

Water Year 2016: Southern Everglades Water Quality Overview

**Governing Board Meeting
South Florida Water Management District**

November 10, 2016

Stuart Van Horn, P.E. – Bureau Chief, Water Quality

Federal Consent Decree and State Phosphorus Requirements

Federal Consent Decree

▪ Limited Areas

- Water Conservation Area – 1 (Loxahatchee National Wildlife Refuge)
- Everglades National Park

State Everglades Forever Act Ch. 373.4592, F.S.

▪ Expanded Areas

- Water Conservation Area – 1 (Loxahatchee National Wildlife Refuge)
- Everglades National Park
- Water Conservation Area – 2
- Water Conservation Area – 3



Everglades Protection Area (EPA)

Areas Targeted for Phosphorus Reductions

Federal Consent Decree and State Phosphorus Requirements

Federal Consent Decree

■ Remedies Imposed

- Best Management Practices (BMPs)
 - Everglades Agricultural Area (EAA) - original area
- Stormwater Treatment Areas (STAs)
 - EAA – original 40K acres
- Everglades research and monitoring program to support establishment of phosphorus numeric criterion for Water Conservation Areas (WCAs)

State Everglades Forever Act Ch. 373.4592, F.S.

■ Remedies Imposed

- BMPs
 - EAA Rule - original and expanded
 - C-139 Rule
- STAs
 - EAA and C139 - original 40K acres and improvements via Long-Term Plan
 - Restoration Strategies - STAs > 64K acres and Flow Equalization Basins > 115K acre-feet storage
- Establish phosphorus numeric criterion
- Additional projects for Quantity-Timing-Distribution (QTD)

Phosphorus Control Programs

Federal Consent Decree and State Phosphorus Requirements

Federal Consent Decree

- **Tracking response to Remedies**
 - BMP: EAA 25% Reduction
 - Loxahatchee National Wildlife Refuge
 - Monthly Level varies as GM, corrected for marsh stage
 - Everglades National Park
 - Annual inflow limit varies for Shark River Slough as FWM, corrected for inflow volume
 - Annual inflow limit fixed for Taylor Slough & Coastal Basins

GM: Geometric Mean (geomean)

FWM: Flow Weighted mean

NPDES: National Pollutant Discharge Effluent System

WQBEL: Water Quality Based Effluent Limit

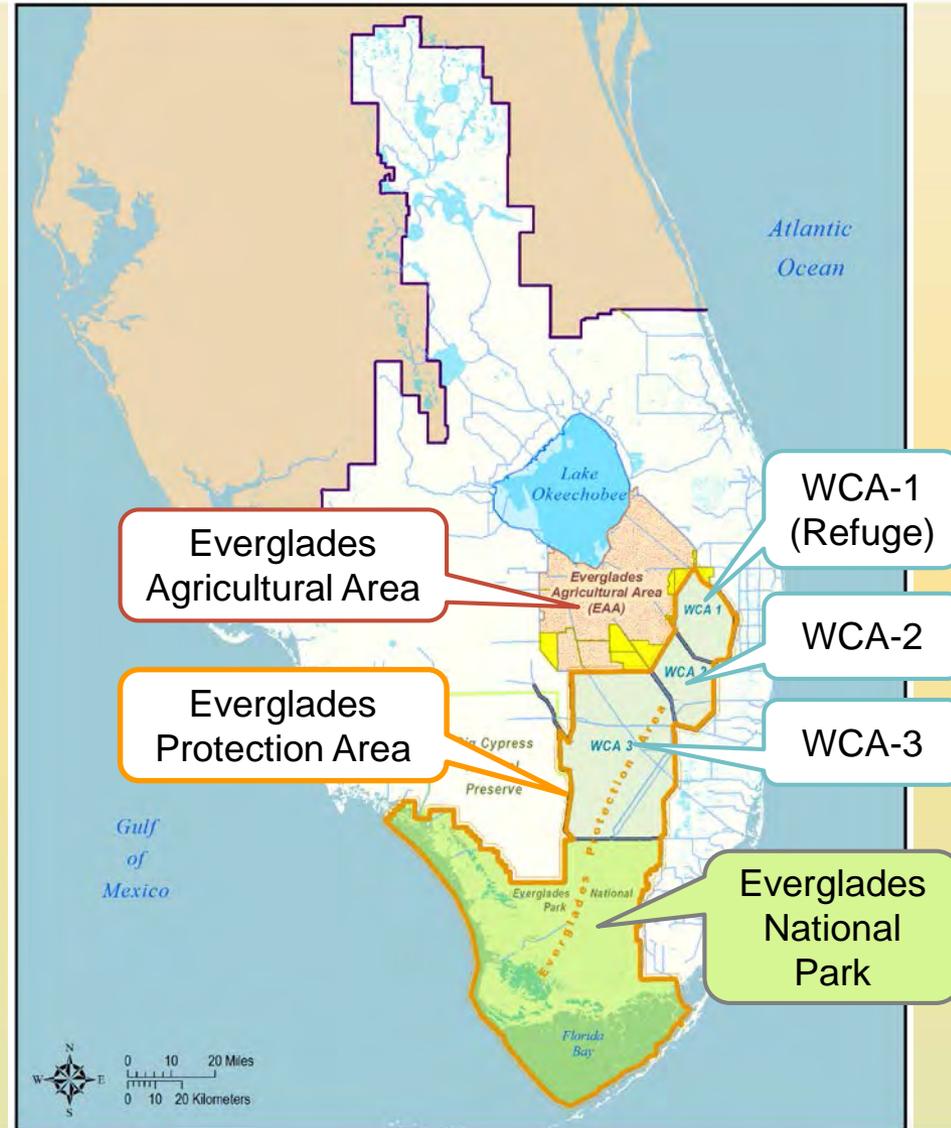
State Everglades Forever Act Ch. 373.4592, F.S.

- **Tracking response to Remedies**
 - BMP: EAA 25% Reduction, C139 Historic
 - WCA-1 (Refuge), WCA-2, WCA-3
 - Total Phosphorus Rule, networks in all WCAs
 - Everglades National Park
 - Inflow limits same as Consent Decree for Shark River Slough & Taylor Slough and Coastal Basins
 - Total Phosphorus Rule – Default criterion if Consent Decree no longer applicable
 - STAs
 - NPDES WQBEL

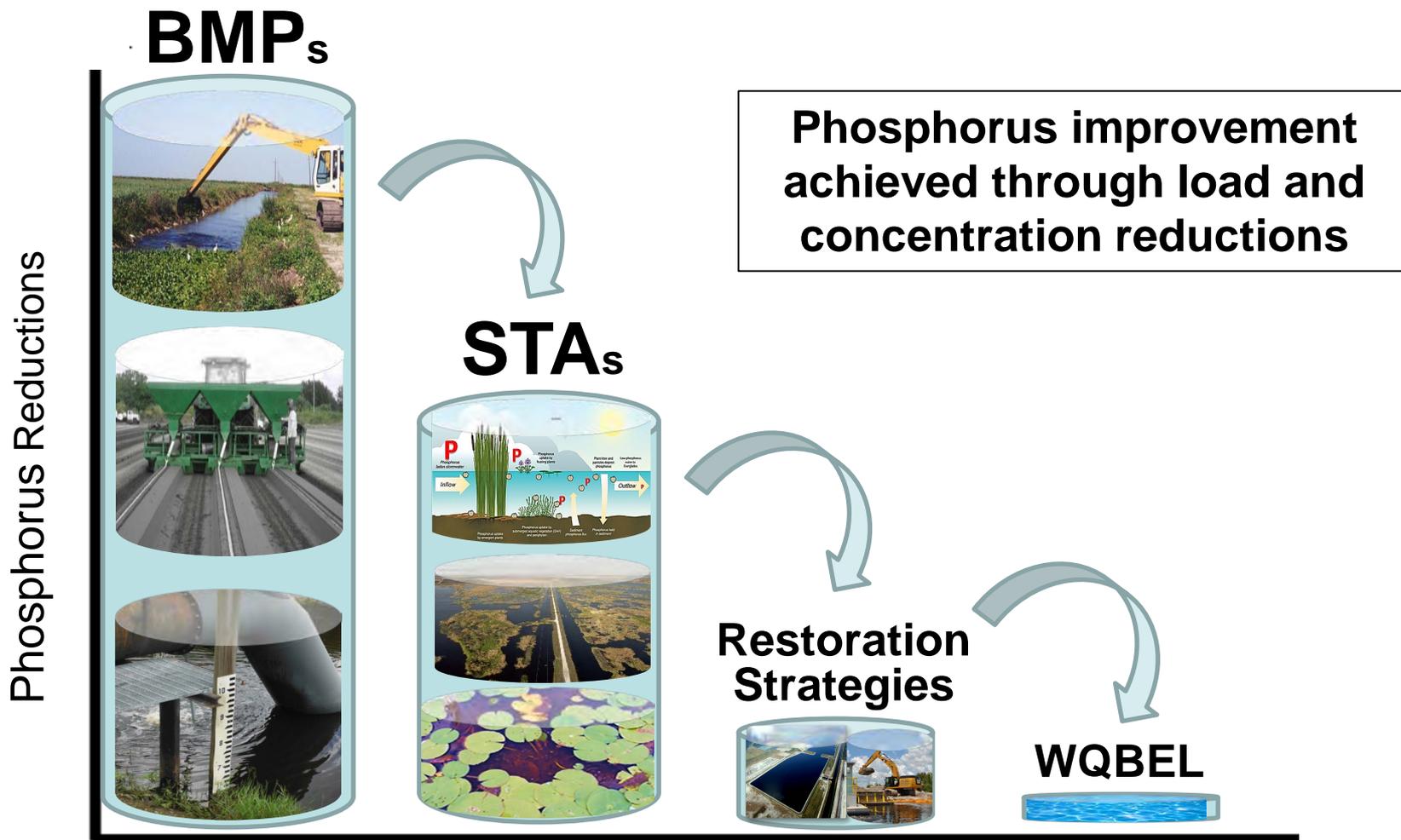
Phosphorus Inflows and Marsh Levels

Overview of Phosphorus Mandates

- **EAA Stormwater Runoff**
 - Consent Decree Appendix E, 25% TP reduction from baseline
 - State Everglades Forever Act and BMP rule (40E-63)
- **STA Discharges to EPA**
 - Original 50 ppb expectation
 - Federal NPDES WQBEL
- **EPA Downstream Marshes**
 - **WCA-1 (Refuge)**
 - Consent Decree Appendix B and State Phosphorus Rule (10 ppb)
 - **WCA-2 and WCA-3**
 - State Phosphorus Rule (10 ppb) (Consent Decree inapplicable)
 - **Everglades National Park**
 - Consent Decree Appendix A (State Phosphorus Rule adopts)

