

Water Year 2016: Southern Everglades Water Quality Overview

Water Resources Advisory Commission
South Florida Water Management District

November 3, 2016

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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

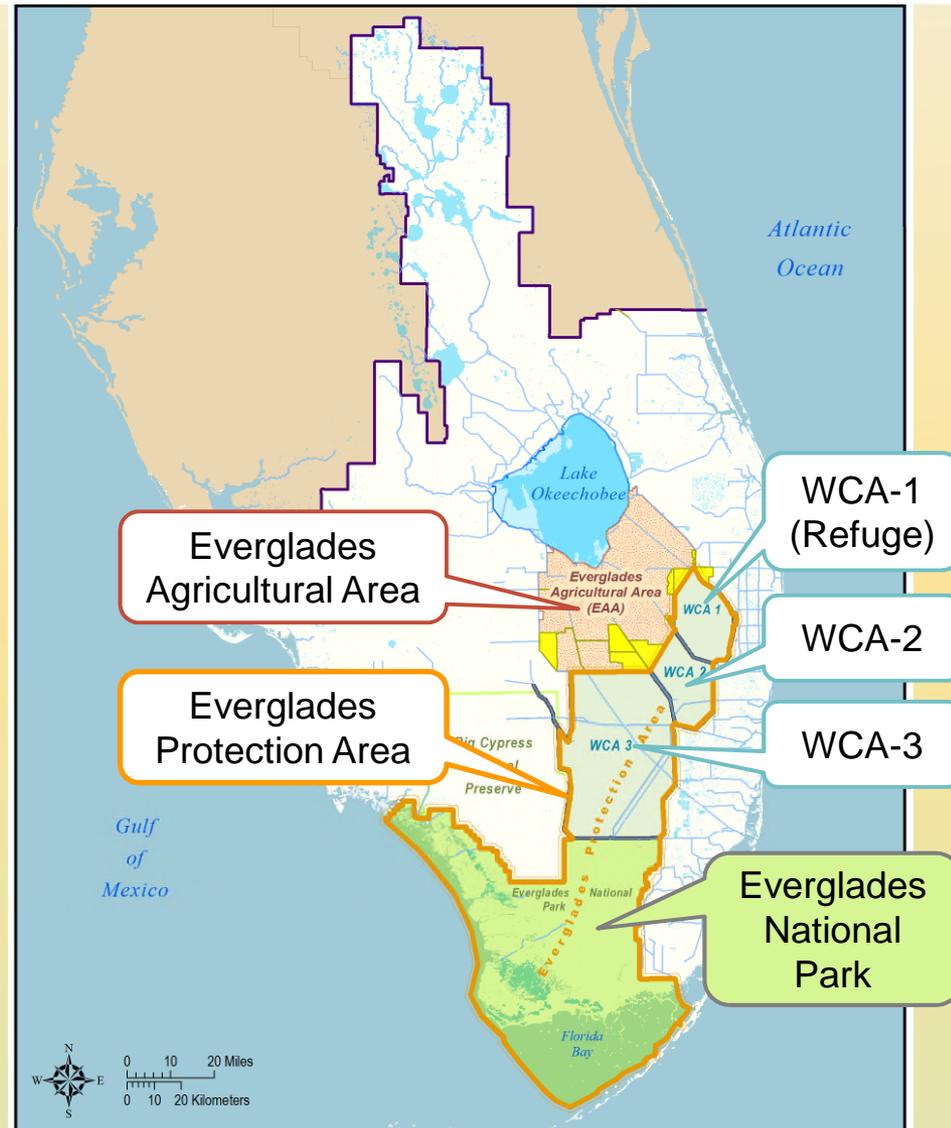
State Everglades Forever Act Ch. 373.4592, F.S.

- **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

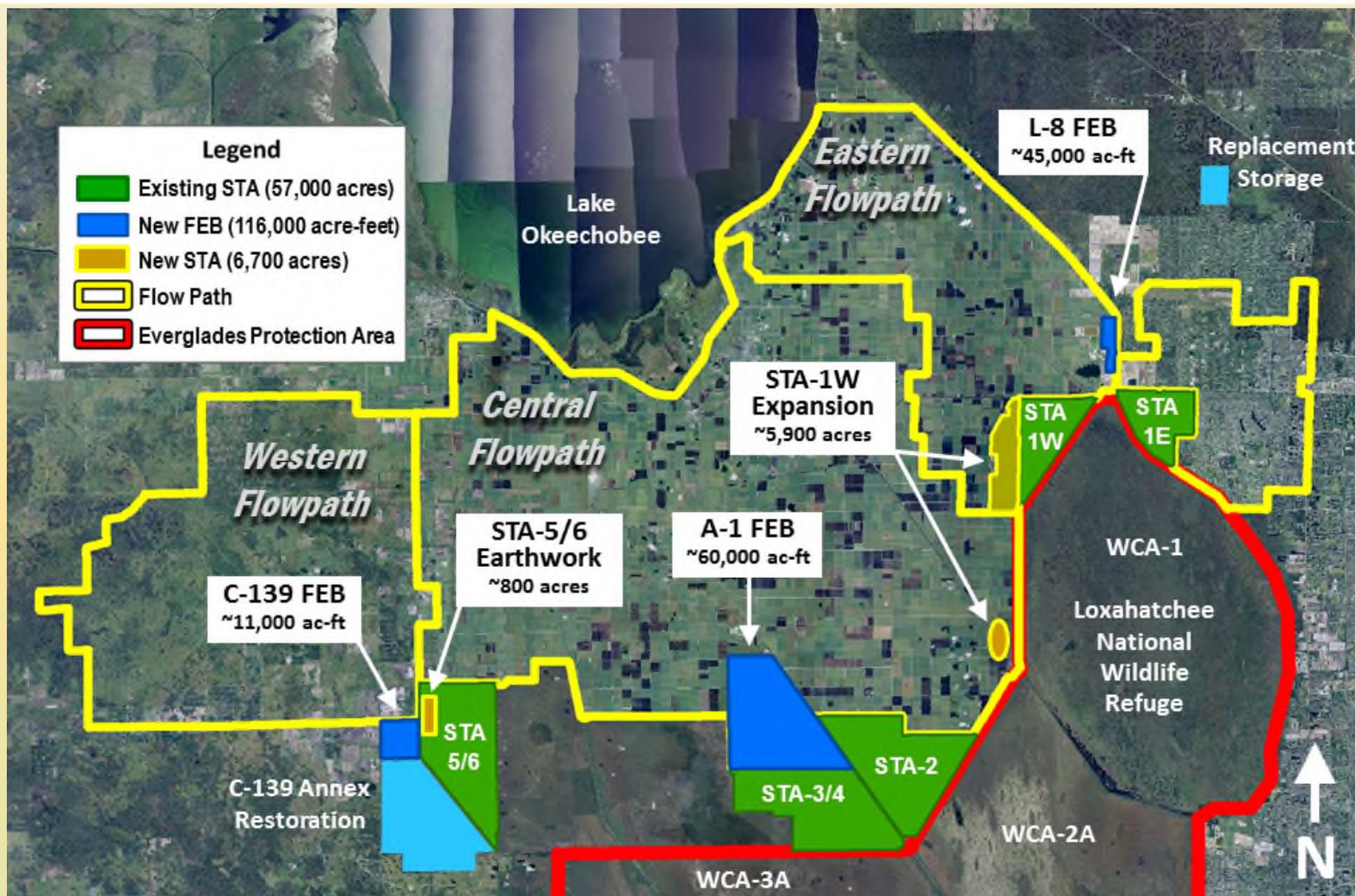
Phosphorus Inflows and Marsh Levels

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)

