

NUTRIENT EXCHANGE DYNAMICS FOLLOWING SEDIMENT RESUSPENSION IN SOUTH FLORIDA WETLANDS

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Background

- Considerable effort has been dedicated to determining the flow velocities and shear stress that can cause resuspension of sediments in shallow lakes, marshes and STAs
- However, the effects of sediment resuspension events on nutrient exchange with the water column are not well understood

Stormwater Treatment Areas (STAs)

- Effective phosphorus sequestration by submerged plants provides a compelling reason to encourage SAV growth in the outflow regions of STA flow paths (e.g., Dierberg et al., 2002 Water Research)
- Fine marl sediments are deposited in SAV cells over years of STA operation
- There is concern that these newly-accrued sediments may adversely impact vegetation health, or contribute to internal P loading via re-suspension, impairing STA performance

Chara sp., STA-2 Cell 3

Covered in fine marl sediment



Najas guadalupensis,
Lake Okeechobee



Sediment in *Typha-Cladium* community
STA 2 Cell 1



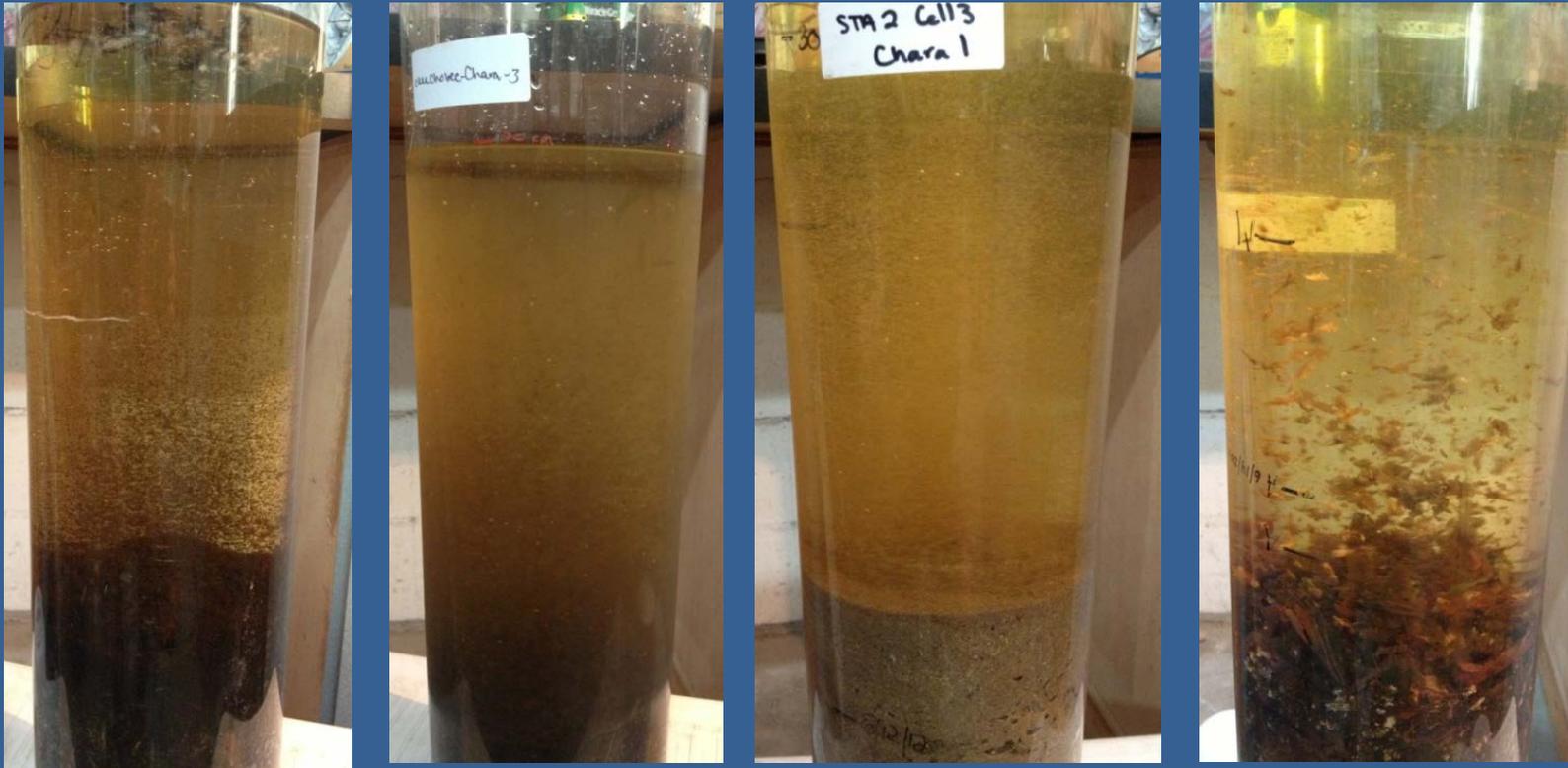
Sampling Approach

- Intact sediment cores (15-cm diam.) retrieved from STAs and Lake Okeechobee littoral zone
- Vegetation was removed at the sediment-water interface
- Overlying water was replaced with low-nutrient water from the outflow of STA 2 Cell 3
- Sediment was suspended for 30 seconds using 48 rpm paddle



Sampling Approach

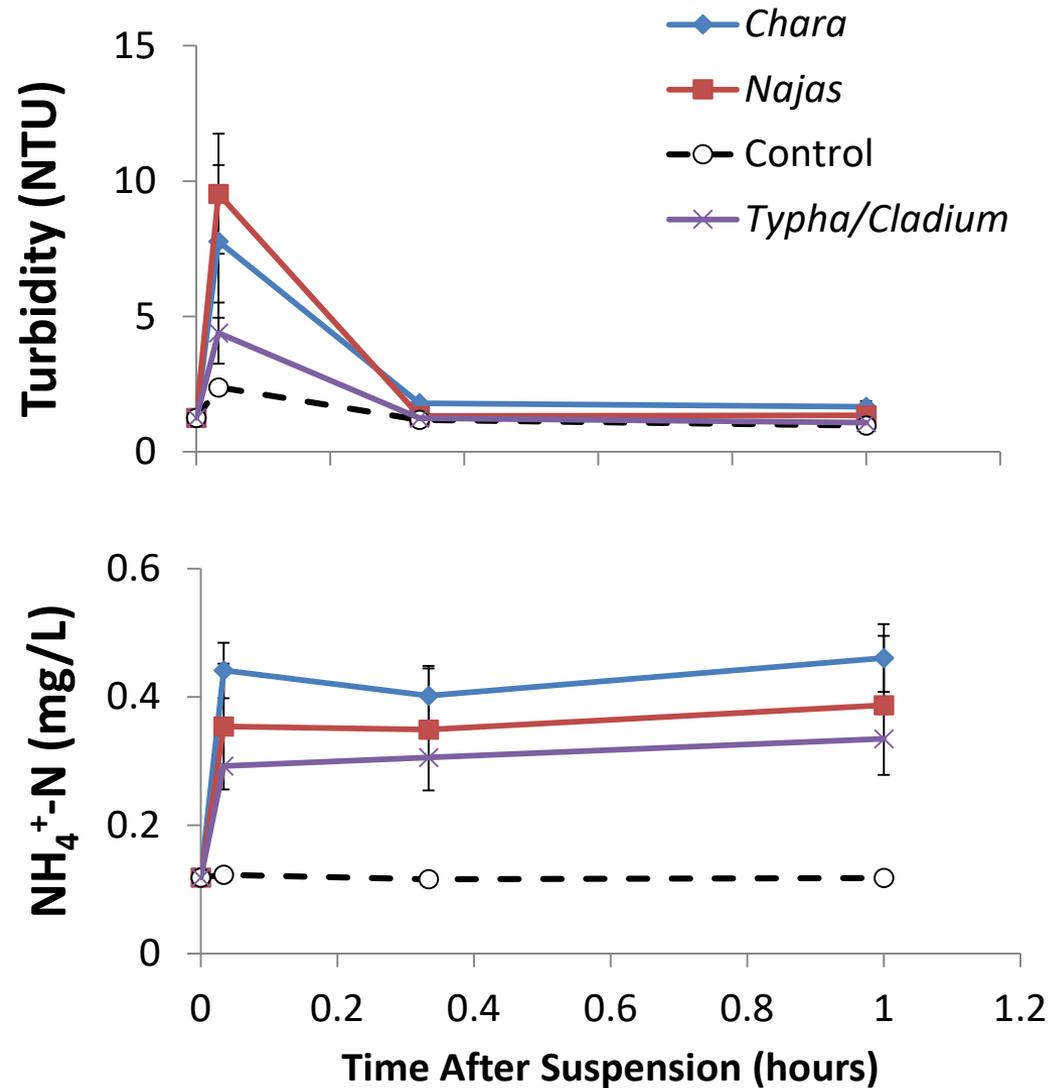
- Water samples were collected over time, with Coliwasa sampling tube in upper 15 cm water column
- Analyzed for turbidity, ammonium and P species