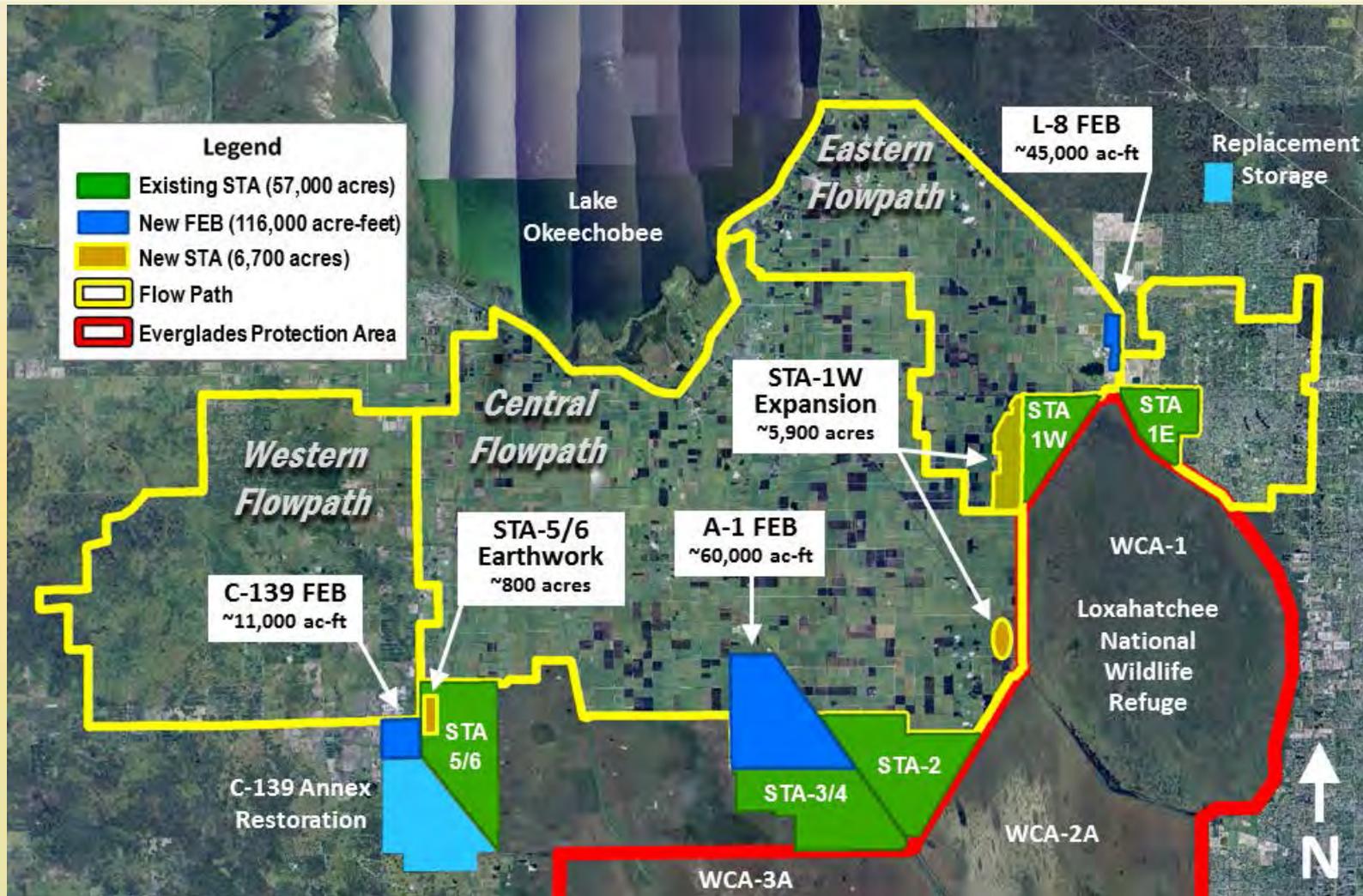


“Treatment Train” Approach to Reduce Phosphorus since Everglades Forever Act



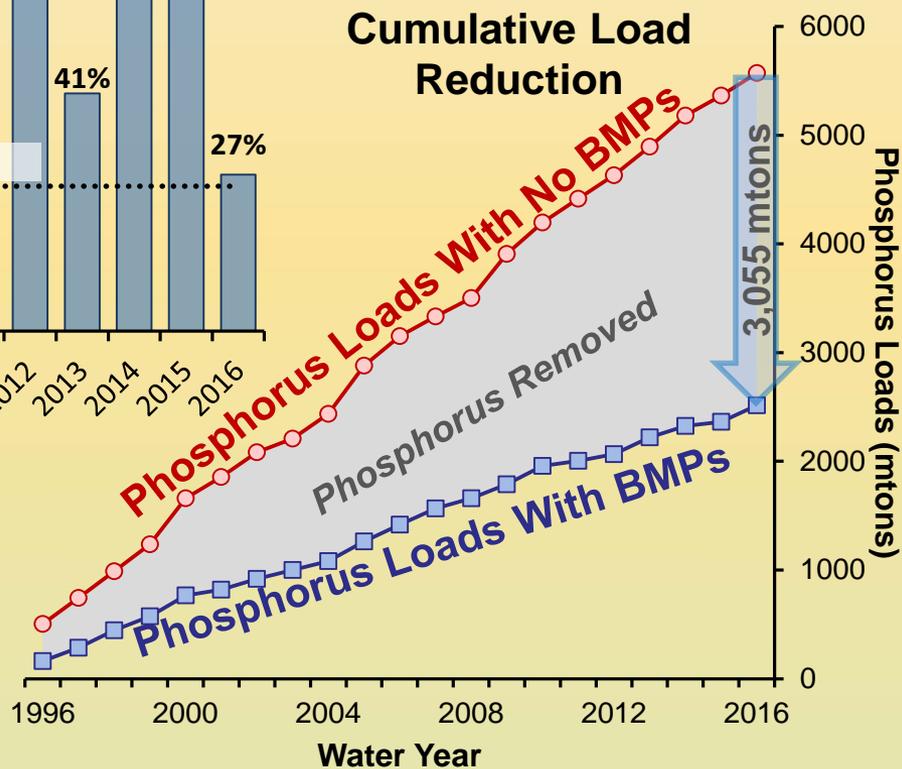
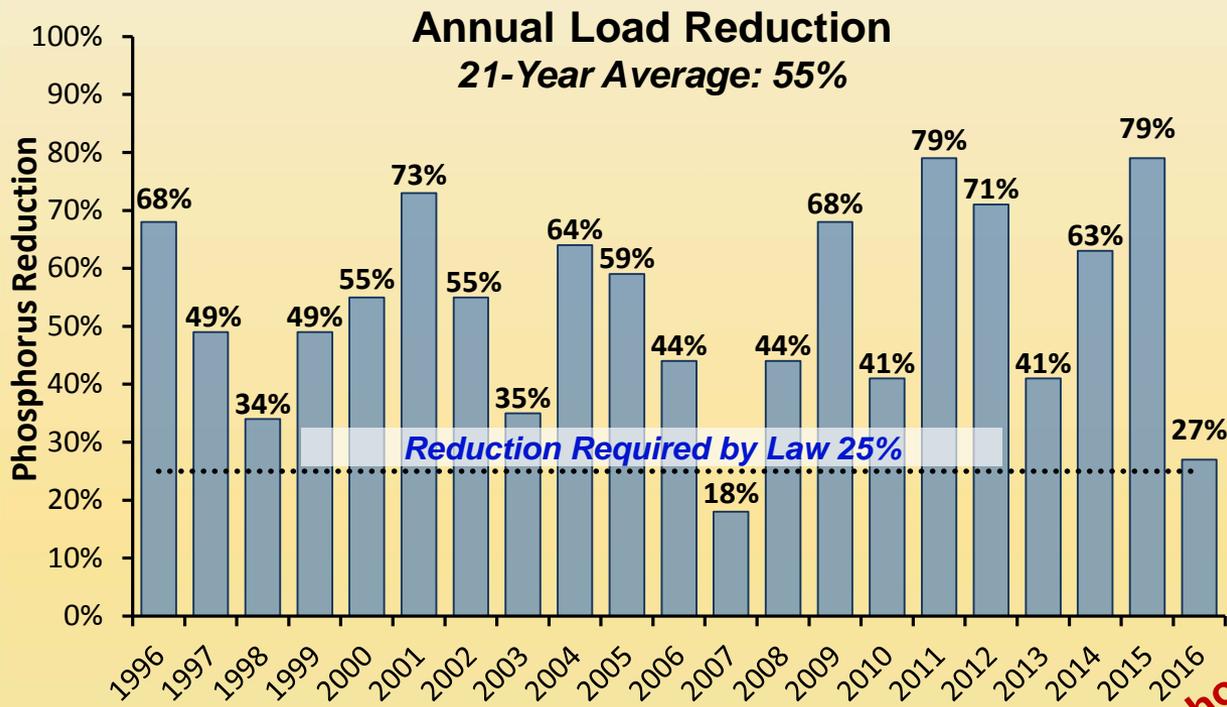
Water Quality Improvement Measures