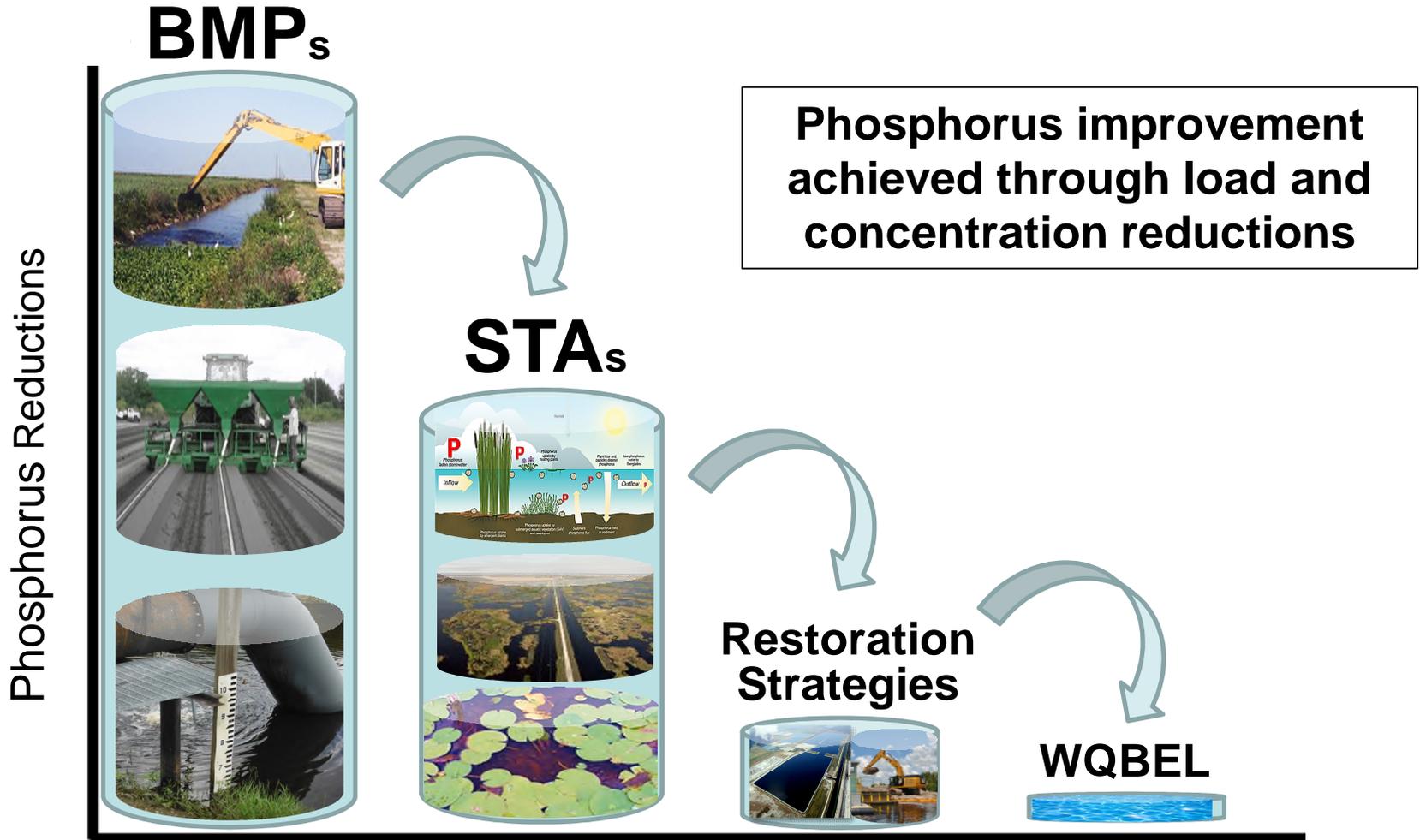


Phosphorus Controls Upstream of Water Conservation Areas



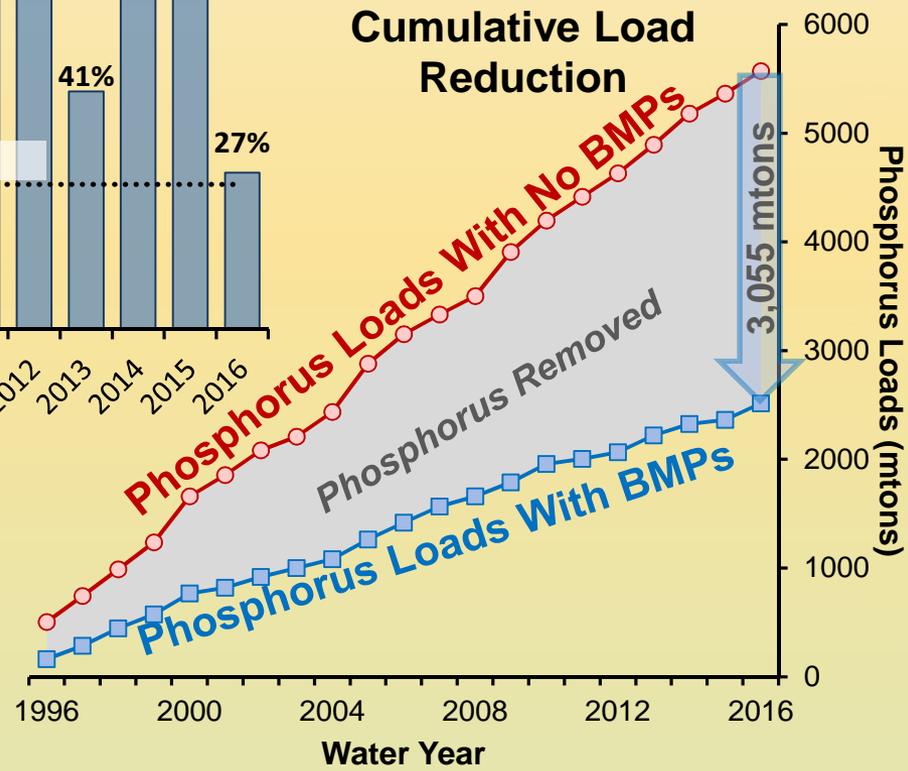
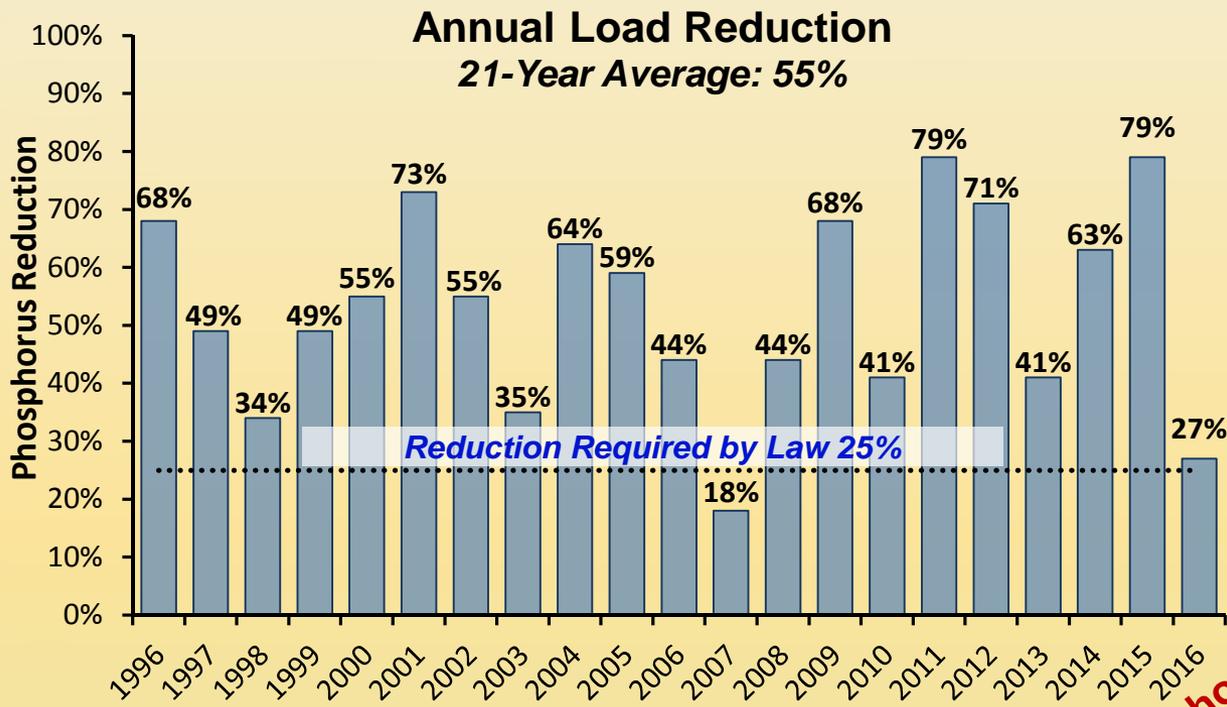
STA – Stormwater Treatment Area; FEB – Flow Equalization Basin