1 minute after suspension

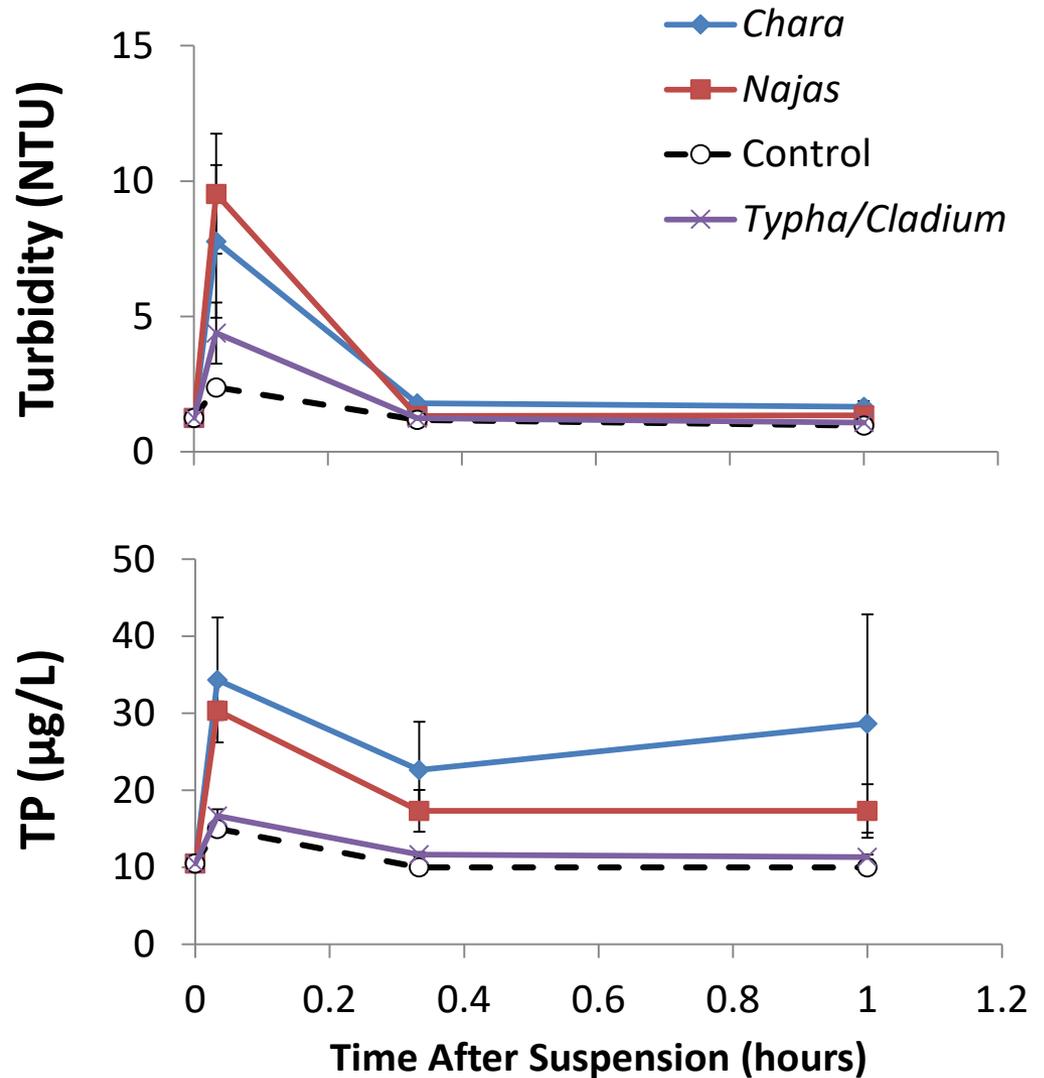
In STAs...