Phosphorus Controls Upstream of Water Conservation Areas



STA – Stormwater Treatment Area; FEB – Flow Equalization Basin

Everglades Agricultural Area Phosphorus Load Reduction Achieved with BMPs

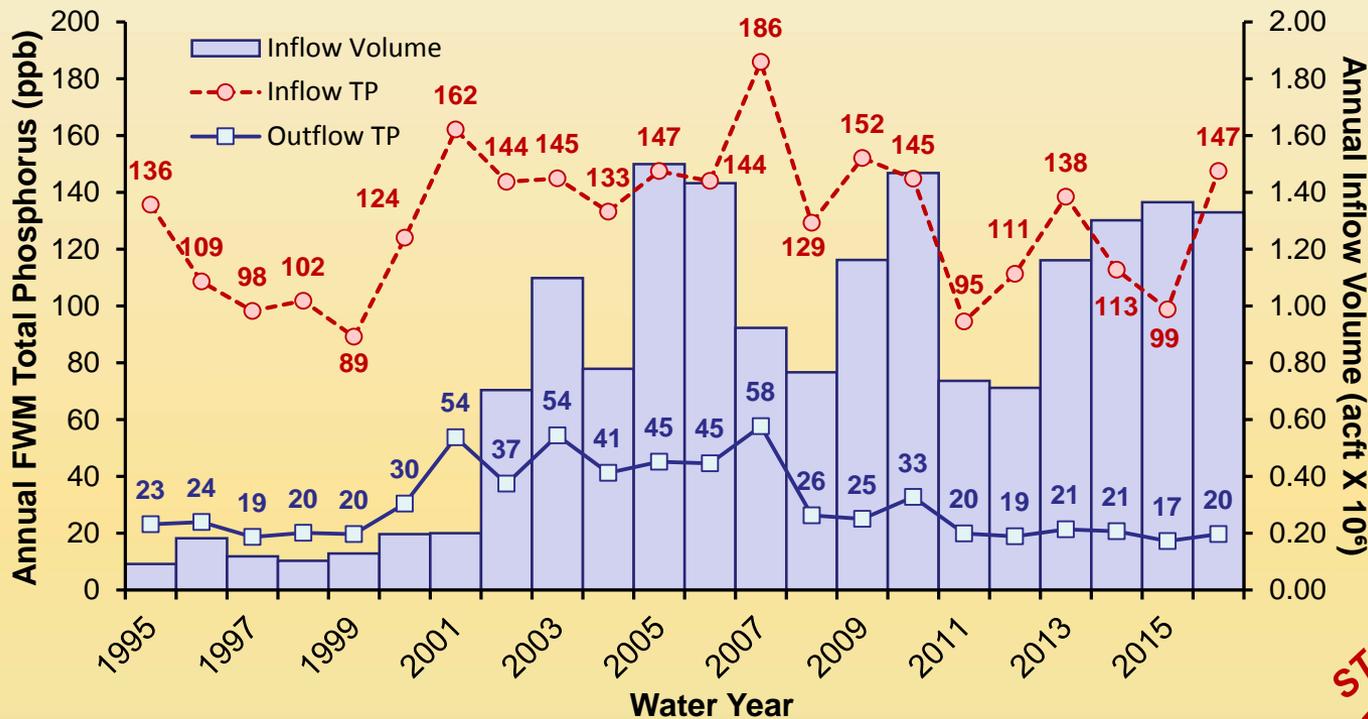


Best Management Practices prevented 3,055 metric tons of phosphorus from leaving the EAA

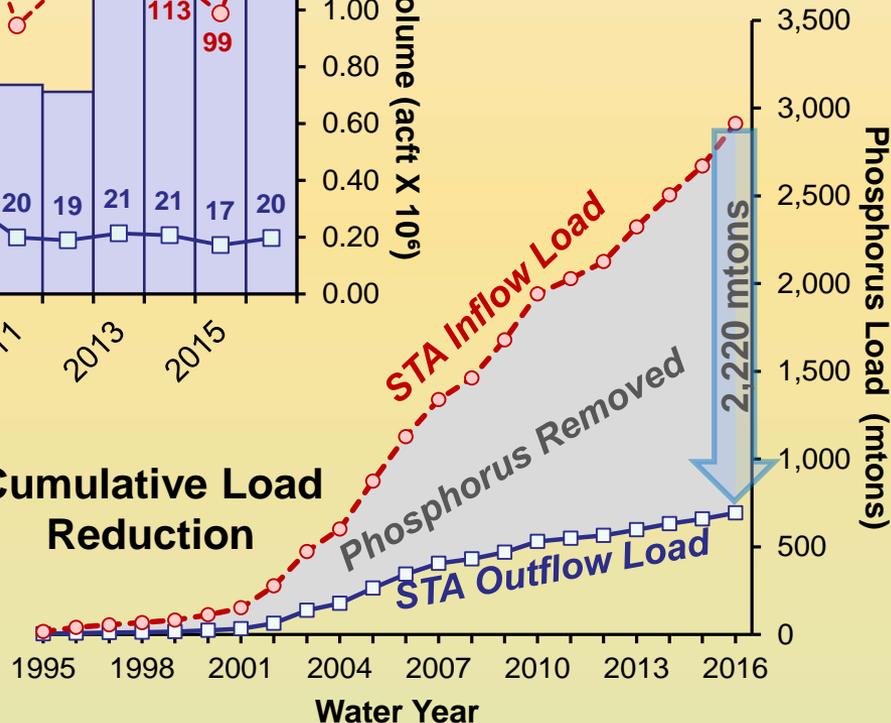
mtons – metric tons = 1,000 kilograms

Everglades Stormwater Treatment Areas Phosphorus Concentration & Load Reductions

Annual Concentration Trend



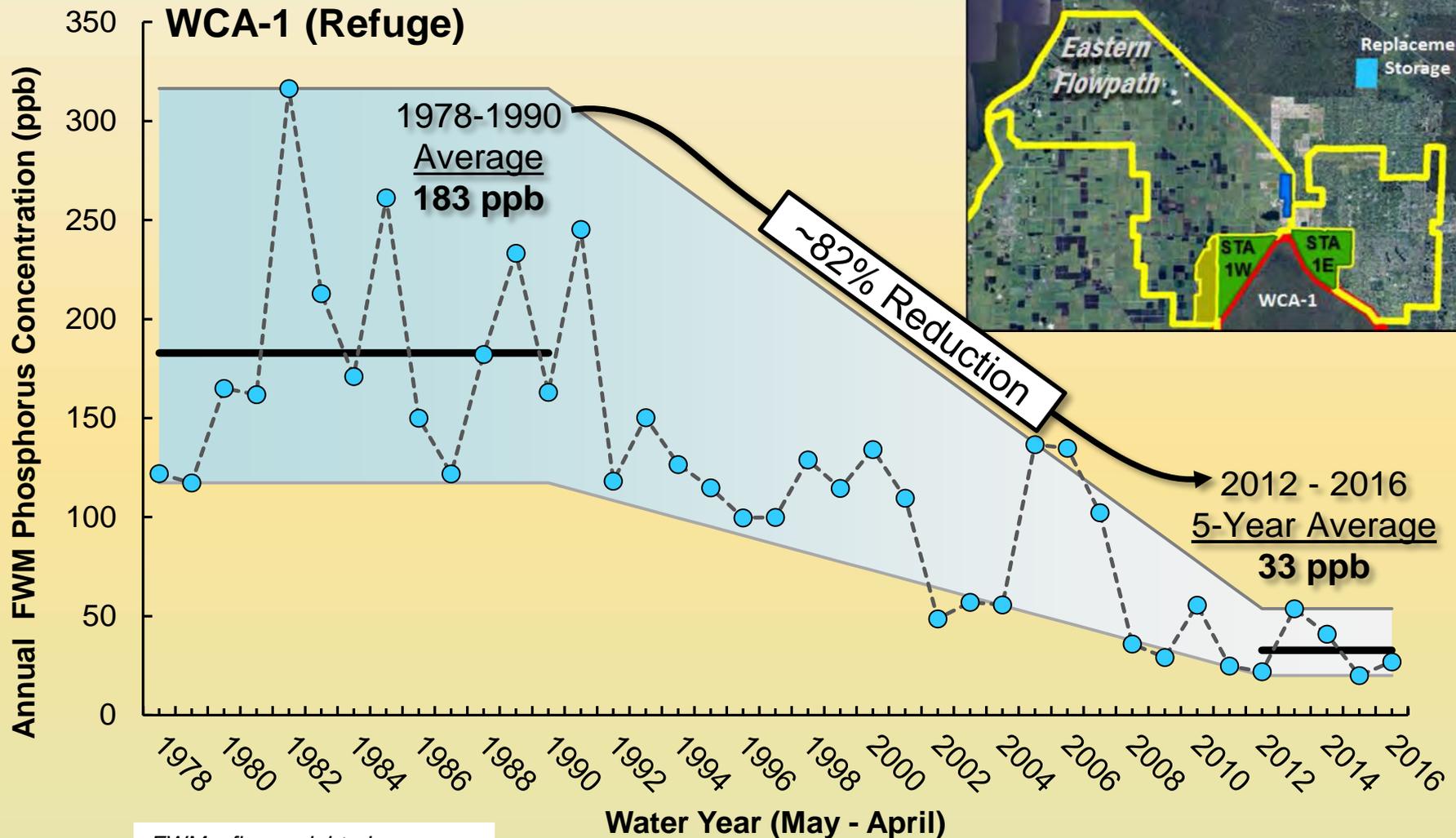
Cumulative Load Reduction



Stormwater Treatment Areas prevented 2,220 metric tons of phosphorus from entering the Water Conservation Areas