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



Water Quality Improvement Measures

Everglades Agricultural Area Phosphorus Load Reduction Achieved with BMPs

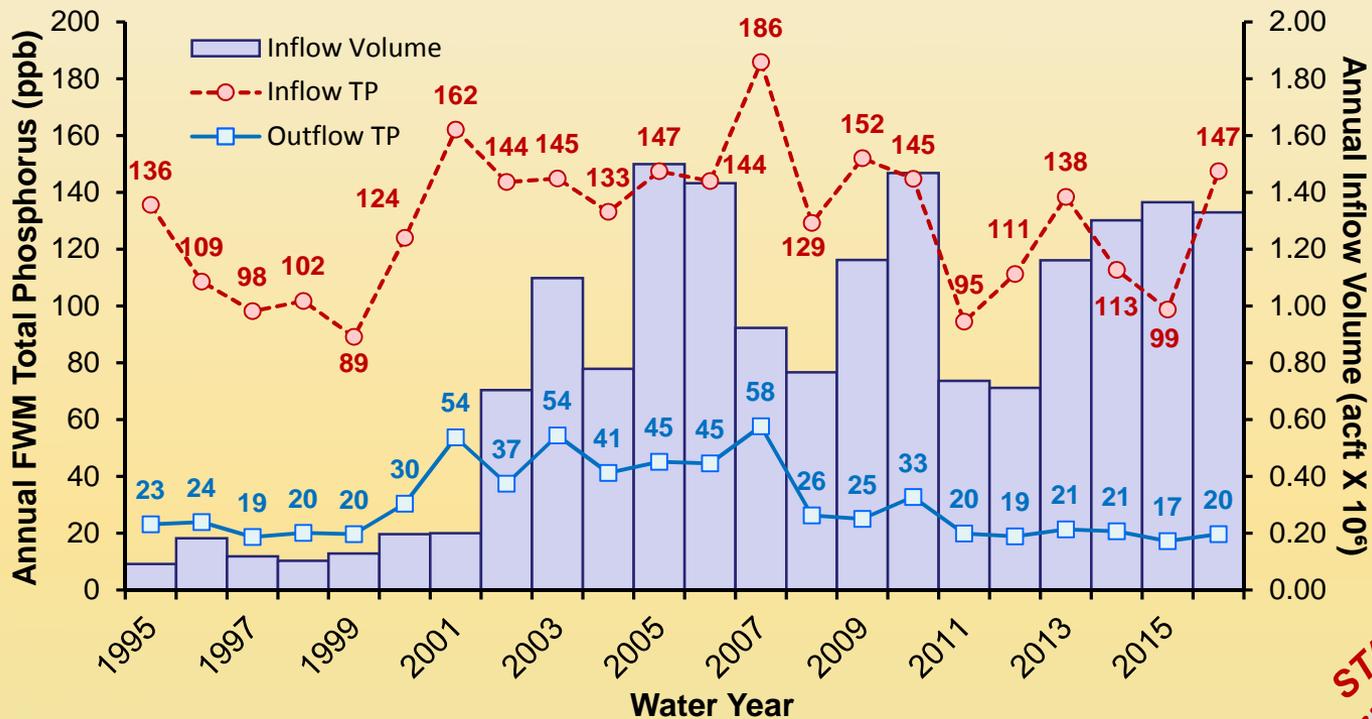


Best Management Practices prevented 3,055 metric tons of phosphorus from leaving the EAA

