Phosphorus Dynamics in Stormwater Treatment Areas: Changes in Phosphorus Forms and Concentrations from Inflow to Outflow

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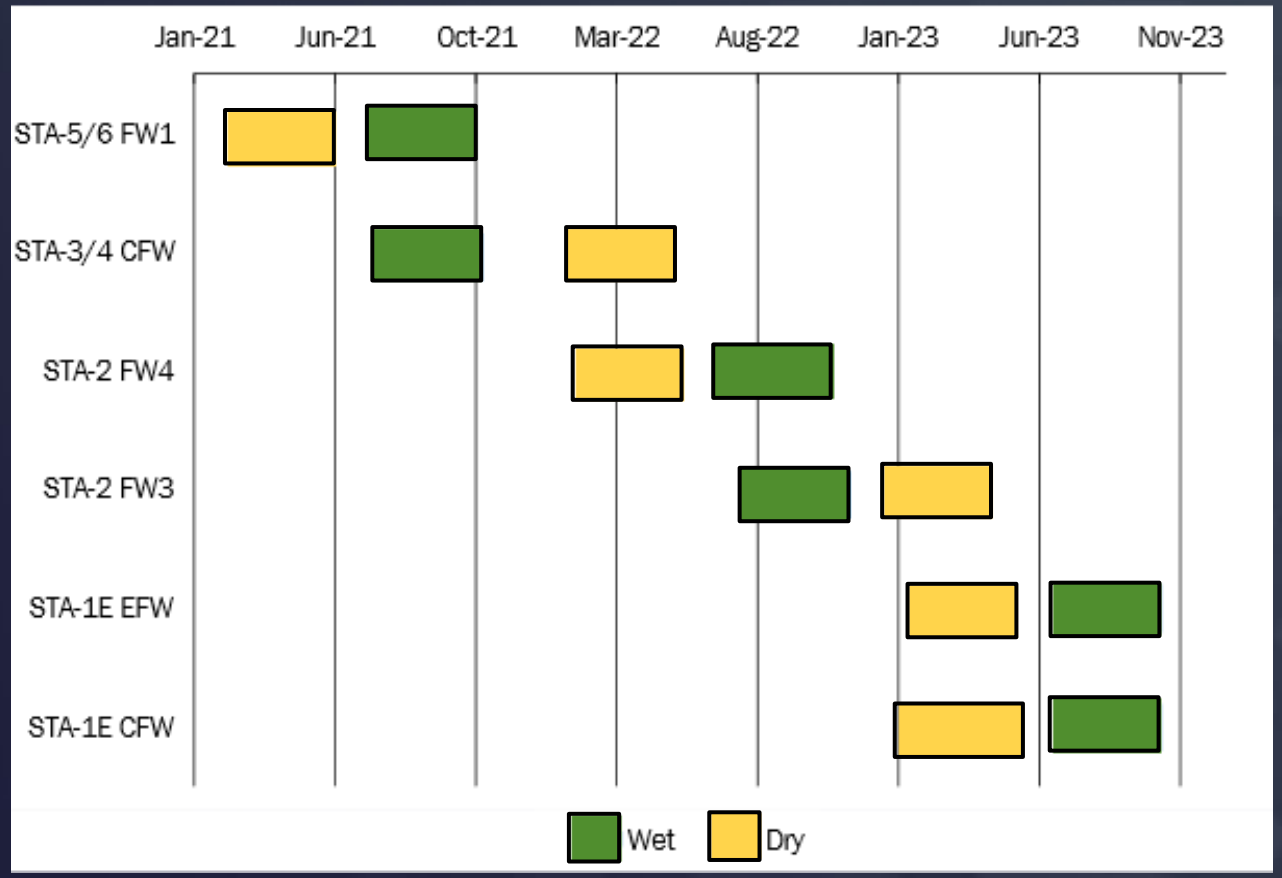
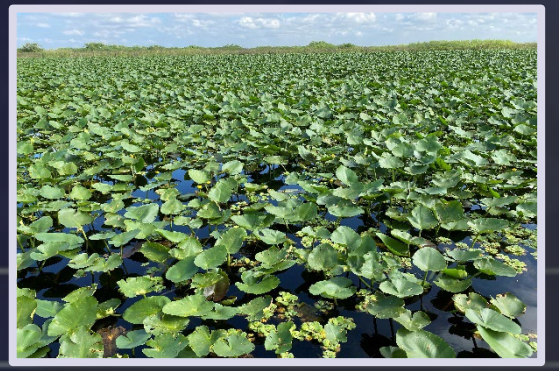
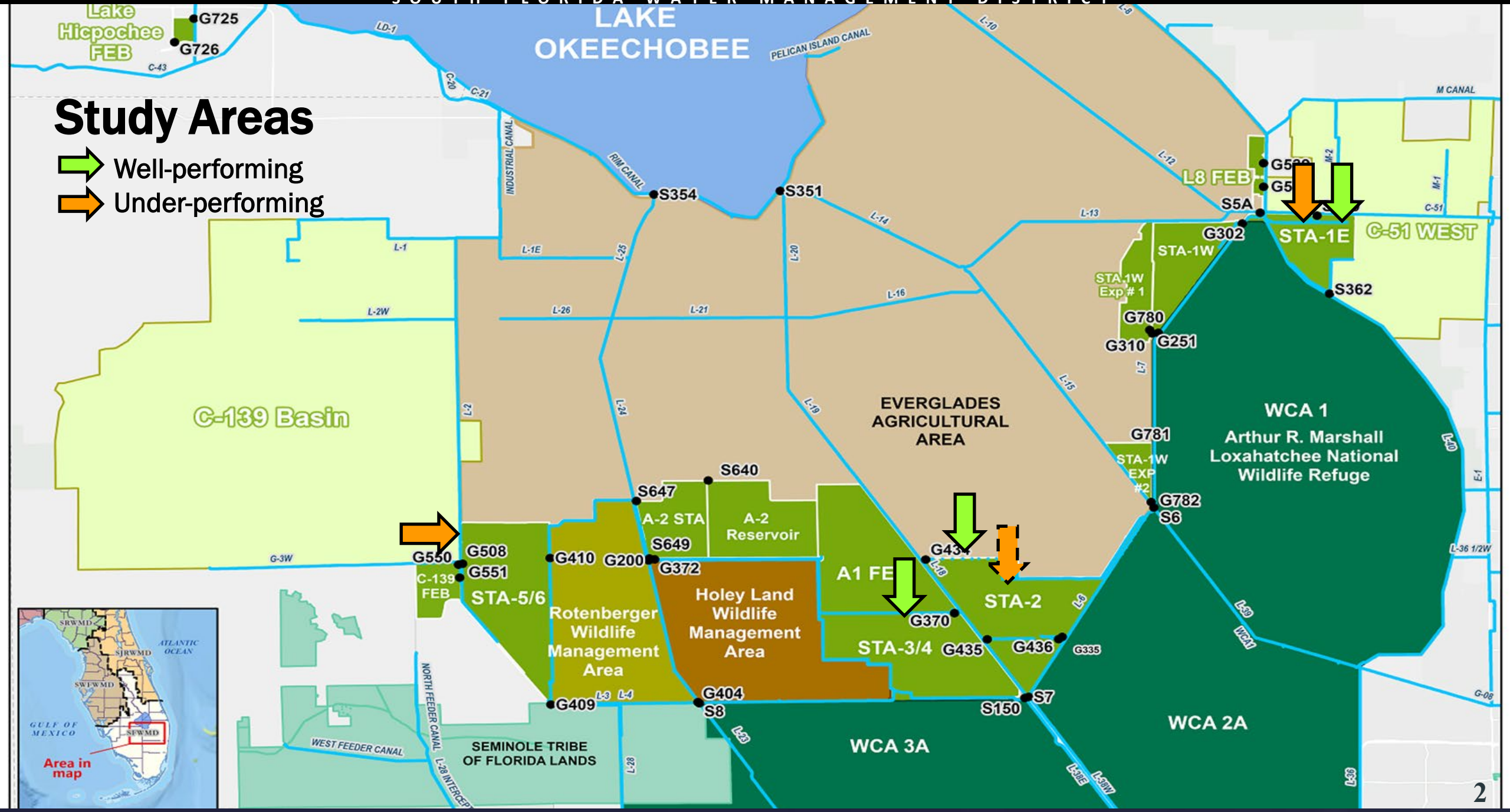
Water Quality Treatment Technologies Section