FWM – flow weighted mean
 ppb – parts per billion; acft – acre feet
 mtons – metric tons = 1,000 kilograms

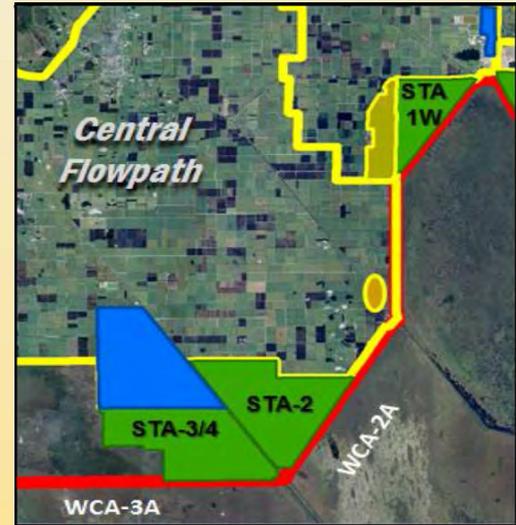
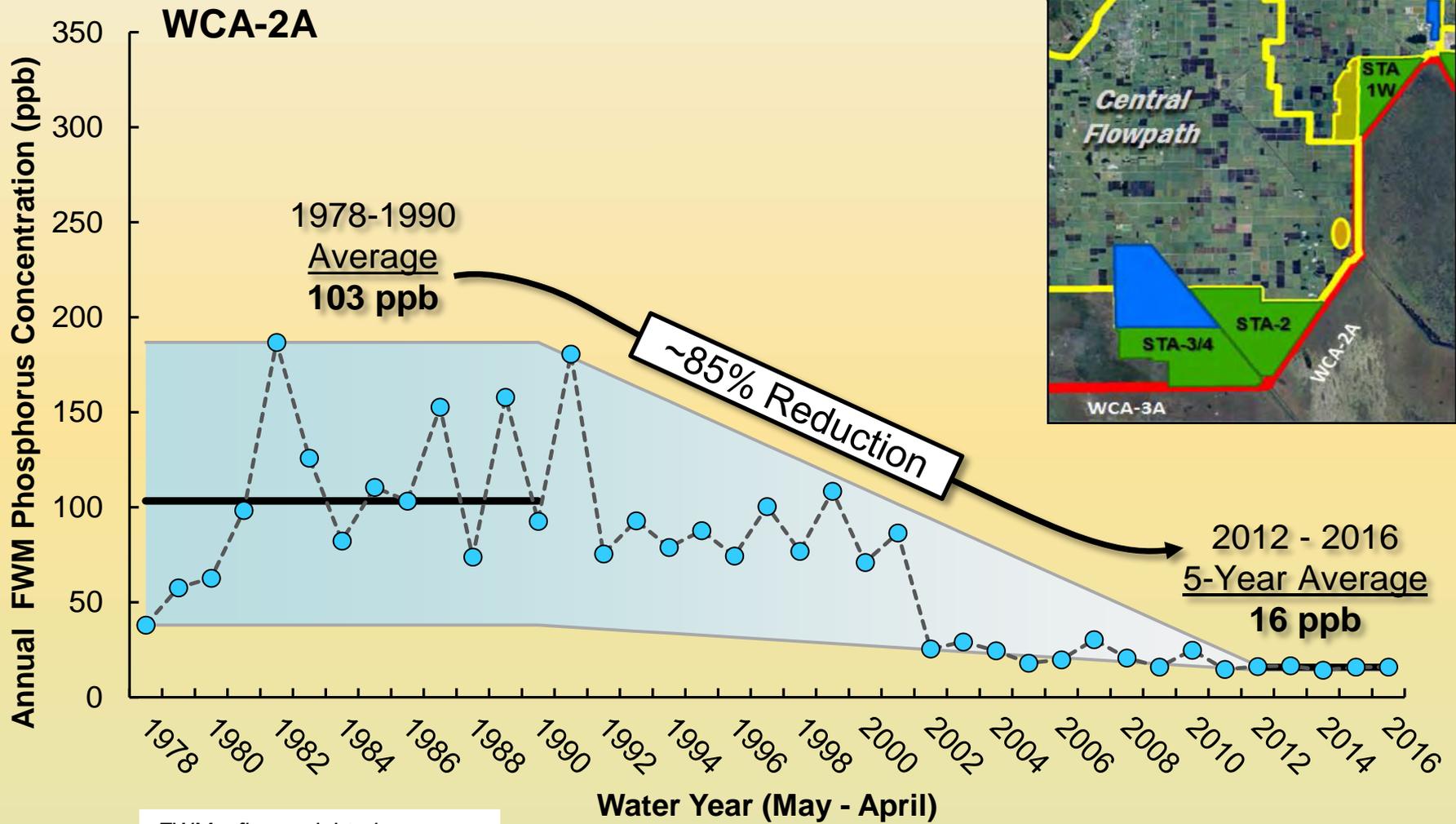
Water Conservation Area 1 (Refuge) Inflow Phosphorus Improvement



FWM – flow weighted mean
ppb – parts per billion

Treatment through STAs 1E and 1W

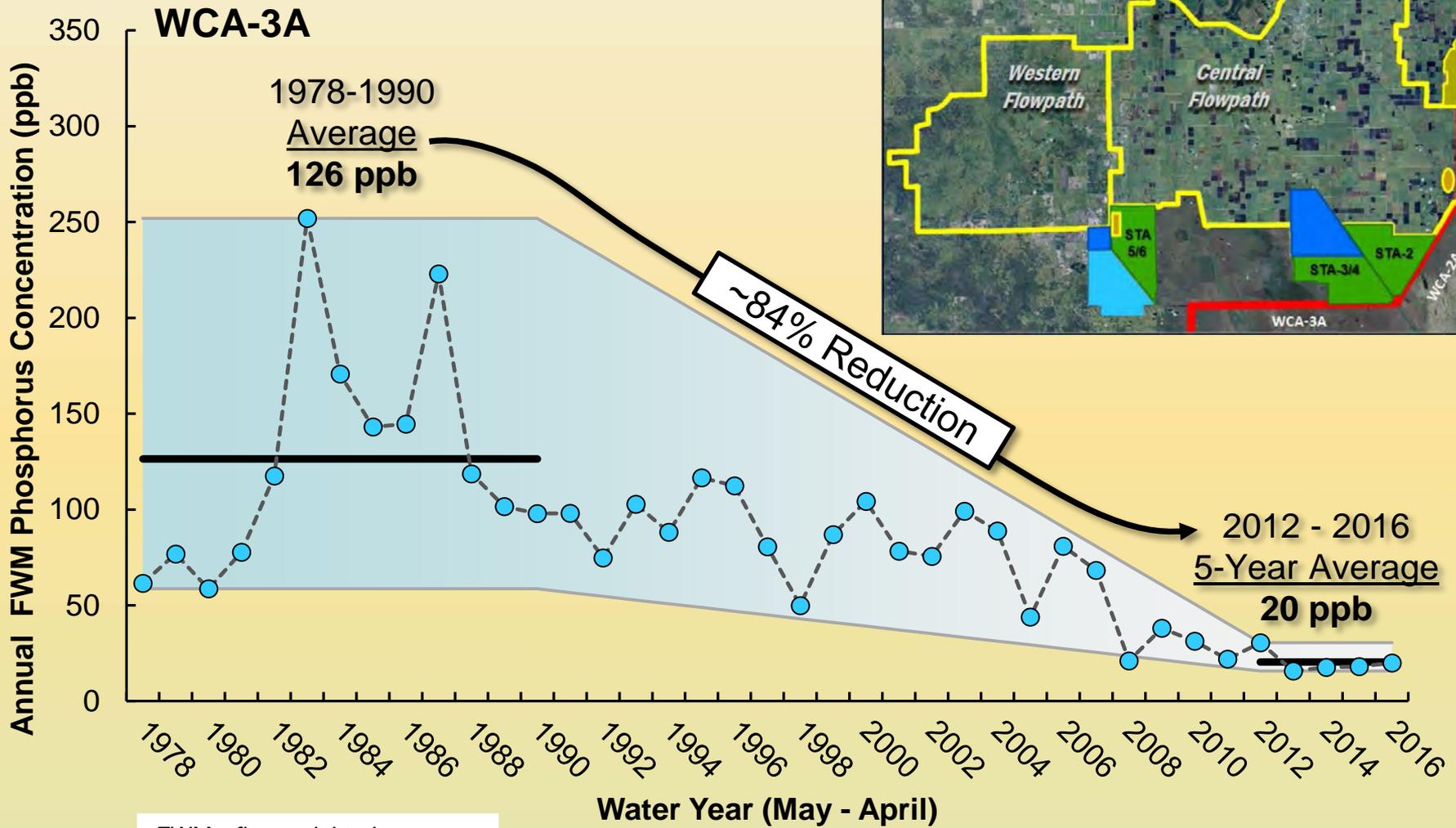
Water Conservation Area 2A Inflow Phosphorus Improvement