- Turbidity increase was short-lived, returning to pre-suspension levels in 20 minutes
- Observed $\text{NH}_4^+\text{-N}$ increase persisted, and was most elevated in *Chara* sediment



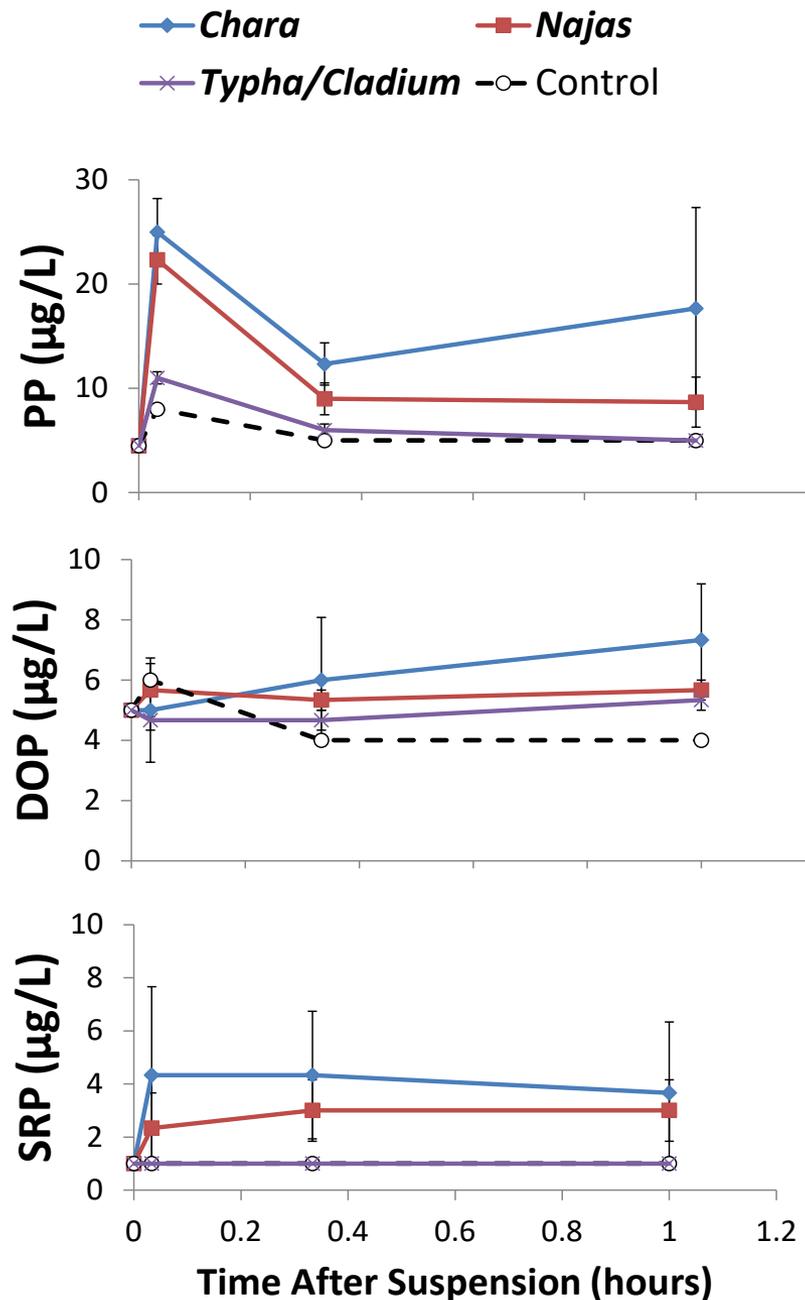
In STAs...