Study Objectives

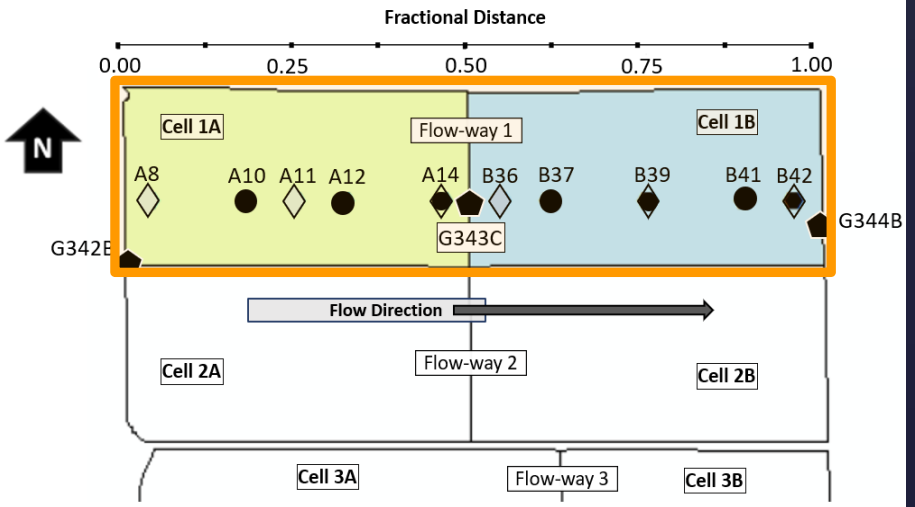
- Evaluate mechanisms and factors influencing outflow TP concentrations under normal, seasonal operations
- Evaluate changes in water column P concentration and P speciation along variable & under performing flow-ways
- Compare mechanisms and processes affecting outflow TP concentrations of well-performing and underperforming STA FWs



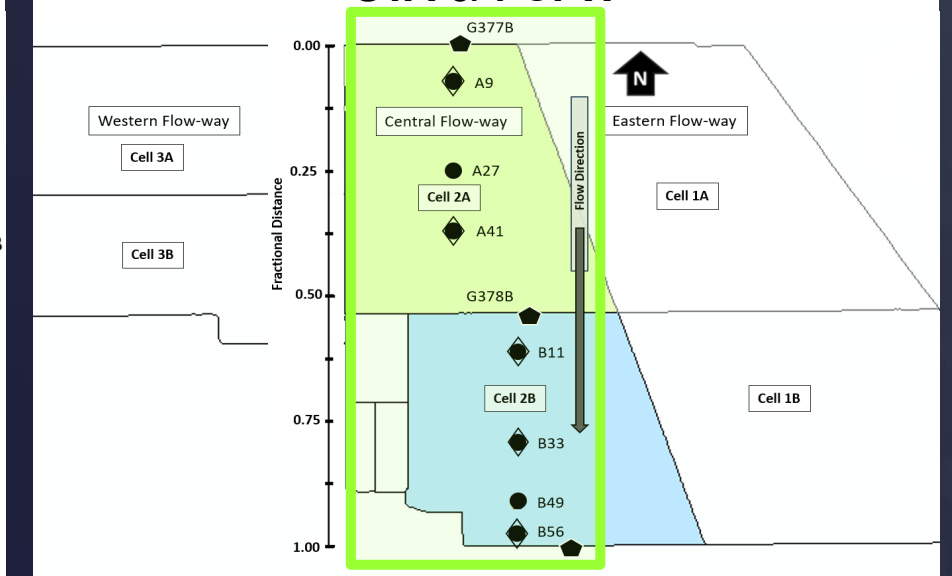



Study Areas
Well-performing
Under-performing
Lake Hicpochee FEB
G725
G726
LAKE OKEECHOBEE
PELICAN ISLAND CANAL
INDUSTRIAL CANAL
RIM CANAL
S354
S351
L8 FEB
S5A
G302
STA-1E
C-51 WEST
STA-1W
STA 1W Exp # 1
S362
G780
G310
G251
C-139 Basin
EVERGLADES AGRICULTURAL AREA
WCA 1
Arthur R. Marshall Loxahatchee National Wildlife Refuge
G781
STA-1W EXP #2
G782
S6
S640
S647
A-2 STA
A-2 Reservoir
S649
G550
G508
G551
C-139 FEB
STA-5/6
G410
G200
G372
Rotenberger Wildlife Management Area
Holey Land Wildlife Management Area
A1 FE
G434
G370
STA-2
STA-3/4
G435
G436
G335
G404
S8
G409
S7
S150
WCA 2A
WCA 3A
SEMINOLE TRIBE OF FLORIDA LANDS
WEST FEEDER CANAL
NORTH FEEDER CANAL
Area in map
SFWMD
SJRWMD
SWFWMD
SRWMD
ATLANTIC OCEAN
GULF OF MEXICO