FWM – flow weighted mean
ppb – parts per billion

Treatment through STAs 2 and 3/4

Water Conservation Area 3A Inflow Phosphorus Improvement



FWM – flow weighted mean
ppb – parts per billion

Treatment through STAs 3/4 and 5/6

Water Conservation Areas Marsh Phosphorus Trends and Mandates

WY1979-1983
High TP in WCAs

WY2012-2016
Majority of area below
10 parts per billion (ppb)

All WCAs

TP Rule 4-part Compliance Test

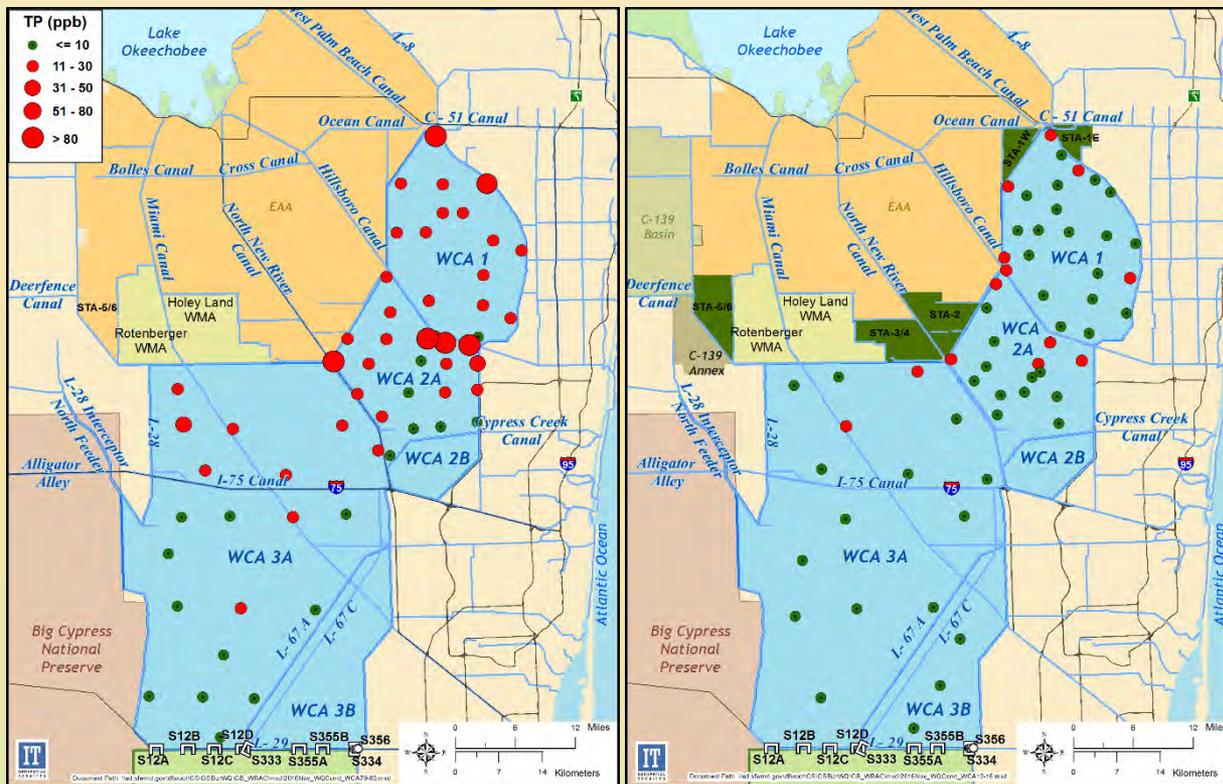
Long-Term Criterion	Applied to	Test
5-year Average	All Stations GM	≤ 10 ppb
3 of 5 years	All Stations GM	≤ 10 ppb
Annual	All Stations GM	≤ 11 ppb
Annual	Individual GM	≤ 15 ppb

Note: Test is applied to Impacted and Unimpacted sites separately

WCA-1 (Refuge) Consent Decree, Appendix B

- **Long-term Level:** Concentration varies with stage (inverse relationship)
 - Level varies 7.2 - 17.6 ppb
 - No more than 1 in 12 months can exceed Level

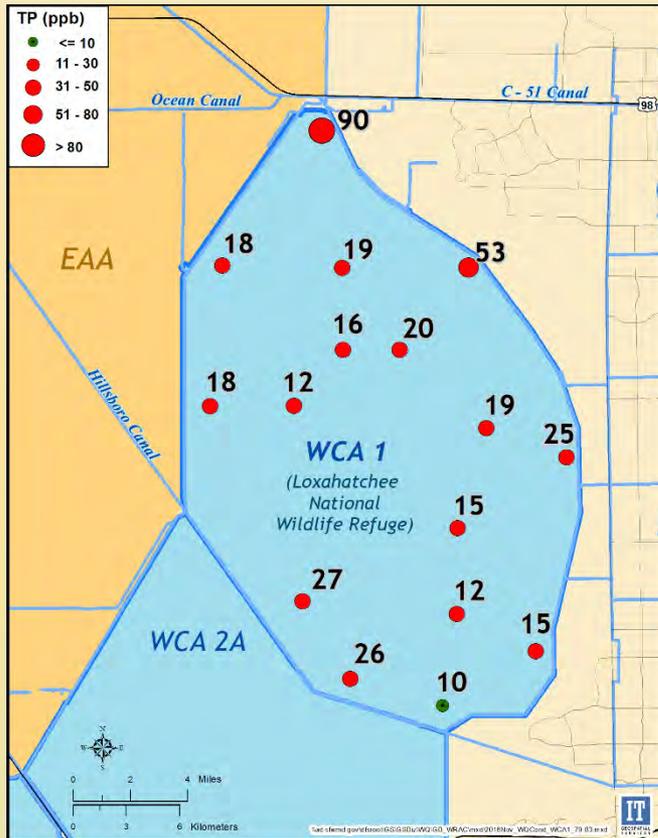
TP values represent the 5-year average of annual geometric means at each station
ppb – parts per billion



Water Conservation Area 1 (Refuge) Marsh Phosphorus Improvement

WY1979-1983

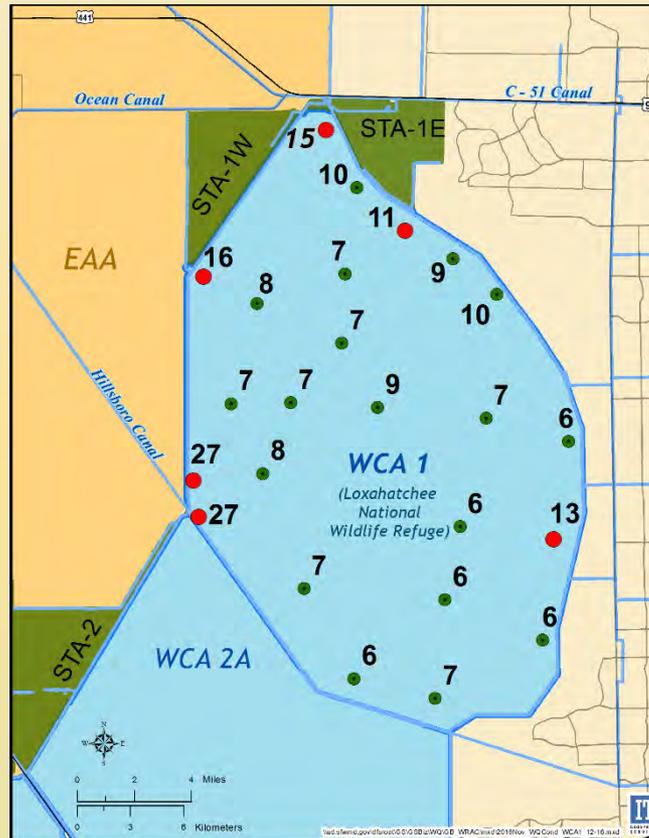
6% of stations ≤ 10 ppb



Mean of 16 stations: 25 ppb
(Mean of CA1-3 to CA1-16: 20 ppb)

WY2012-2016

75% of stations ≤ 10 ppb



Mean of 24 P-Rule stations: 10 ppb
(Mean of LOX3 to LOX16: 7 ppb)

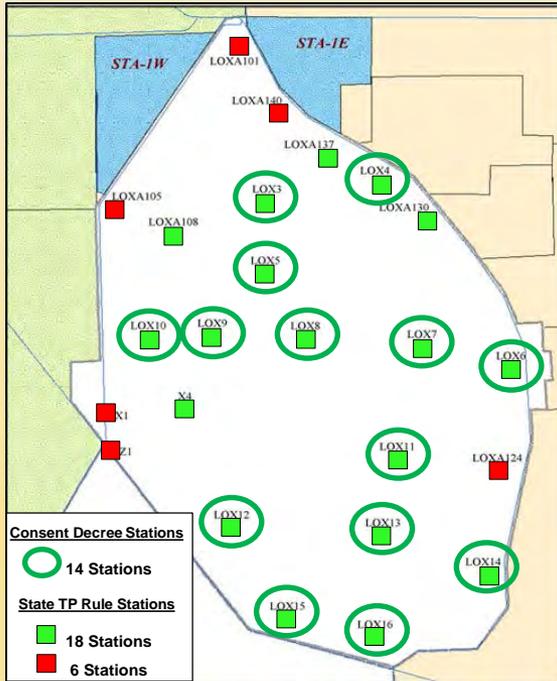
Water Year 2016

- Unimpacted 18 stations
 - All 4 parts of compliance test met
 - Average geometric mean 8 ppb
- Impacted 6 stations
 - 2 stations met annual individual test
 - Average geometric mean 17 ppb