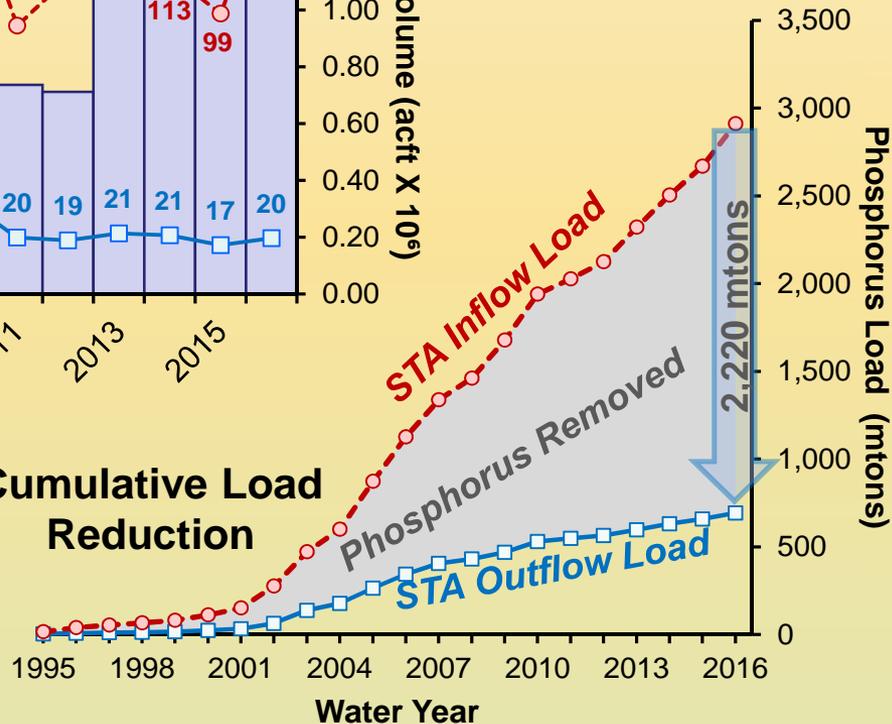
mtons – metric tons = 1,000 kilograms

Everglades Stormwater Treatment Areas Phosphorus Concentration & Load Reductions

Annual Concentration Trend



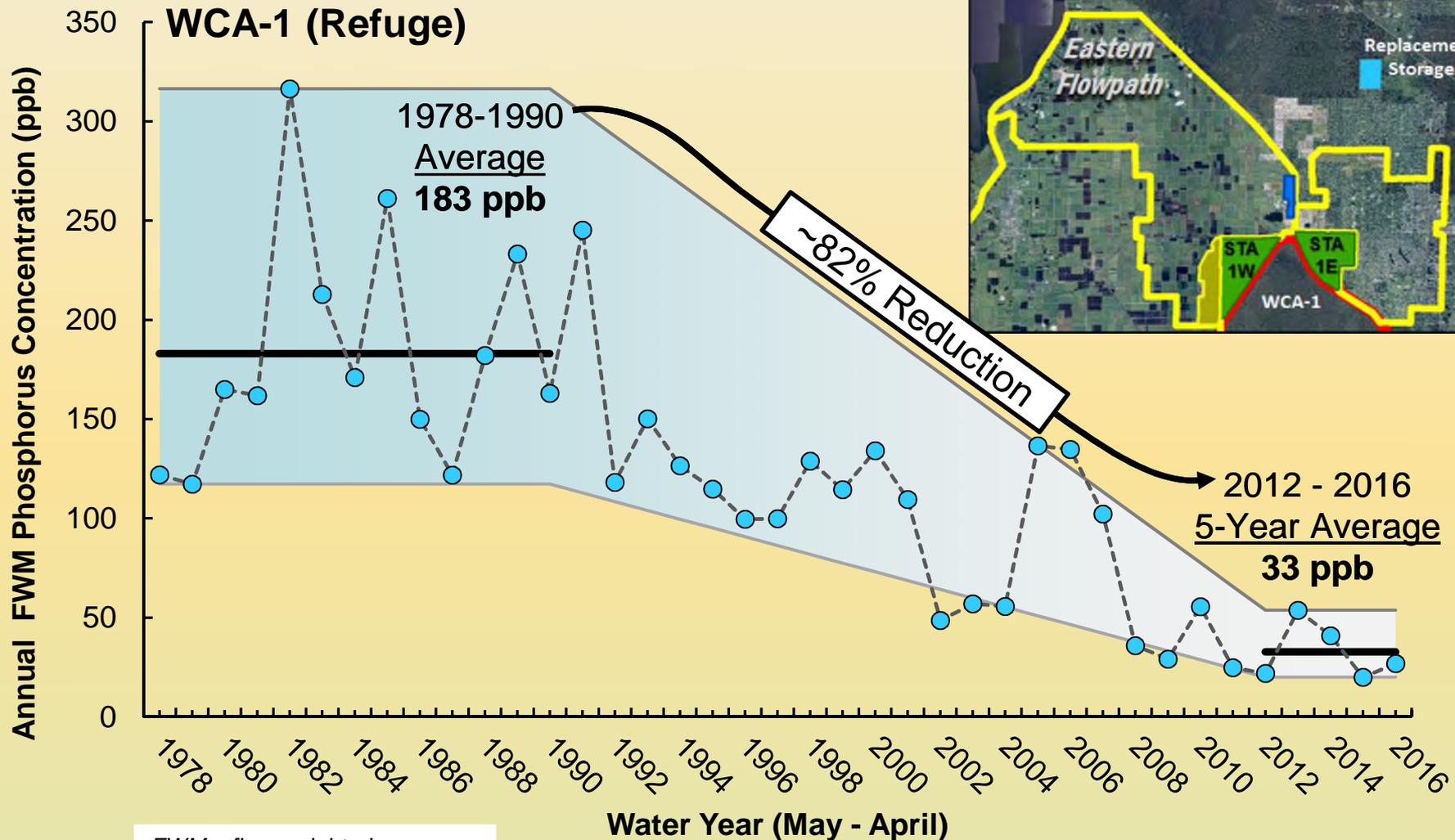
Cumulative Load Reduction



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

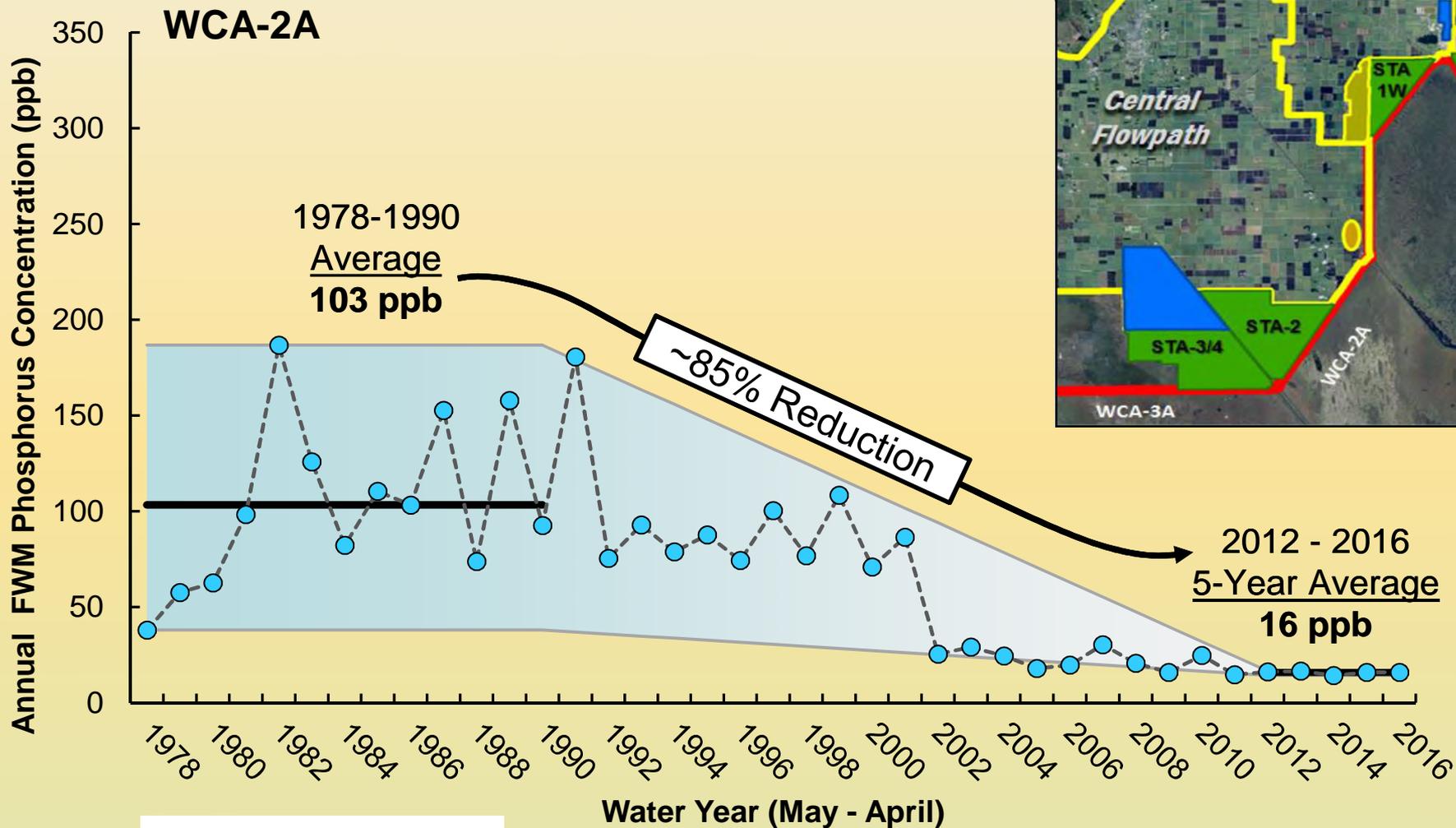
FWM – flow weighted mean
 ppb – parts per billion; acft – acre feet
 mtons – metric tons = 1,000 kilograms

Water Conservation Area 1 (Refuge) Inflow Phosphorus Improvement



FWM – flow weighted mean
ppb – parts per billion

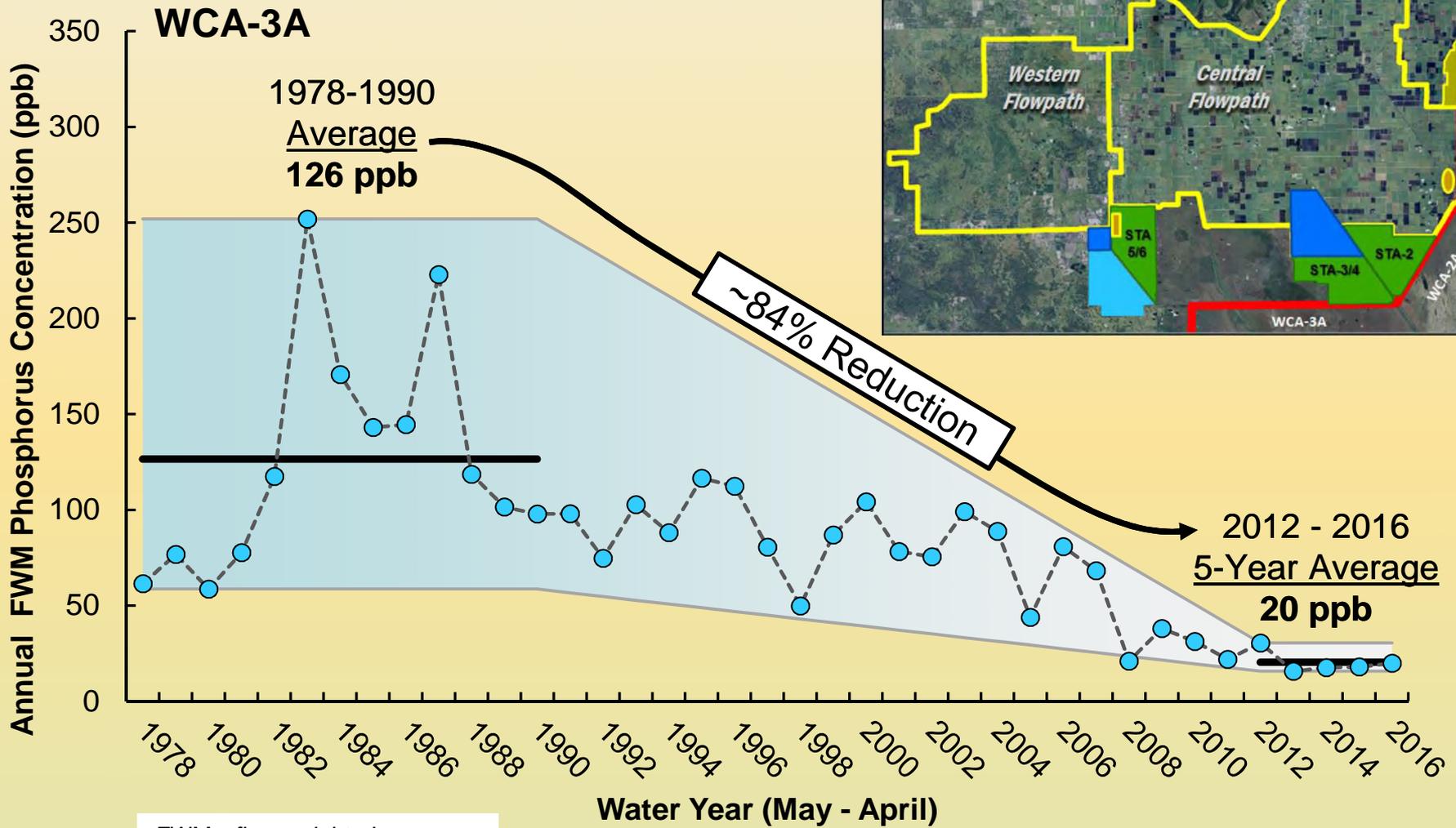
Water Conservation Area 2A Inflow Phosphorus Improvement