STA-5/6 FW1

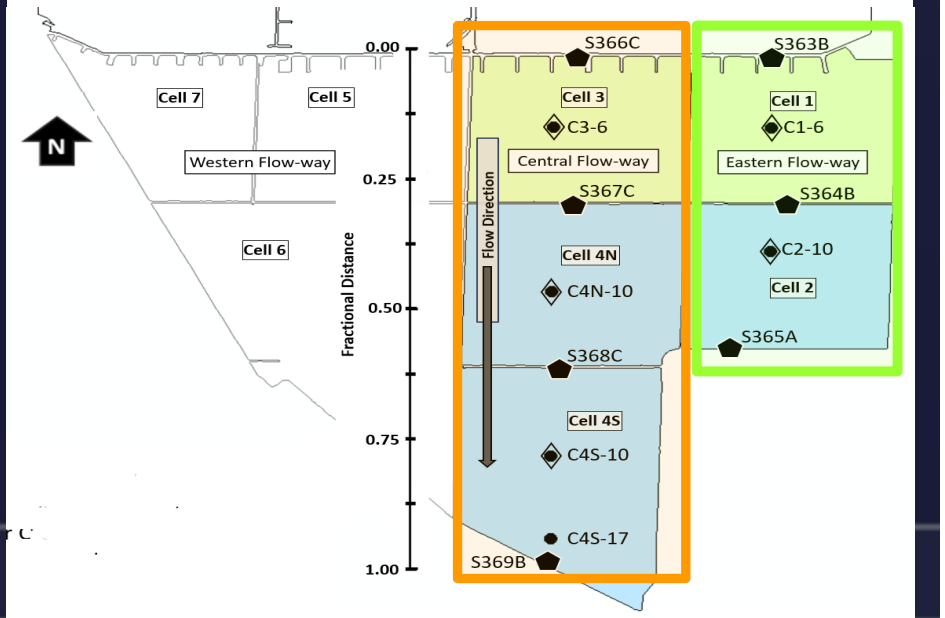


STA-3/4 CFW

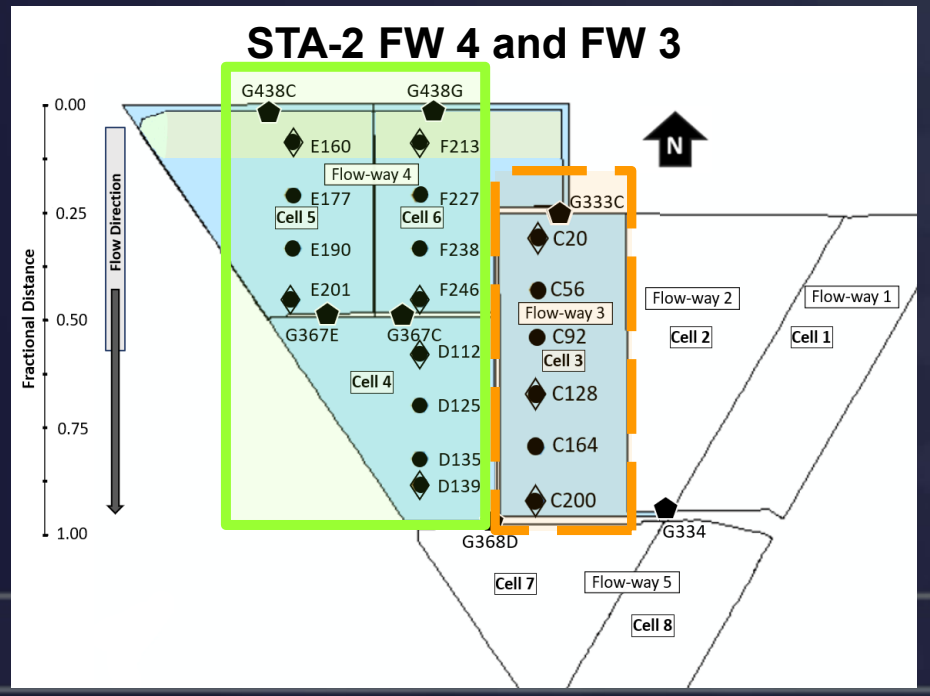


Methods

STA-1E CFW and EFW



STA-2 FW 4 and FW 3

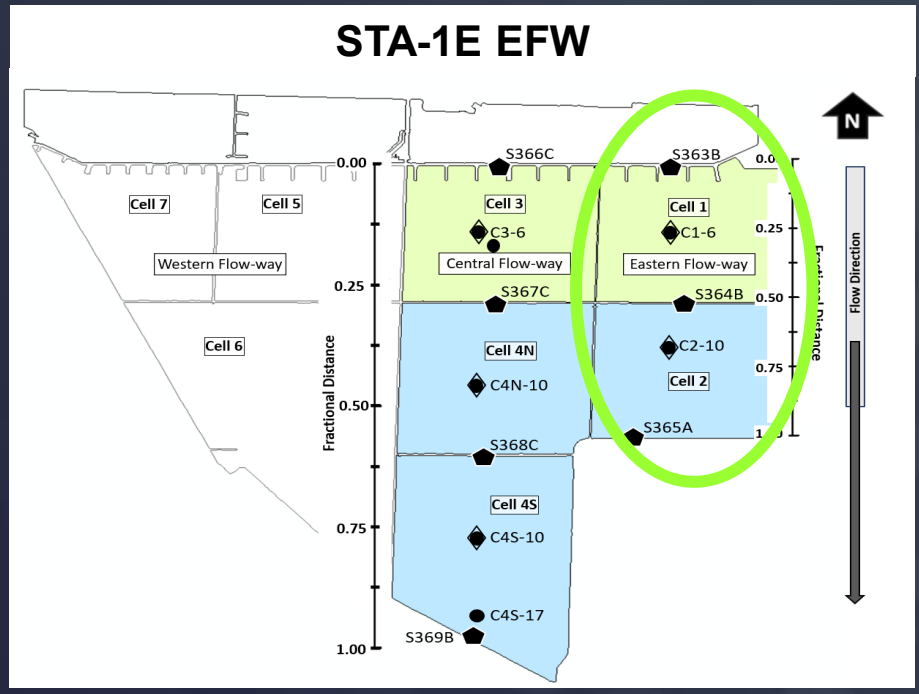


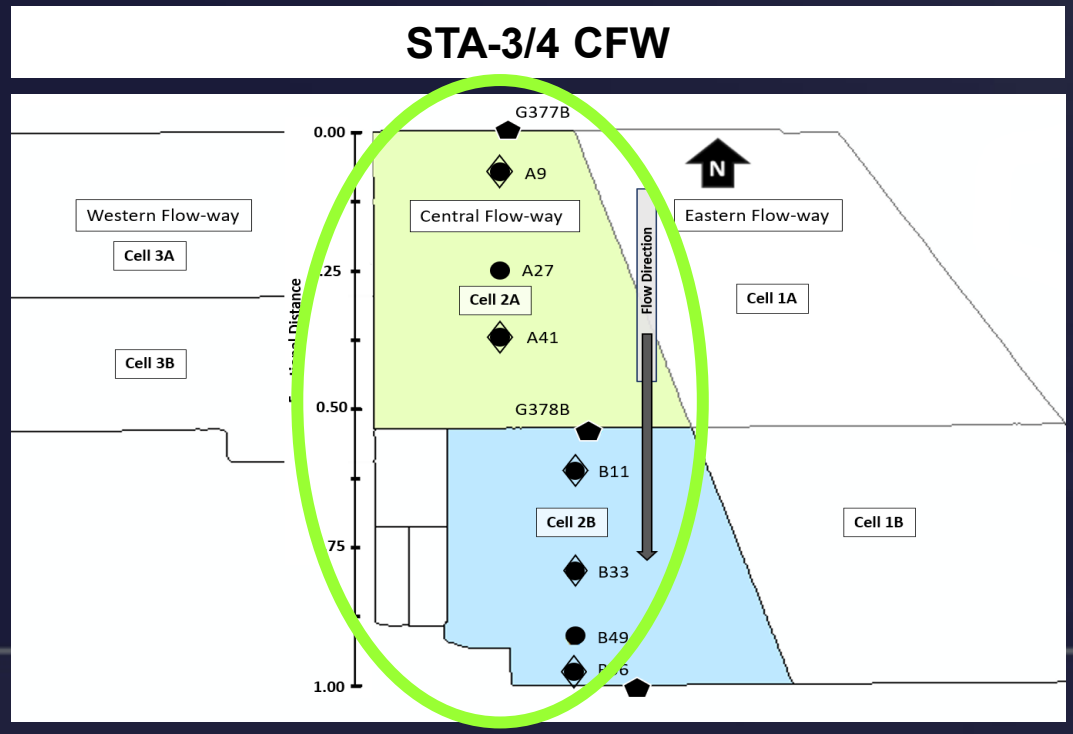
Legend

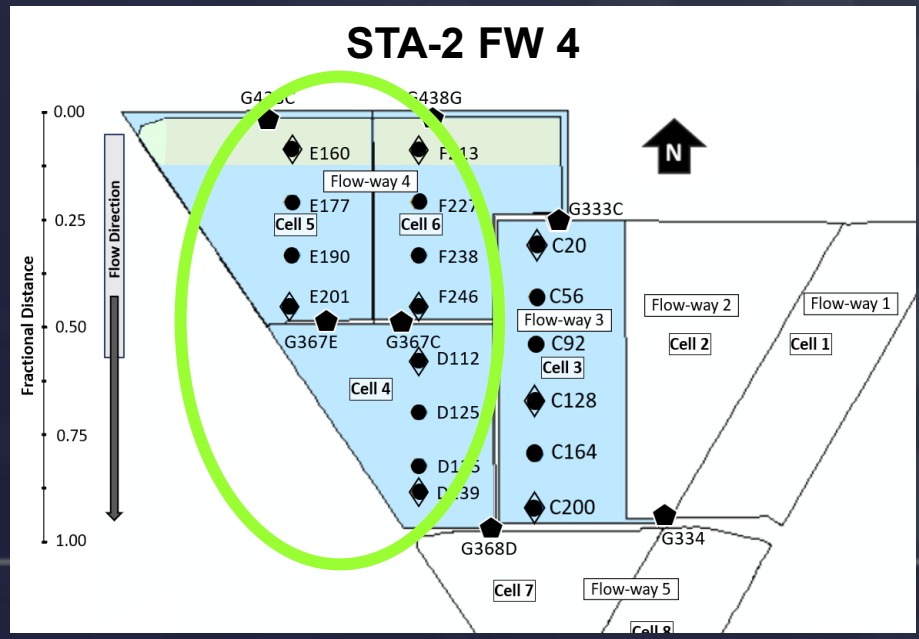
- Water Quality Grab Site
- Continuous Field Monitoring Station
- Water Quality Grab Structure
- Emergent Aquatic Vegetation (EAV) Cell
- Submerged Aquatic Vegetation (SAV)/Mixed Marsh Cell

Defining Performance
Well-performing

- STA-1E Eastern Flow-way (EFW), STA-2 Flow-way 4 (FW4) and STA-3/4 Central Flow-way (CFW)
- Produce annual TP outflow flow-weighted mean concentrations (FWMCs) less than or equal to 19 micrograms per liter (µg/L)