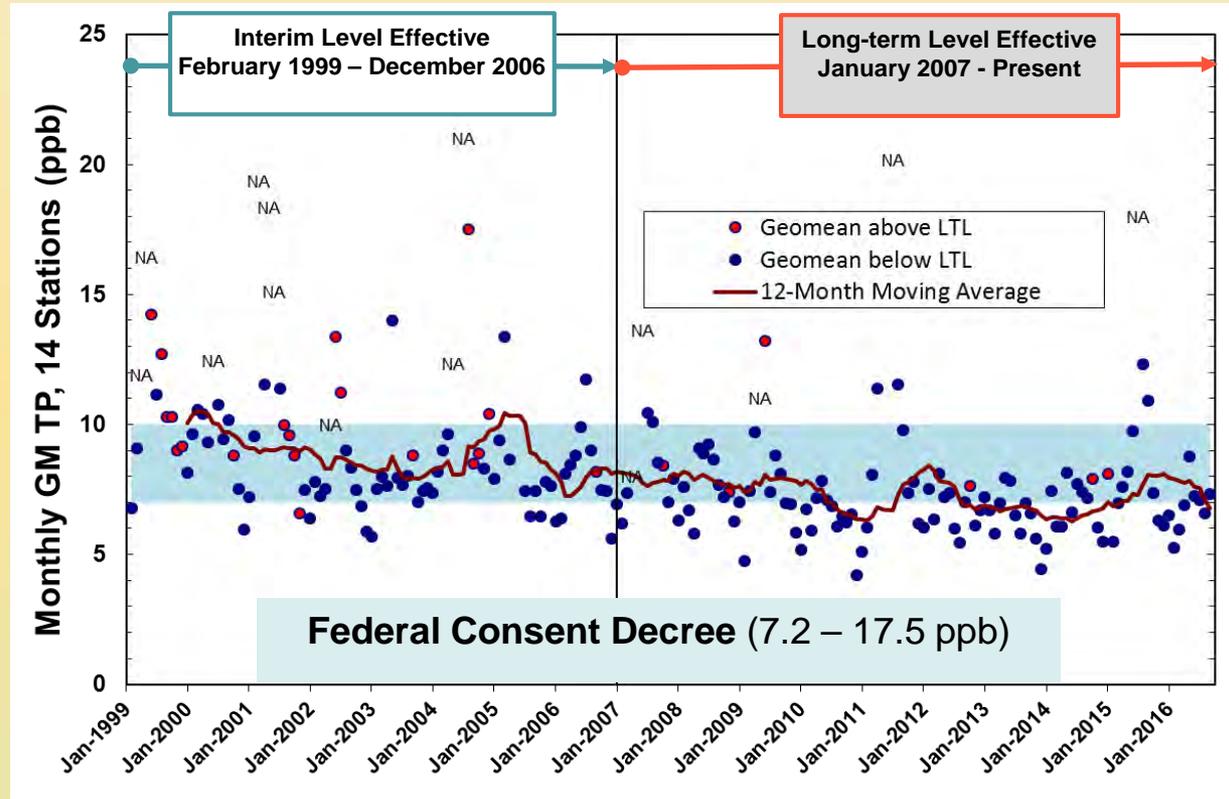
TP values represent the 5-year average of annual geometric means at each station
ppb – parts per billion

State Phosphorus Rule

Water Conservation Area 1 (Refuge) Marsh Phosphorus Improvement



Consent Decree Long-term Goal
 Achieve approximately 7 ppb



- Actual 14-station geometric mean downward trend:
 1999 (Feb-Dec) geometric mean >10 ppb
 2016 (Jan-Sep) geometric mean < 7 ppb

Water Conservation Area 2 Marsh Phosphorus Improvement

WY1979-1983

29% of stations ≤ 10 ppb

WY2012-2016

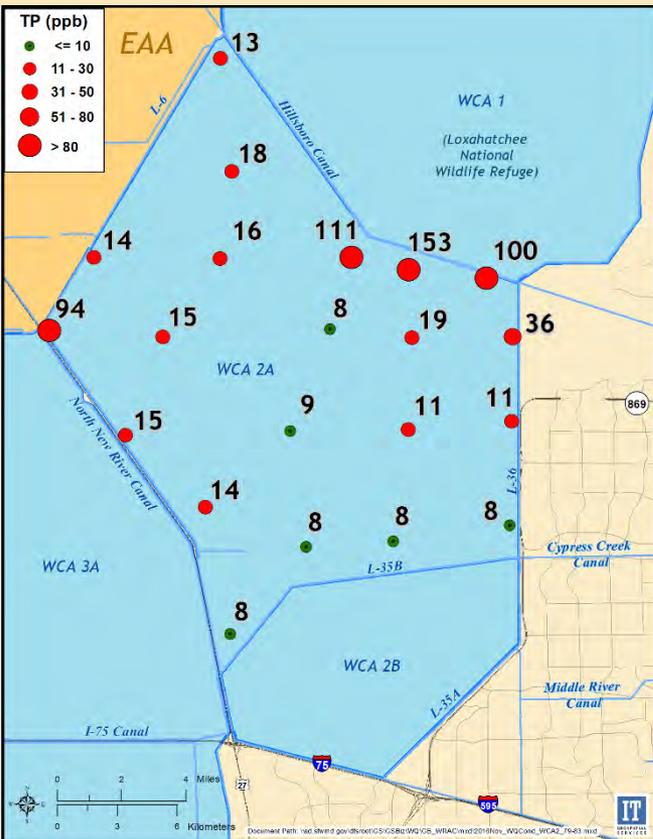
All sites significantly improved
62% of stations ≤ 10 ppb

Water Year 2016

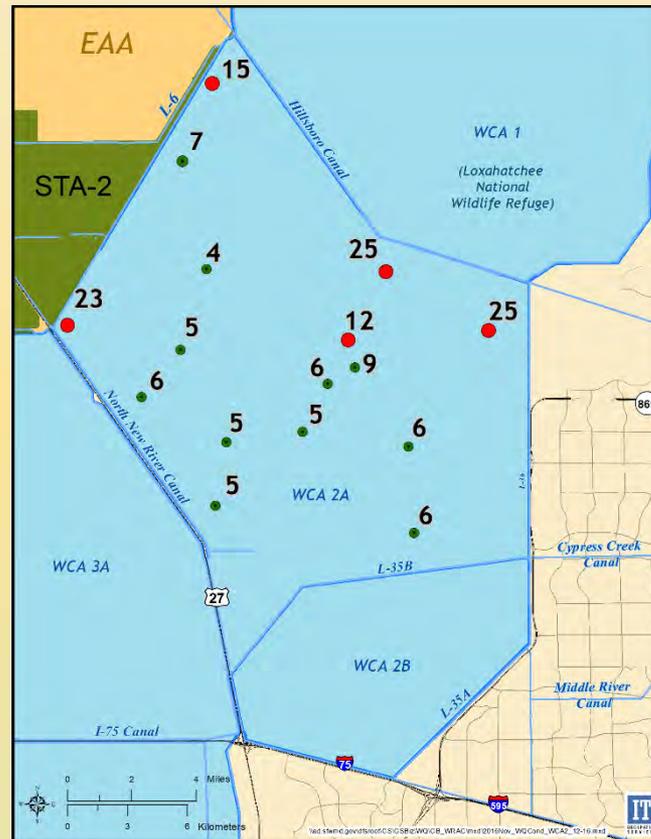
- Unimpacted 11 stations
 - All 4 parts of compliance test met
 - Average geometric mean 6 ppb
- Impacted 5 stations
 - 1 station met annual individual test
 - Average geometric mean 20 ppb

TP values represent the 5-year average of annual geometric means at each station
ppb – parts per billion