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

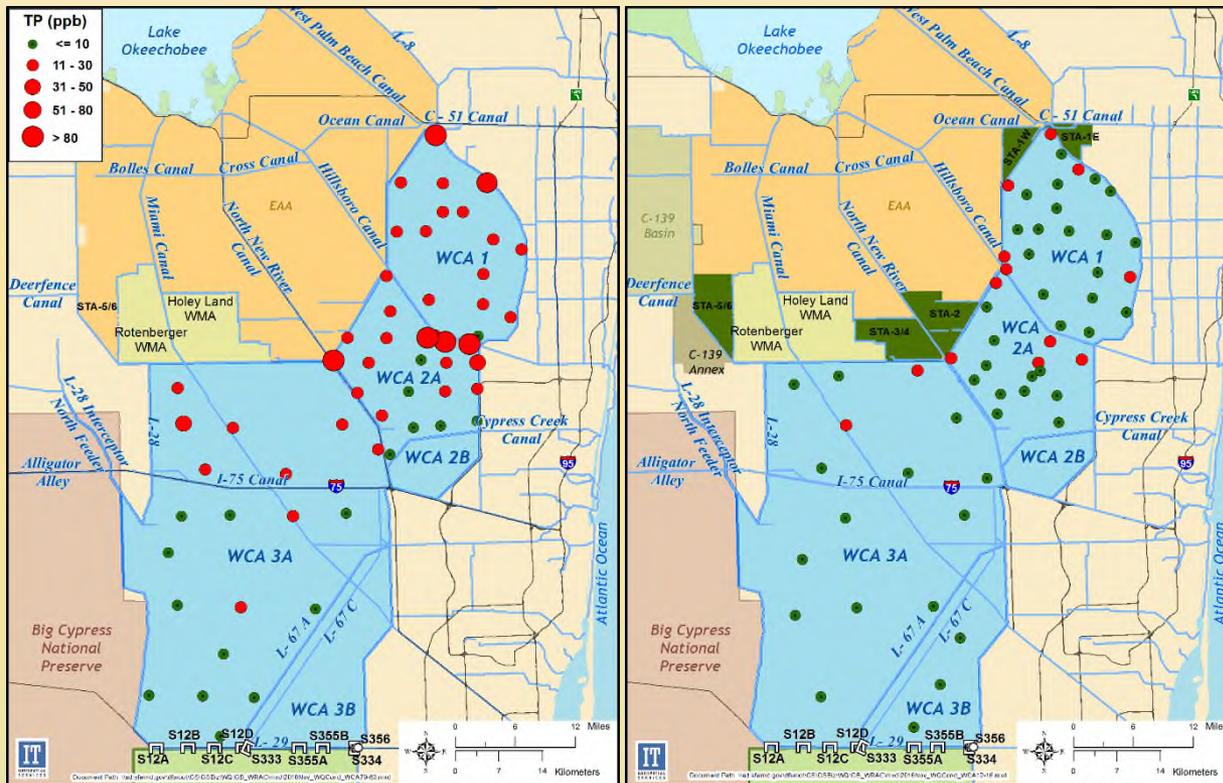
Long-Term Criterion	Applied to	Test
5-year Average	All Stations GM	≤ 10 ppb
3 of 5 years	All Stations GM	≤ 10 ppb
Annual	All Stations GM	≤ 11 ppb
Annual	Individual GM	≤ 15 ppb

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

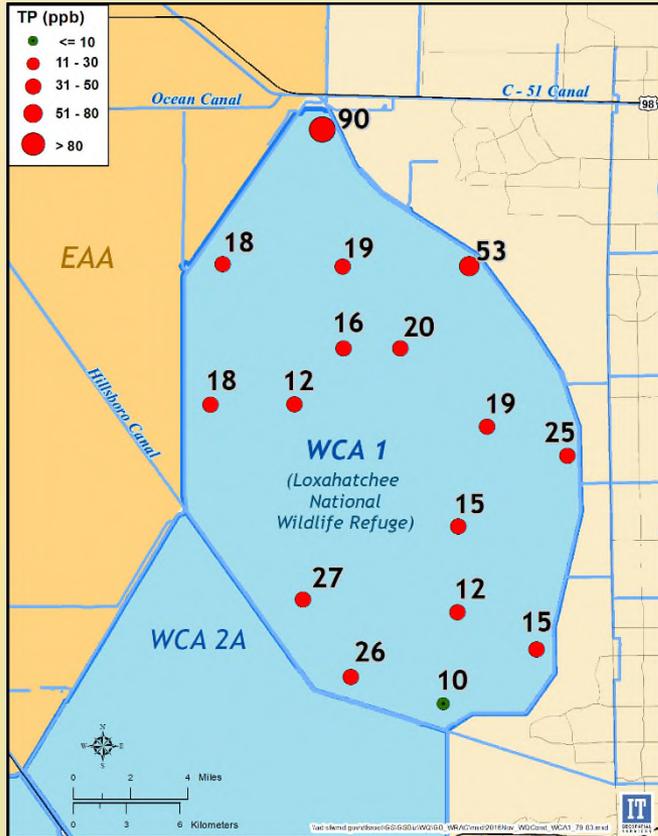
TP values represent the 5-year average of annual geometric means at each station
ppb – parts per billion



Water Conservation Area 1 (Refuge) Marsh Phosphorus Improvement

WY1979-1983

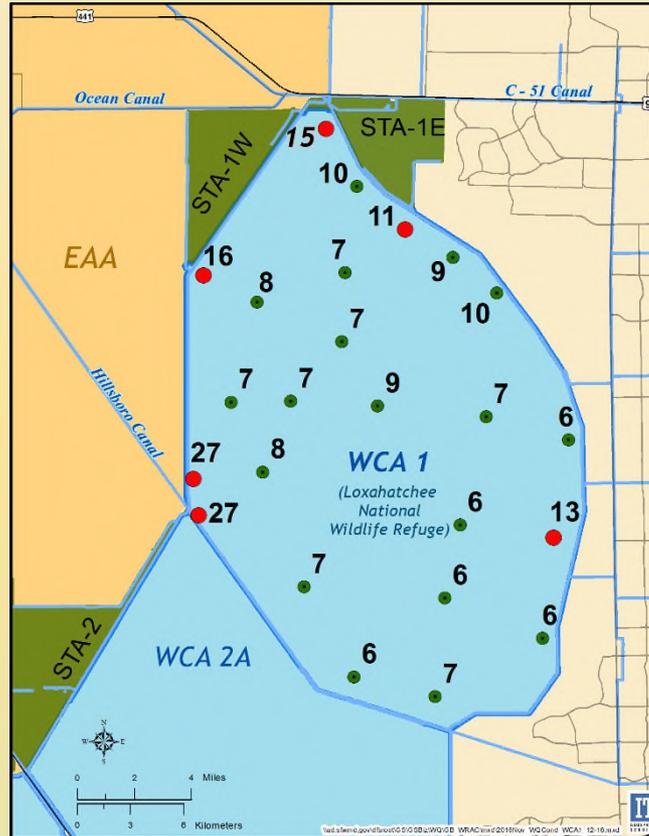
6% of stations ≤ 10 ppb



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)

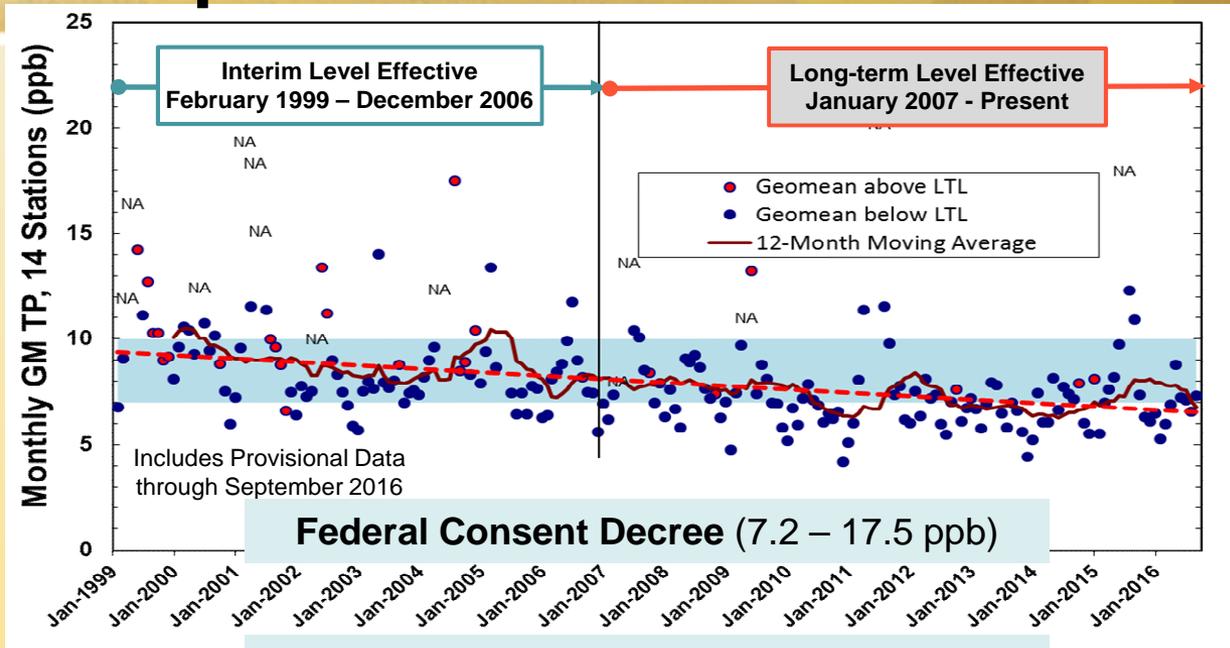
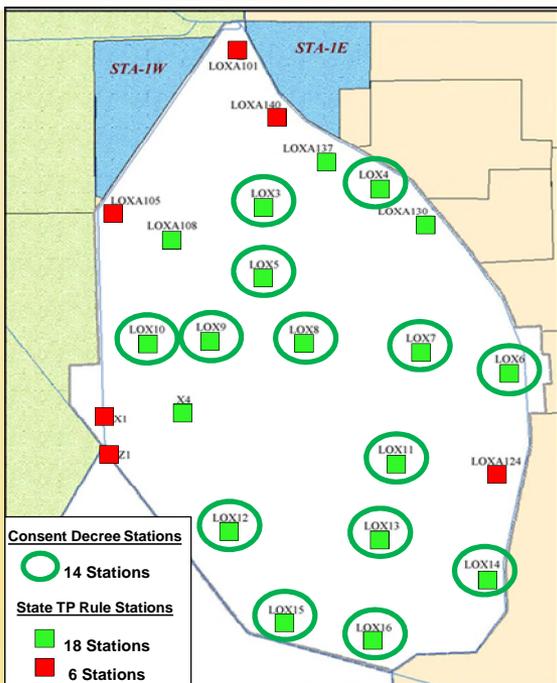
Water Year 2016