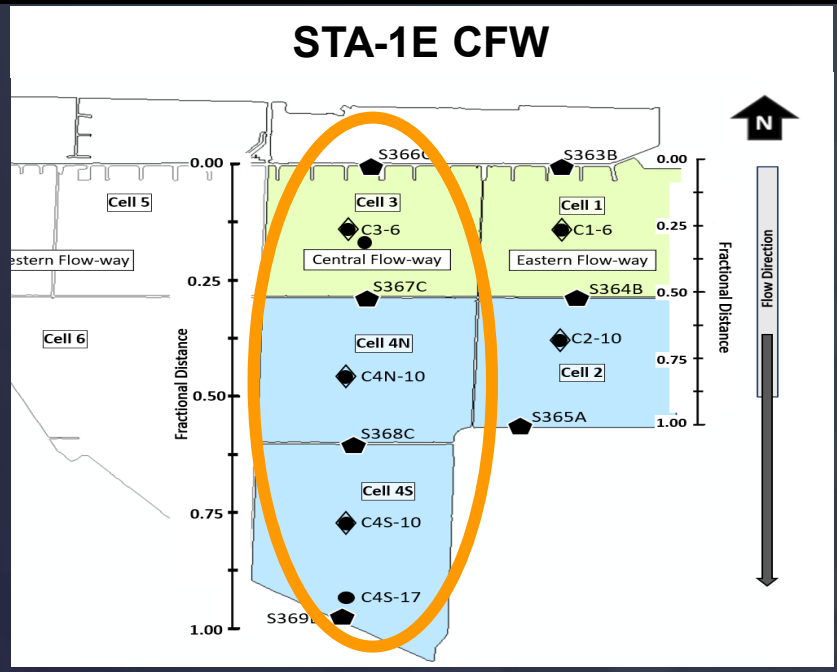
Defining Performance

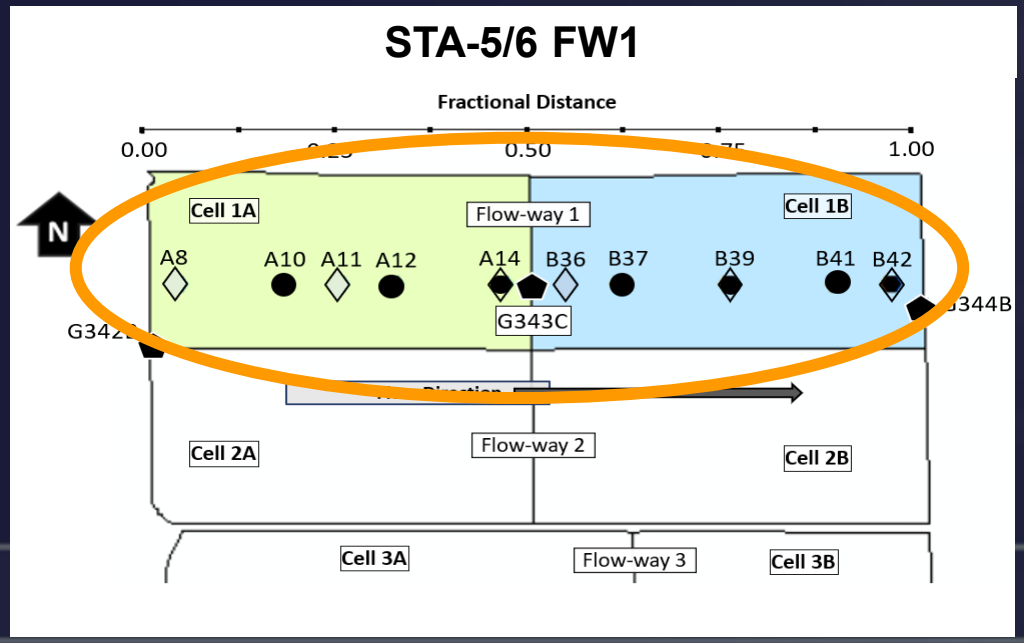
Under-performing

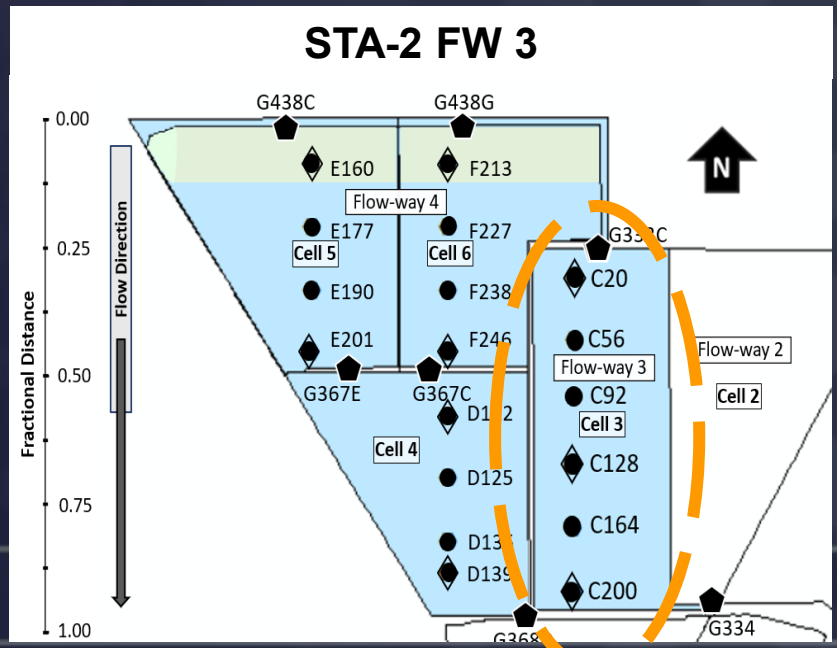
- STA-1E Central Flow-way (CFW) and STA-5/6 Flow-way 1 (FW1)
- FWMC TP greater than 19 µg/L

Variable performing

- STA-2 Flow-way 3
- Historically STA-2 Flow-way 3 (FW3) was well-performing however, it has been underperforming since 2017