State Phosphorus Rule



Mean of all 21 stations: 33 ppb

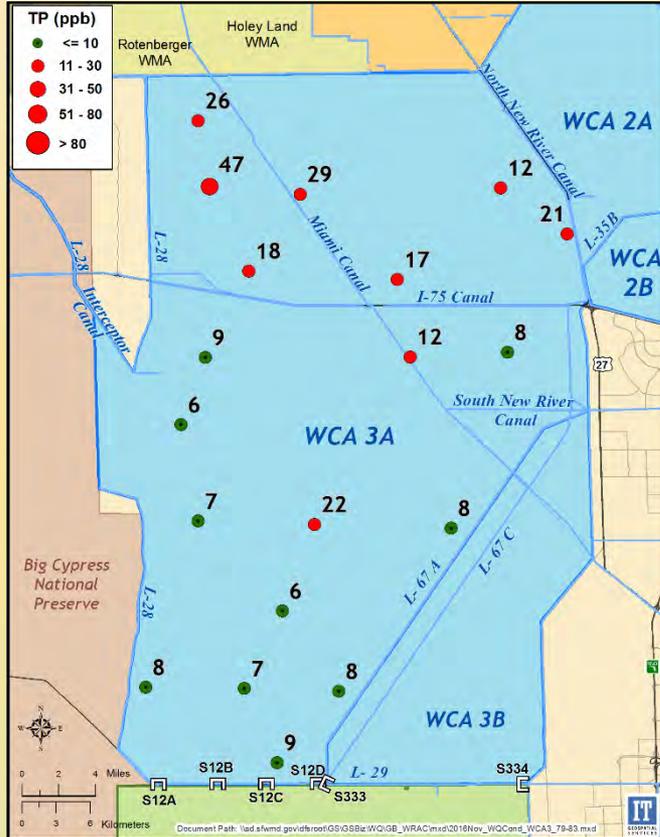


Mean of all 16 P-Rule stations: 10 ppb

Water Conservation Area 3 Marsh Phosphorus Improvement

WY1979-1983

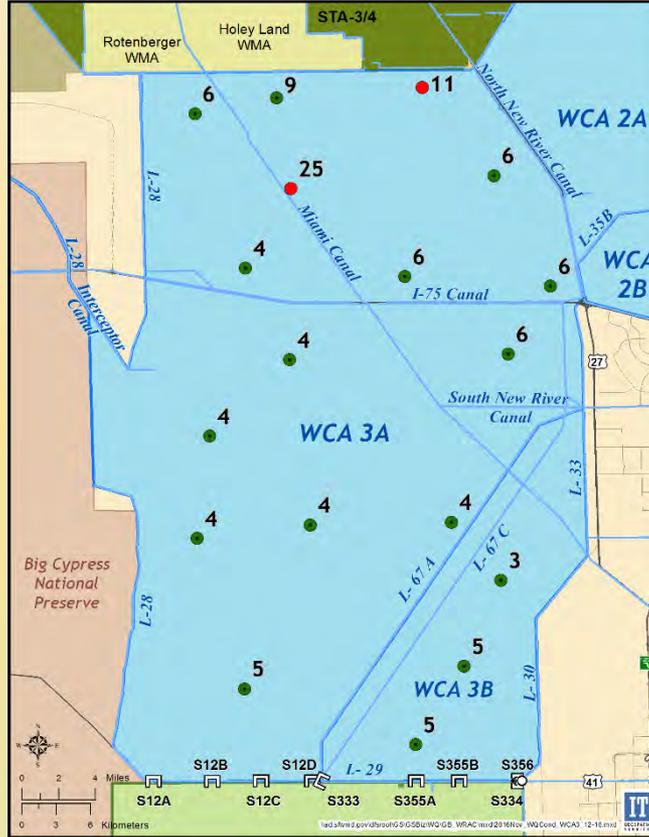
55% of stations \leq 10 ppb



Mean of all 20 stations: 15 ppb

WY2012-2016

89% of stations \leq 10 ppb



Mean of all 18 P-Rule stations: 7 ppb

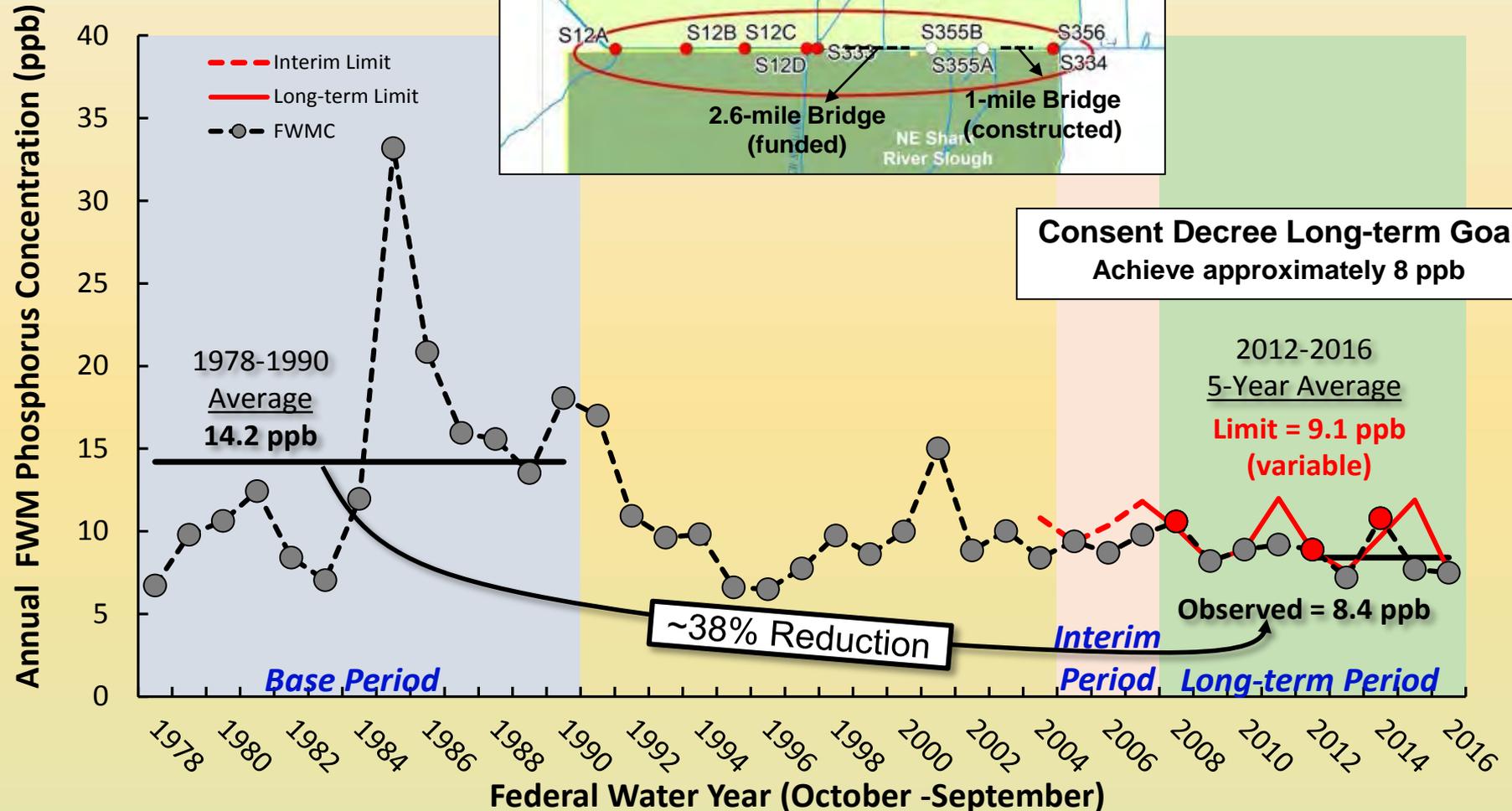
Water Year 2016

- Unimpacted 15 stations
 - All 4 parts of compliance test met
 - Average geometric mean 5 ppb
- Impacted 3 stations
 - 2 stations met annual individual test
 - Average geometric mean 15 ppb

TP values represent the 5-year average of annual geometric means at each station
ppb – parts per billion

State Phosphorus Rule

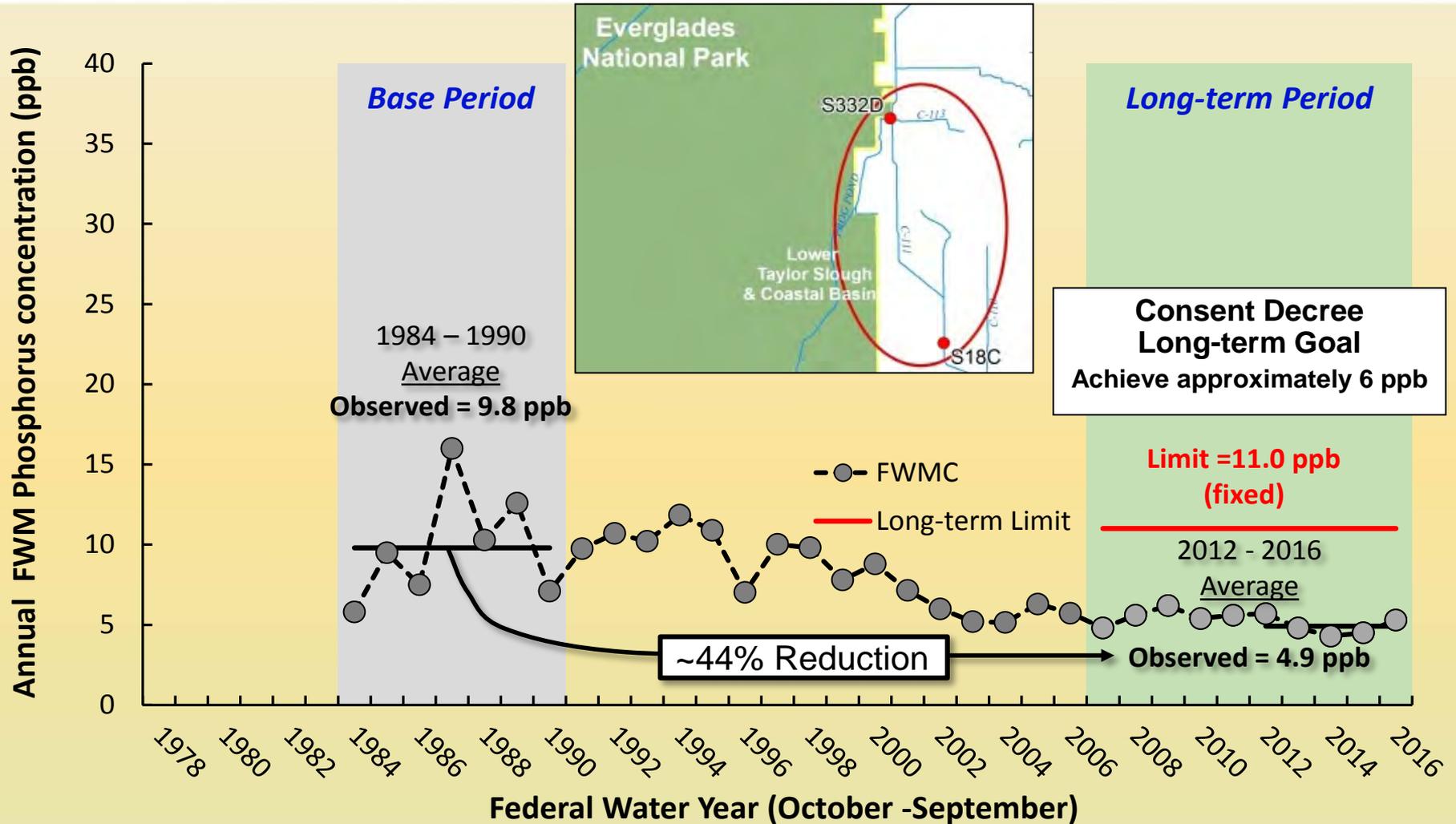
Everglades National Park - Shark River Slough Inflow Phosphorus Improvement