- Turbidity increase was short-lived, returning to pre-suspension levels in 20 minutes
- TP increase from SAV sediment persisted through 1 hour; could potentially impair STA performance



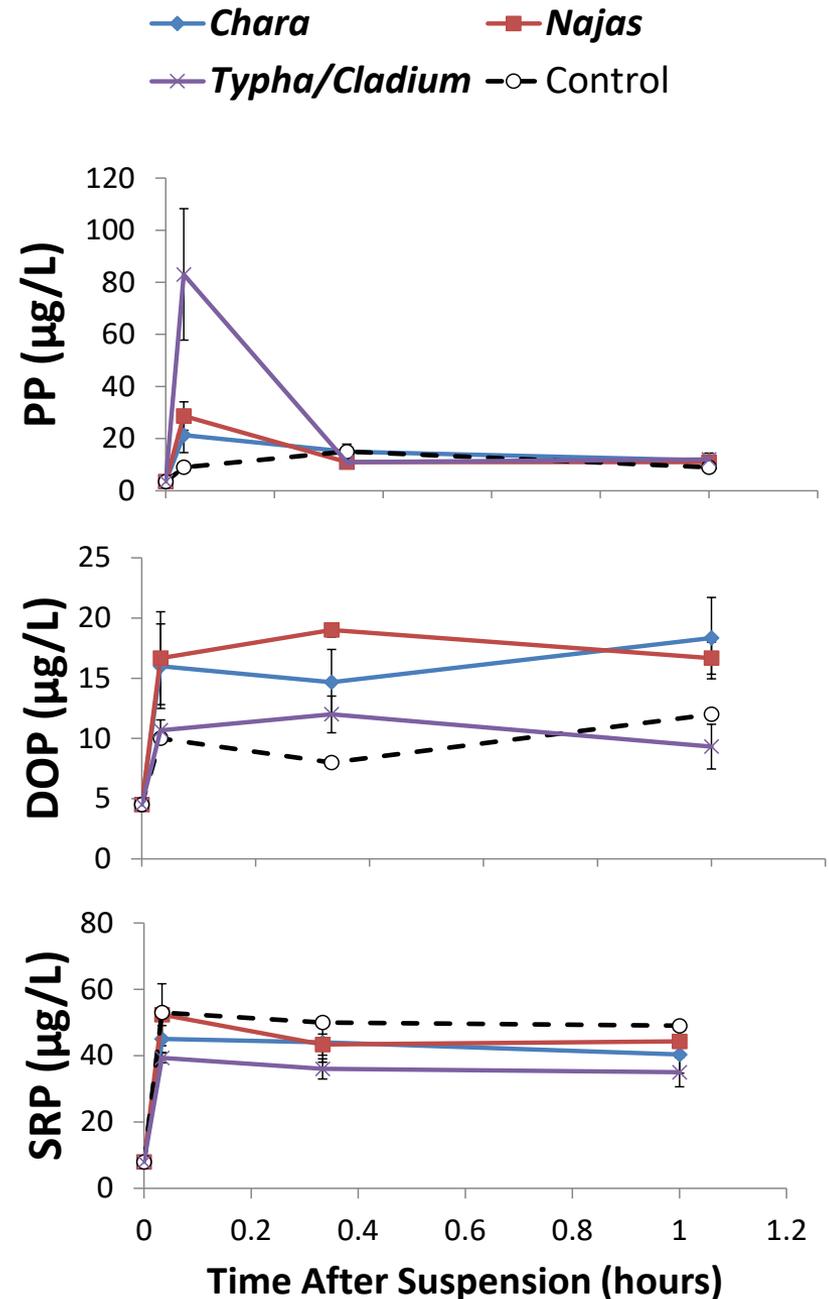
P Forms in Water Column

- Increases in all P forms remained elevated after SAV sediment was suspended
- Lowest P in *Typha/Cladium* sediment