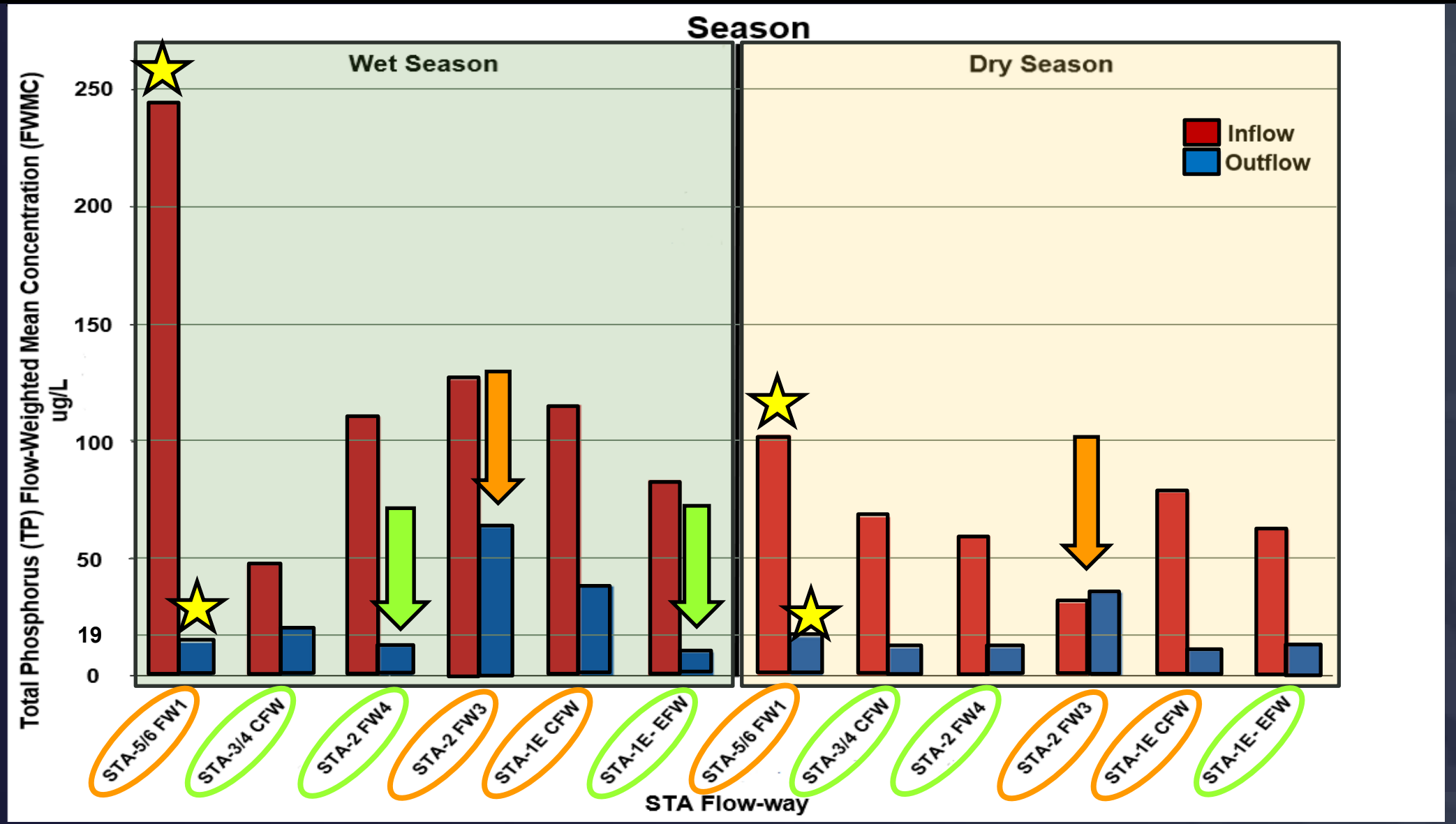






Well-performing

Underperforming

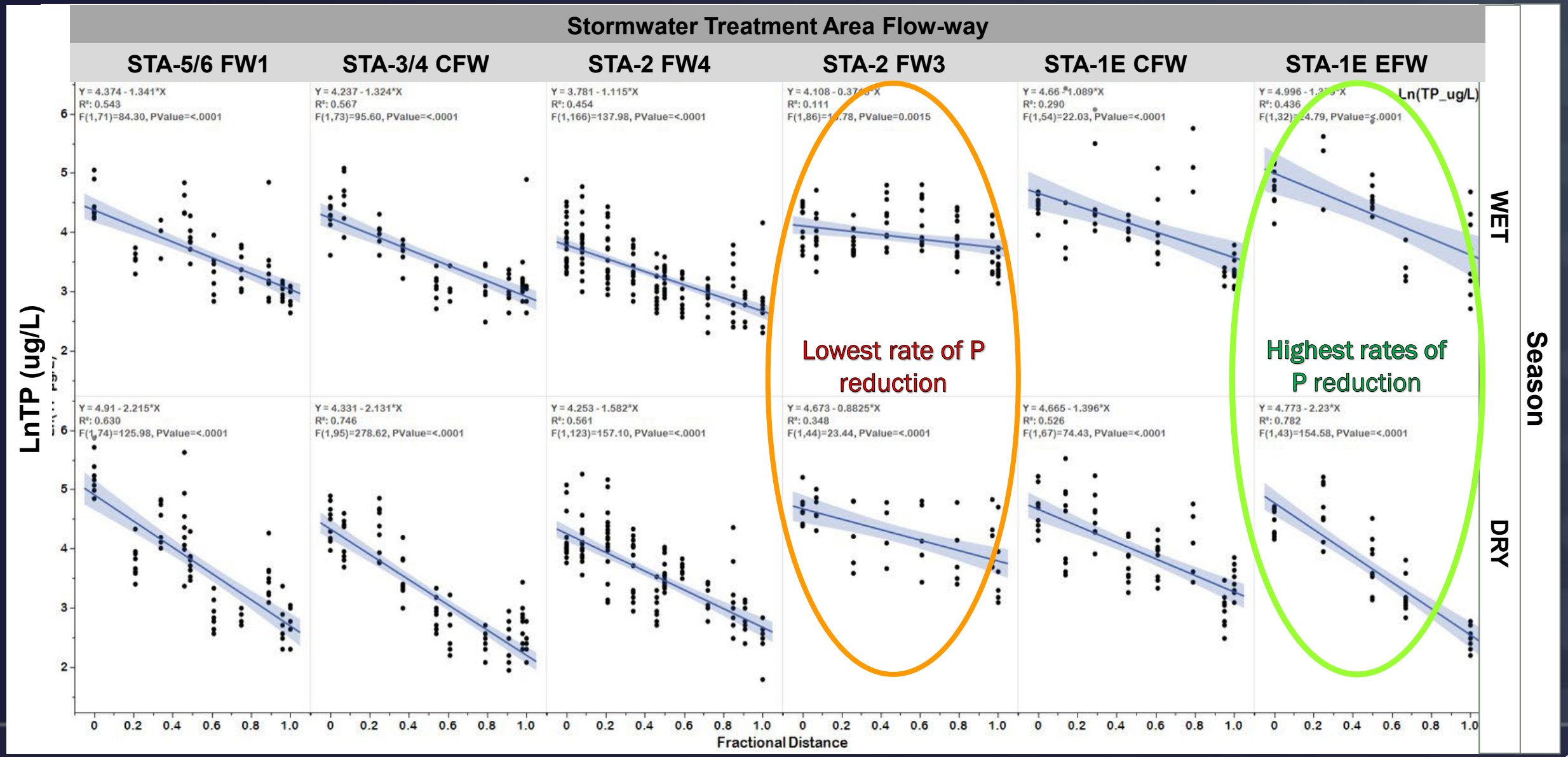


May June July August September October November December January February March April