FWMC – flow weighted mean concentration
 Note: The laboratory margin of error is +/- 2 ppb

Federal Consent Decree, Appendix A

ENP – Taylor Slough and Coastal Basins Inflow Phosphorus Improvement



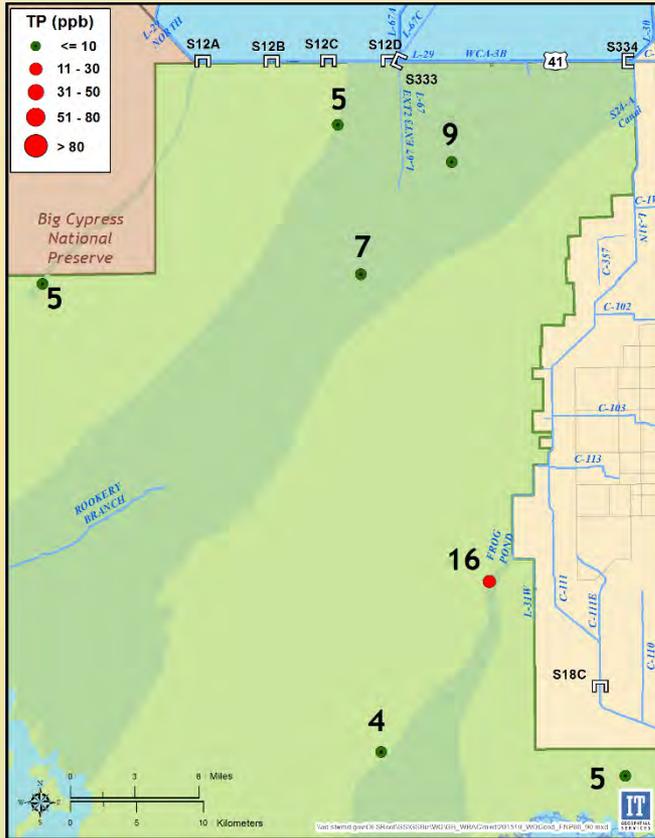
ENP – Everglades National Park
FWMC – flow-weighted mean concentration

Federal Consent Decree, Appendix A

Everglades National Park Marsh Phosphorus Improvement

WY1986-1990

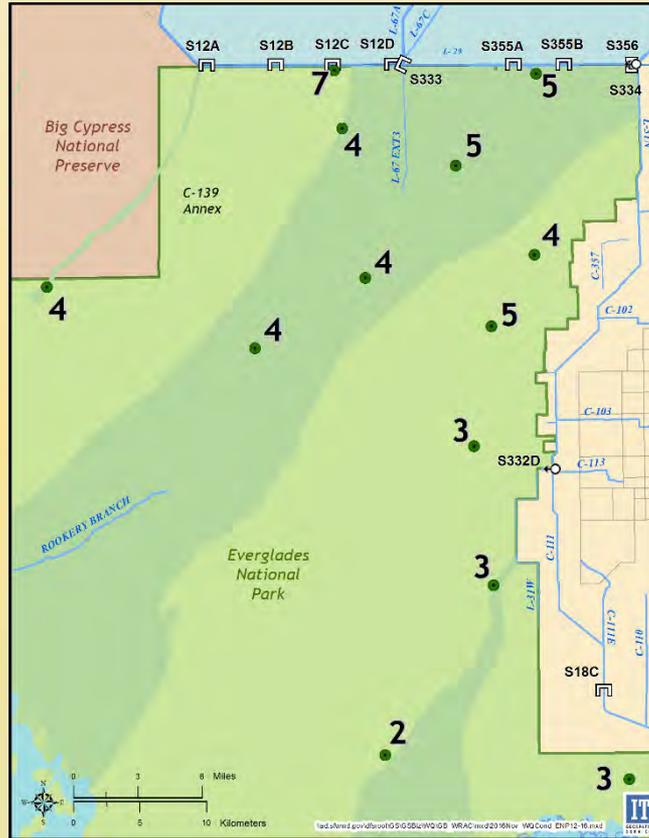
86% of stations ≤ 10 ppb



Mean of all 7 stations: 7 ppb

WY2012-2016

100% of stations ≤ 10 ppb



Mean of all 13 P-Rule stations: 4 ppb

Water Year 2016

- Unimpacted
13 stations
 - All 4 parts of default compliance test met
 - Average geometric mean 4 ppb
- No Impacted stations

TP values represent the 5-year average of annual geometric means at each station
ppb – parts per billion

State Phosphorus Rule (Default)

Phosphorus in the Everglades Watershed WY2012 to WY2016

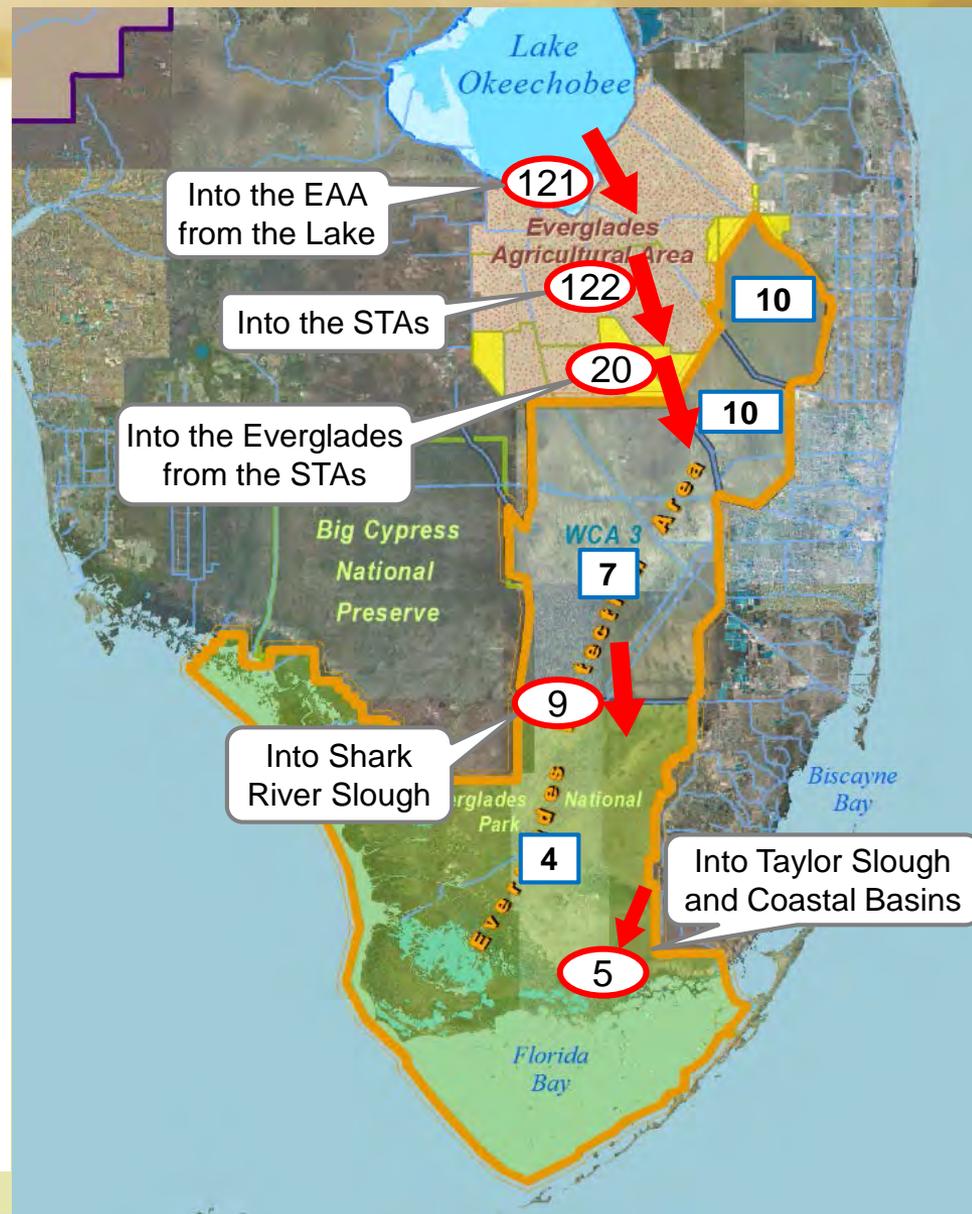
Current Condition

○ Flow-weighted mean TP concentrations in discharge decrease from North to South

□ Water Conservation Areas and Everglades National Park marshes at or below 10 ppb

- Overall average of “Impacted” and “Unimpacted” for State P-Rule network

90% of Everglades (EPA) is meeting or exceeding 10 ppb





Discussion