- 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



Actual 14-station geometric mean downward trend:

1999 (Feb-Dec) geometric mean >10 ppb
 2016 (Jan-Sep) geometric mean < 7 ppb

Monthly TP averages for 5-yrs (Oct 2012-Sep 2016):

~ 95% of months below level by 3.7 ppb
 ~ 5% of months above level by 0.4 ppb

Exceedance Event TP Differences in ppb

	Actual	Long-term Level	Difference
2008 Nov	7.4	7.2	0.2
2009 Jun	13.2	12.1	1.1
2014 Oct	7.9	7.2	0.7
2015 Jan	8.1	7.9	0.2

Avg 0.8 ppb

Note: Two monthly Excursions in 12-month period result in an Exceedance of long-term compliance level.

Water Conservation Area 2 Marsh Phosphorus Improvement

WY1979-1983

29% of stations ≤ 10 ppb

WY2012-2016

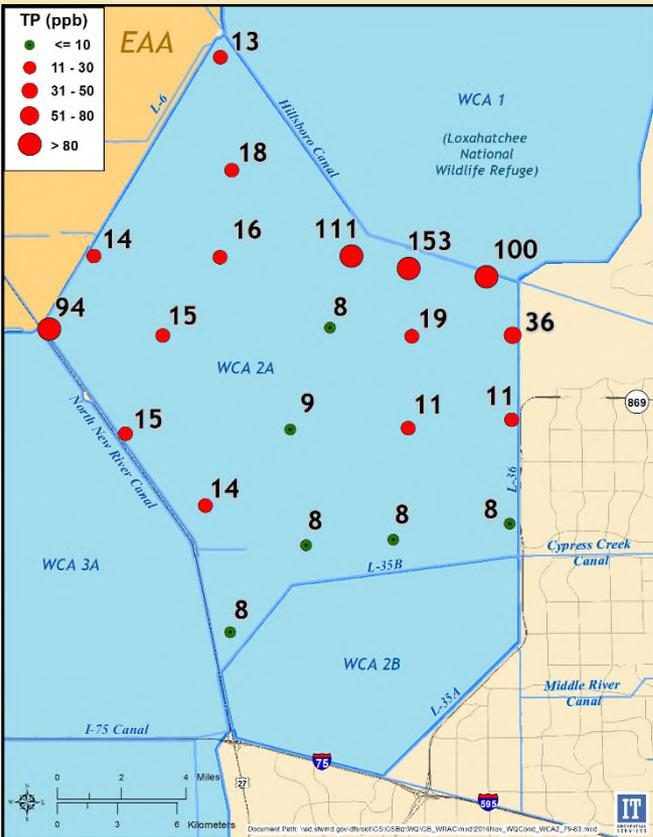
All sites significantly improved
62% of stations ≤ 10 ppb

Water Year 2016

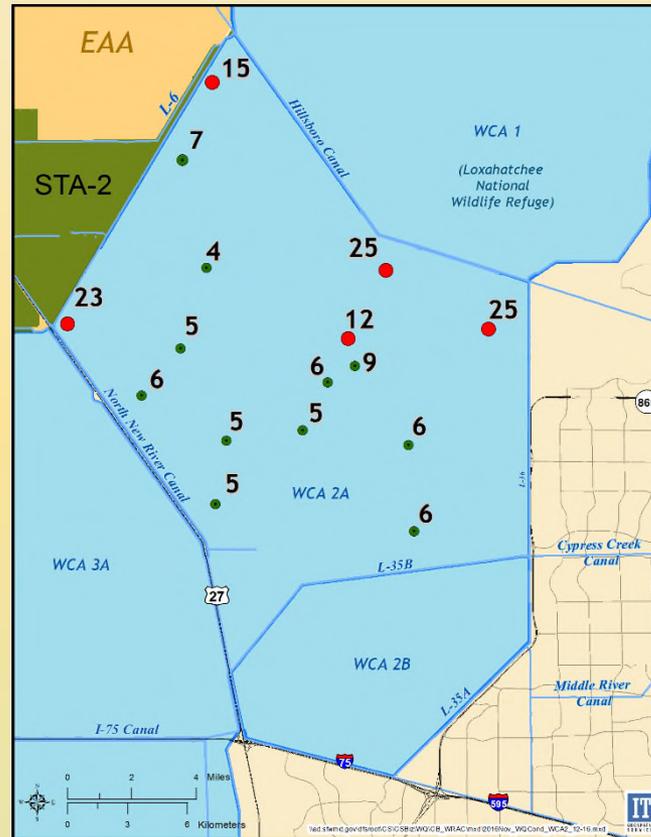
- Unimpacted 11 stations
 - All 4 parts of compliance test met
 - Average geometric mean 6 ppb
- Impacted 5 stations
 - 1 station met annual individual test
 - Average geometric mean 20 ppb