Wet Season

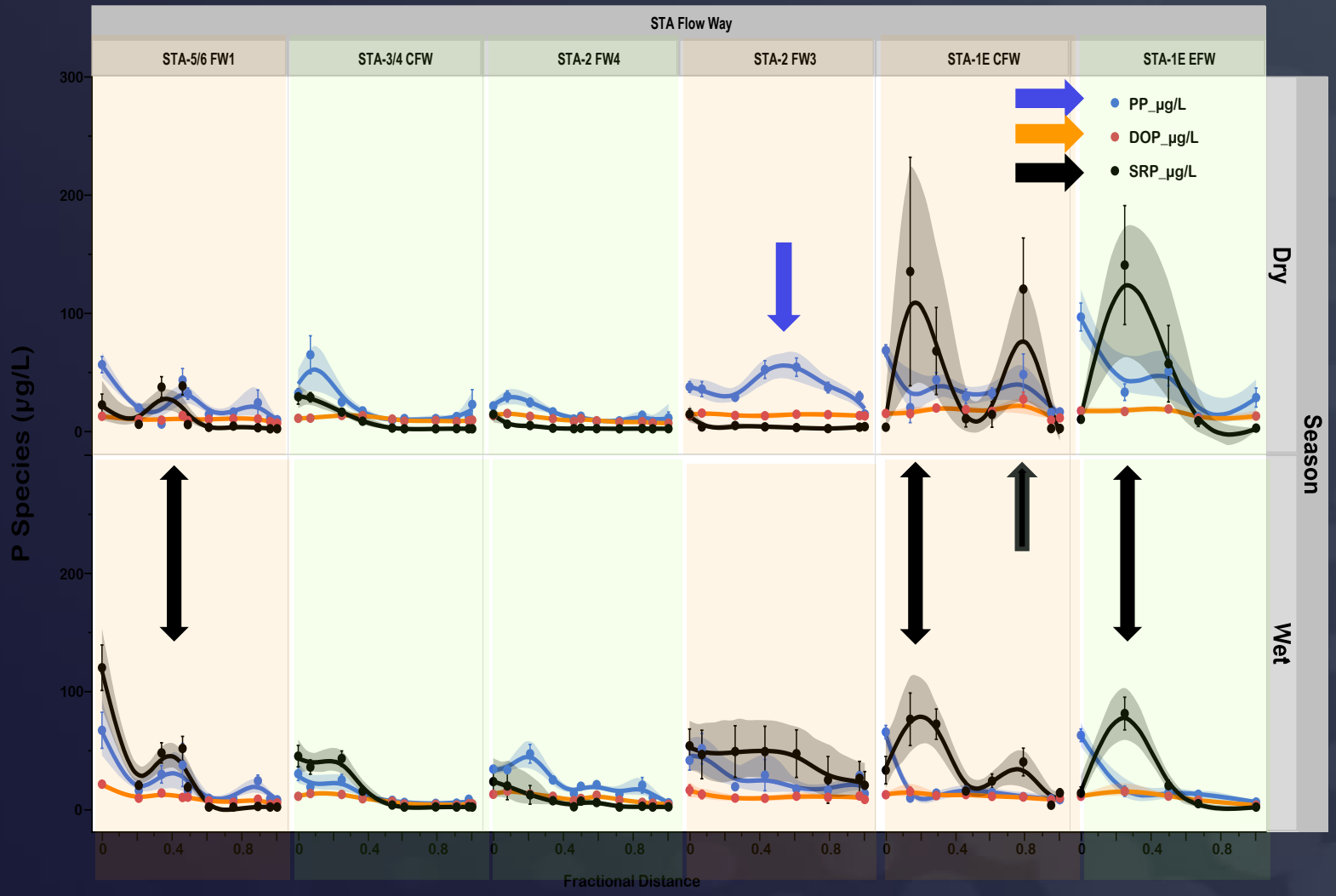
Dry Season

Total Phosphorus (TP)