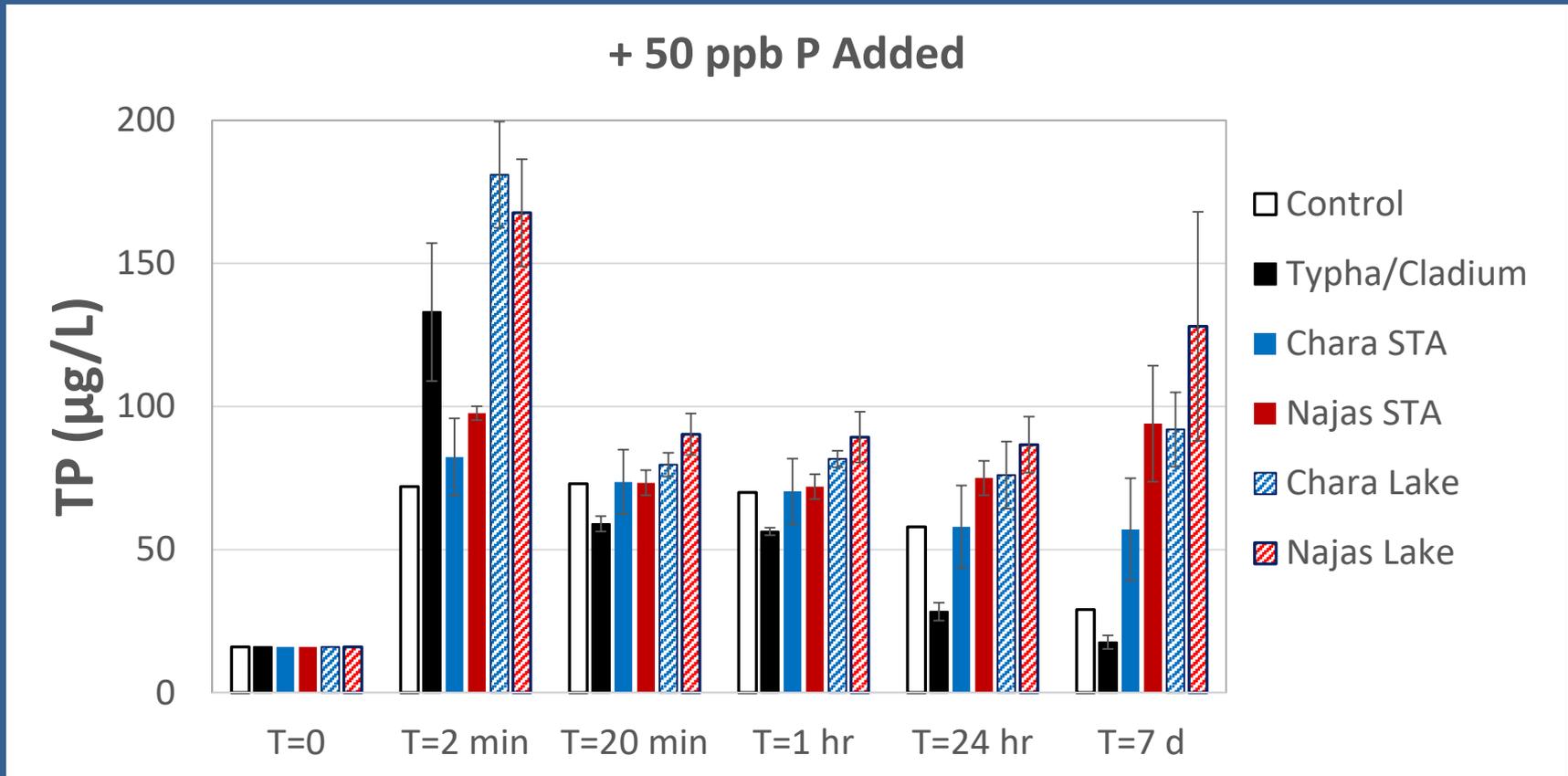


P Forms in Water Column

- When + 50 ppb SRP added during suspension, DOP and PP increased in controls and soil suspensions alike
- After one hour, SRP lower than controls while DOP was elevated
- DOM scavenged a portion of added P, keeping it in water column after particles had settled



P increase persisted for 7 days in SAV sediments, but declined in *Typha/Cladium* sediments from well-performing STA Flow-way (STA 2 Cell 1)



Initial Findings

- Large increases in turbidity were short-lived, but PP, DOP increases persisted
- Ammonium-N remained elevated after suspension, especially with *Chara* sediments
 - Similar NH_4^+ -N response observed by Reddy et al. 1996 for Lake Apopka sediments
- Outflow sediments from a *Typha/Cladium*-dominated marsh (STA 2 Cell 1) were able to scavenge and reduce water column P

Next Steps

- Apply technique to other STA vegetation communities, including floating-leaved species (*Nymphaea odorata* and *Nuphar advena*) that have become increasingly common in STAs
- Incorporate field measurements of resuspension effects, to evaluate the technique and guide vegetation management efforts for improved P removal performance in STAs