA operation and management strategies.

QUESTIONS?