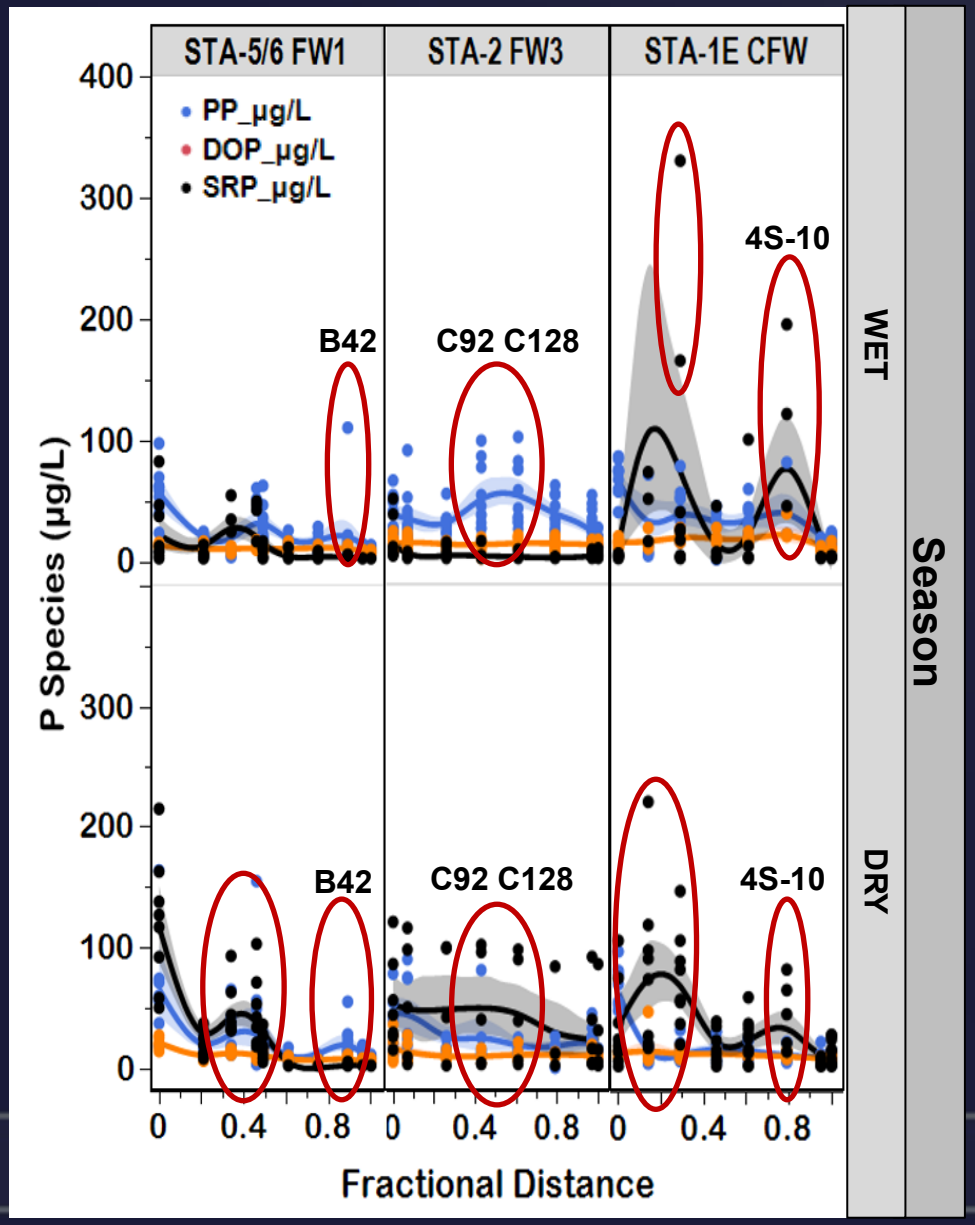
Phosphorus (P) Speciation

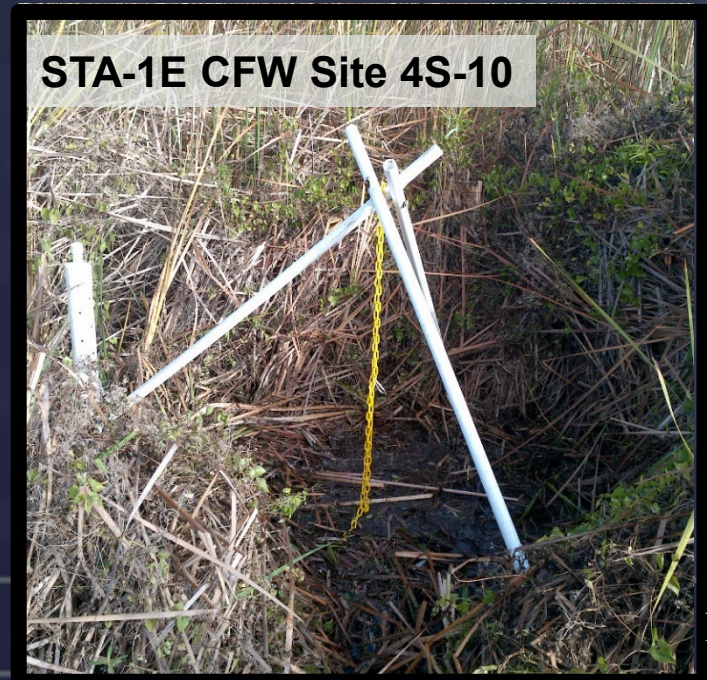
- Particulate Phosphorus (PP)
  - TP – TDP = PP
  - Greatest proportion of inflow P sampled during the dry season
- Dissolved Organic Phosphorus (DOP)
  - TDP – SRP = DOP
  - Low at the inflow, minimal reduction throughout the FW, highest proportion of P at the outflow
- Soluble Reactive Phosphorus (SRP)
  - Direct measurement
  - Greatest proportion of inflow P sampled during the wet season



Spline curve of P species concentration along fractional distance of FW for each STA FW by season (blue line – PP, orange line – DOP, and black line – SRP).

Phosphorus (P) Spikes



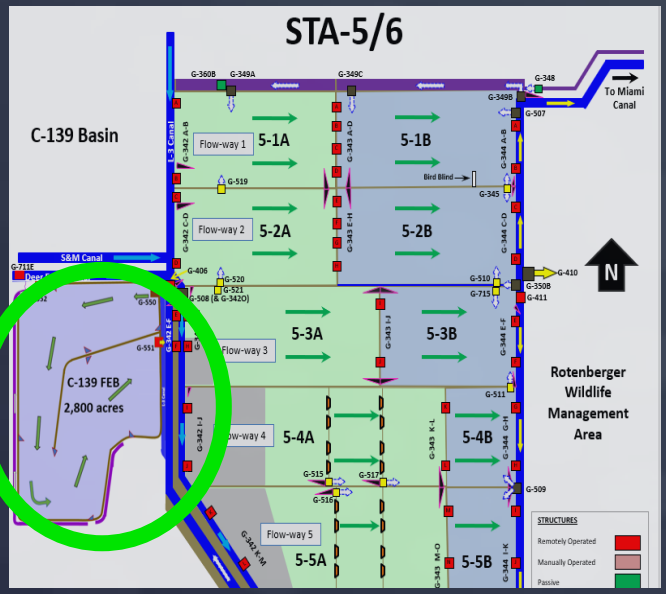


Summary of Results

- TP reduction was higher during the wet season than the dry season
- SRP is a metric of performance
- P species spikes within a FW, indicate internal P loading

Improvement Projects

- STA-2 Cell 3 drawdown
- Grading Cell 3 and 4N of STA-1E CFW
- C-139 FEB upstream of STA-5/6



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