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

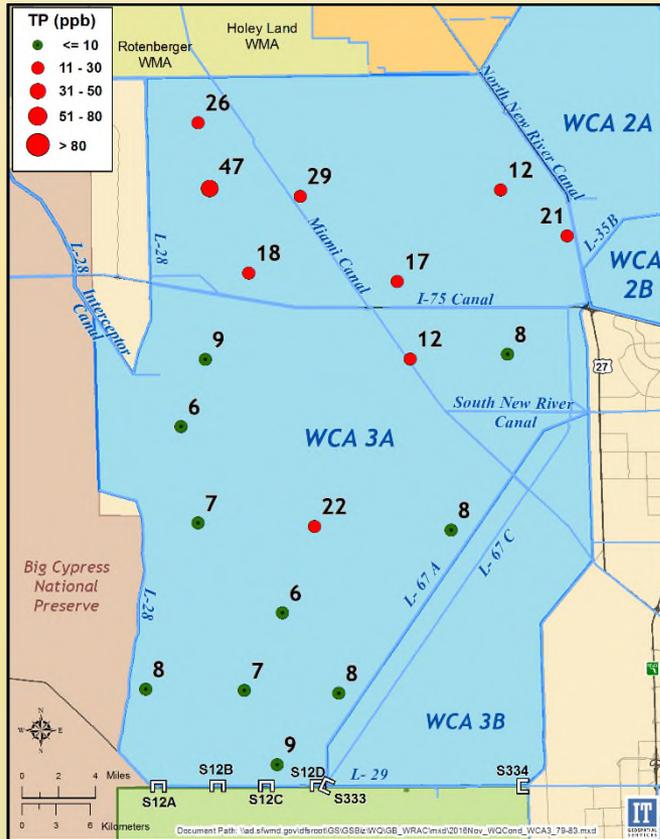


Mean of all 16 P-Rule stations: 10 ppb

Water Conservation Area 3 Marsh Phosphorus Improvement

WY1979-1983

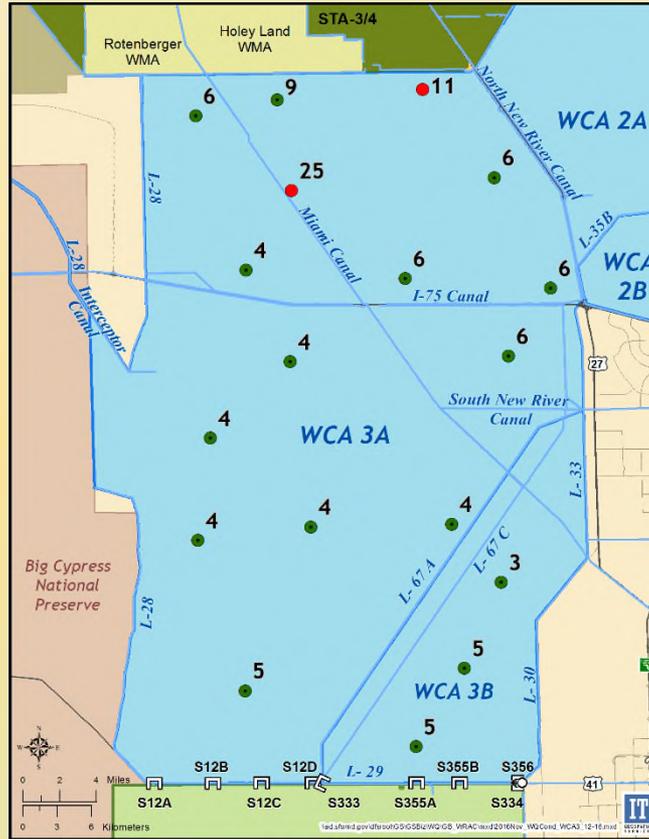
55% of stations \leq 10 ppb



Mean of all 20 stations: 15 ppb

WY2012-2016

89% of stations \leq 10 ppb



Mean of all 18 P-Rule stations: 7 ppb

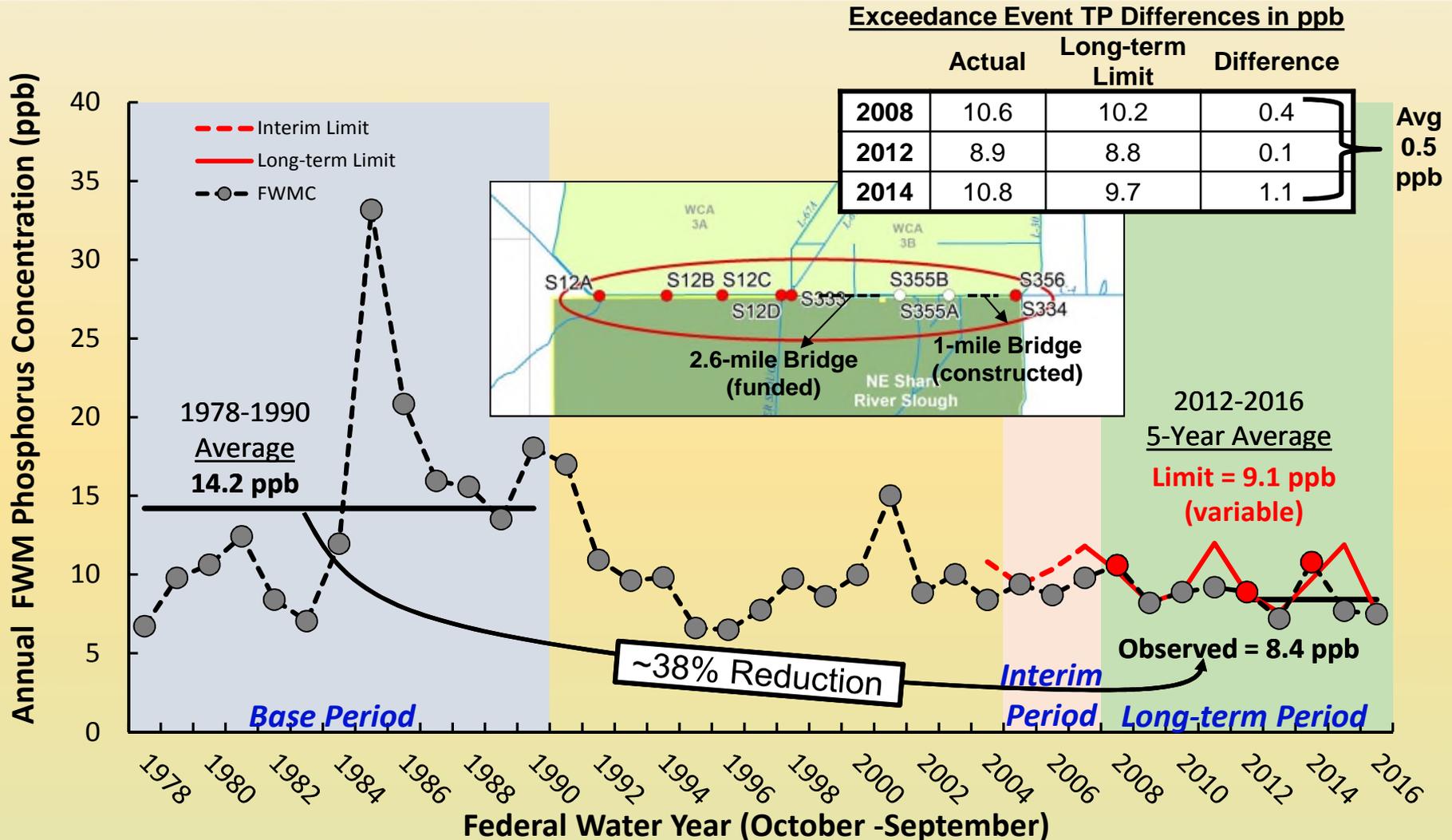
Water Year 2016

- 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

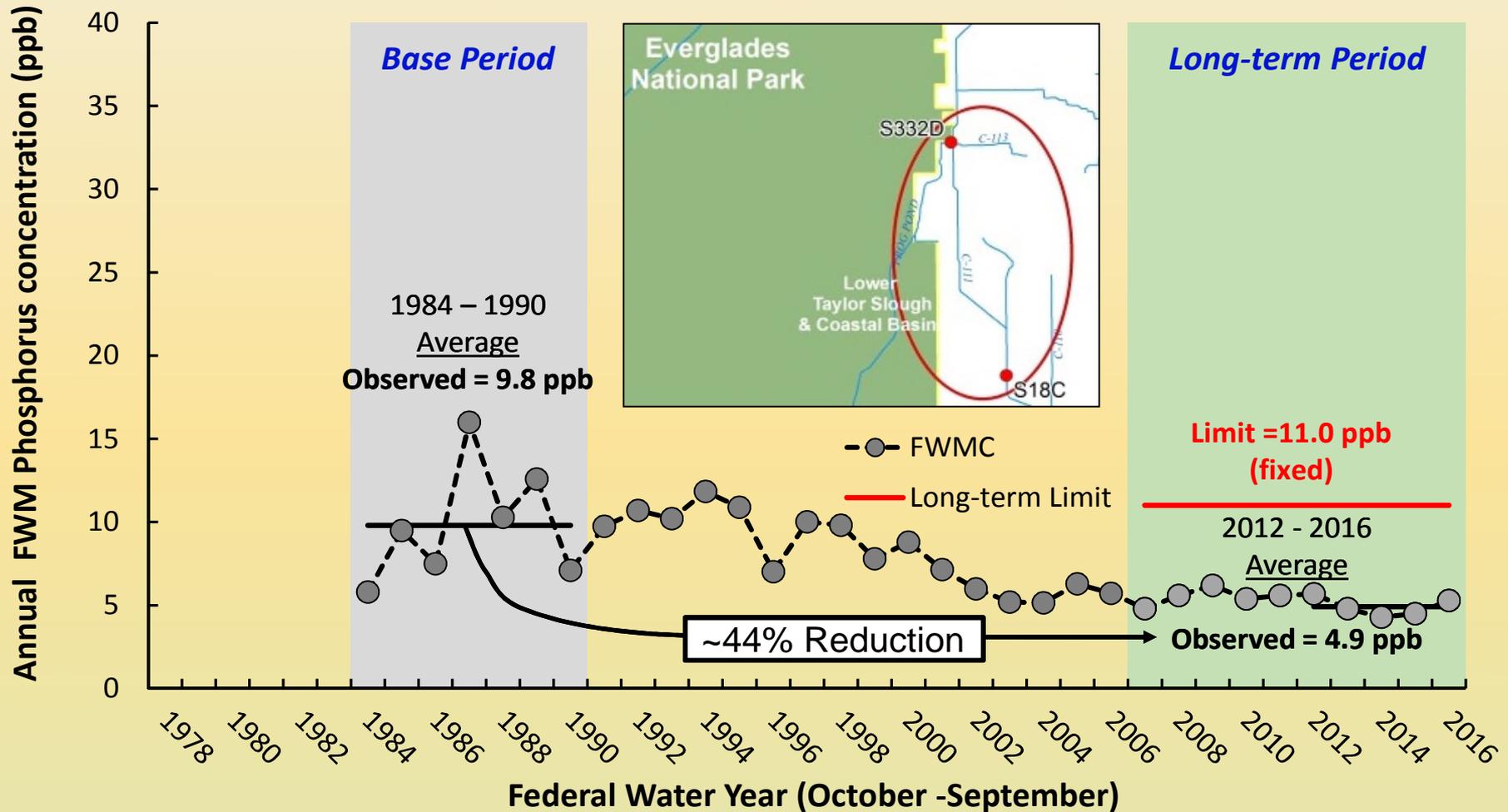
TP values represent the 5-year average of annual geometric means at each station
ppb – parts per billion

State Phosphorus Rule

Everglades National Park - Shark River Slough Inflow Phosphorus Improvement



ENP – Taylor Slough and Coastal Basins Inflow Phosphorus Improvement



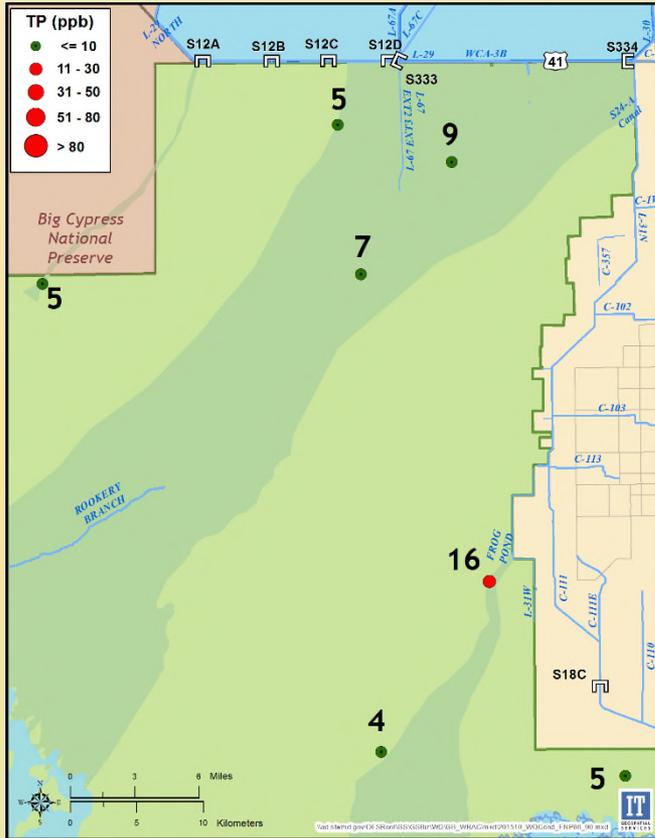
ENP – Everglades National Park
 FWMC – flow-weighted mean concentration

Federal Consent Decree, Appendix A

Everglades National Park Marsh Phosphorus Improvement

WY1986-1990

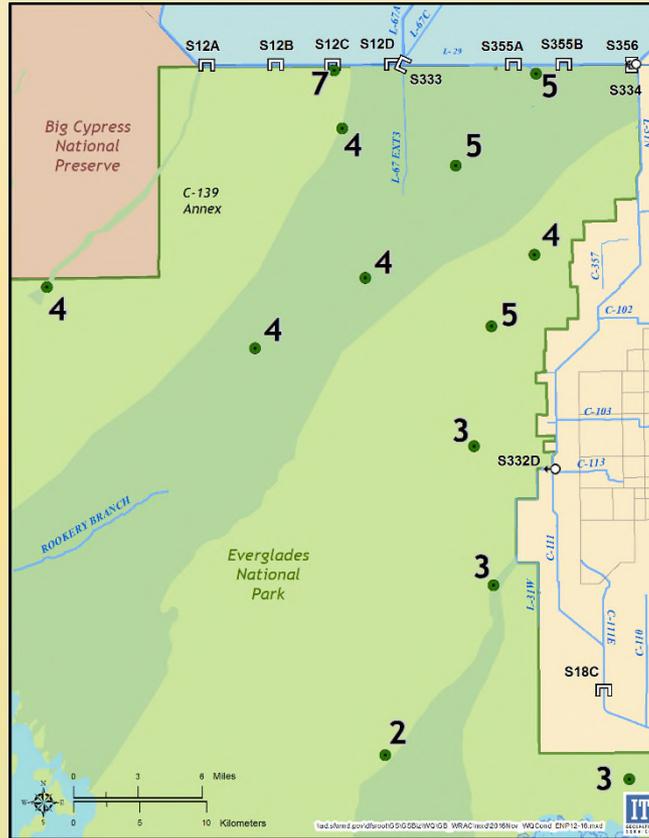
86% of stations ≤ 10 ppb



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

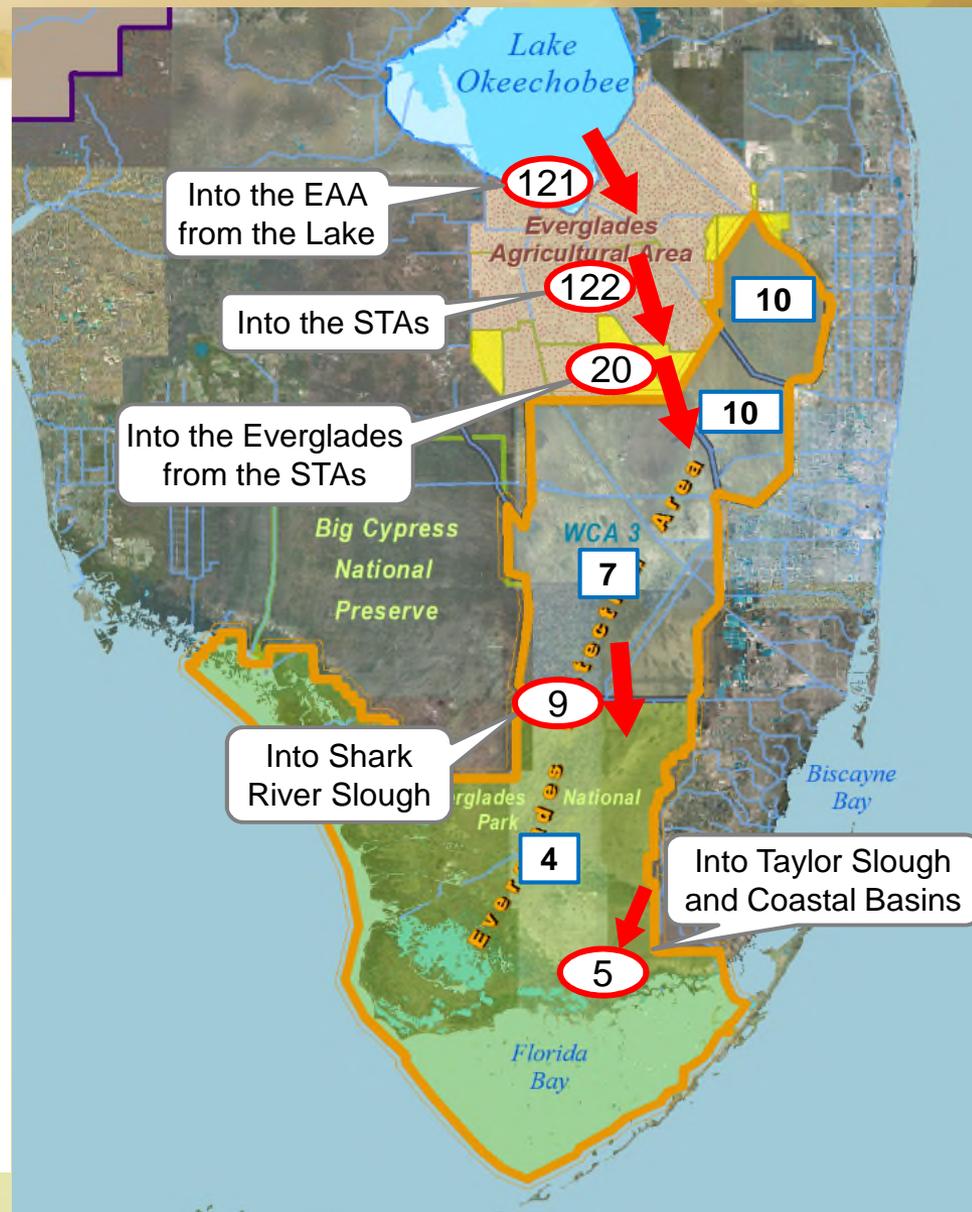
State Phosphorus Rule (Default)

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



An aerial photograph of a vast wetland or marsh area. The landscape is a mosaic of dark, reflective water and numerous small, irregular islands of lush green vegetation. The water appears to be shallow and still, mirroring the sky. The vegetation consists of dense, low-lying plants, likely mangroves or similar wetland species. The overall scene is a complex, textured expanse of natural habitat.

Discussion