

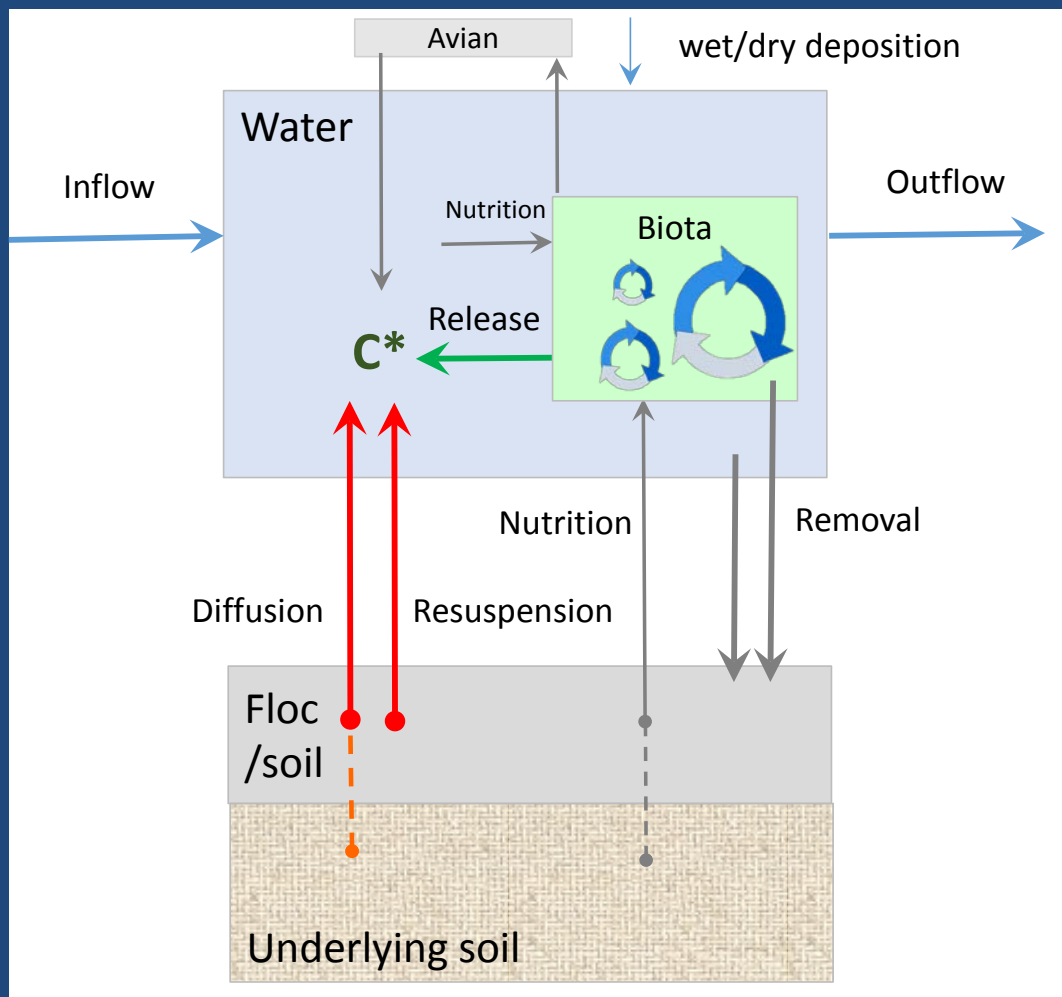
Rates of and influences on Phosphorus Flux in the STAs

Long-Term Plan Meeting
3 March 2017

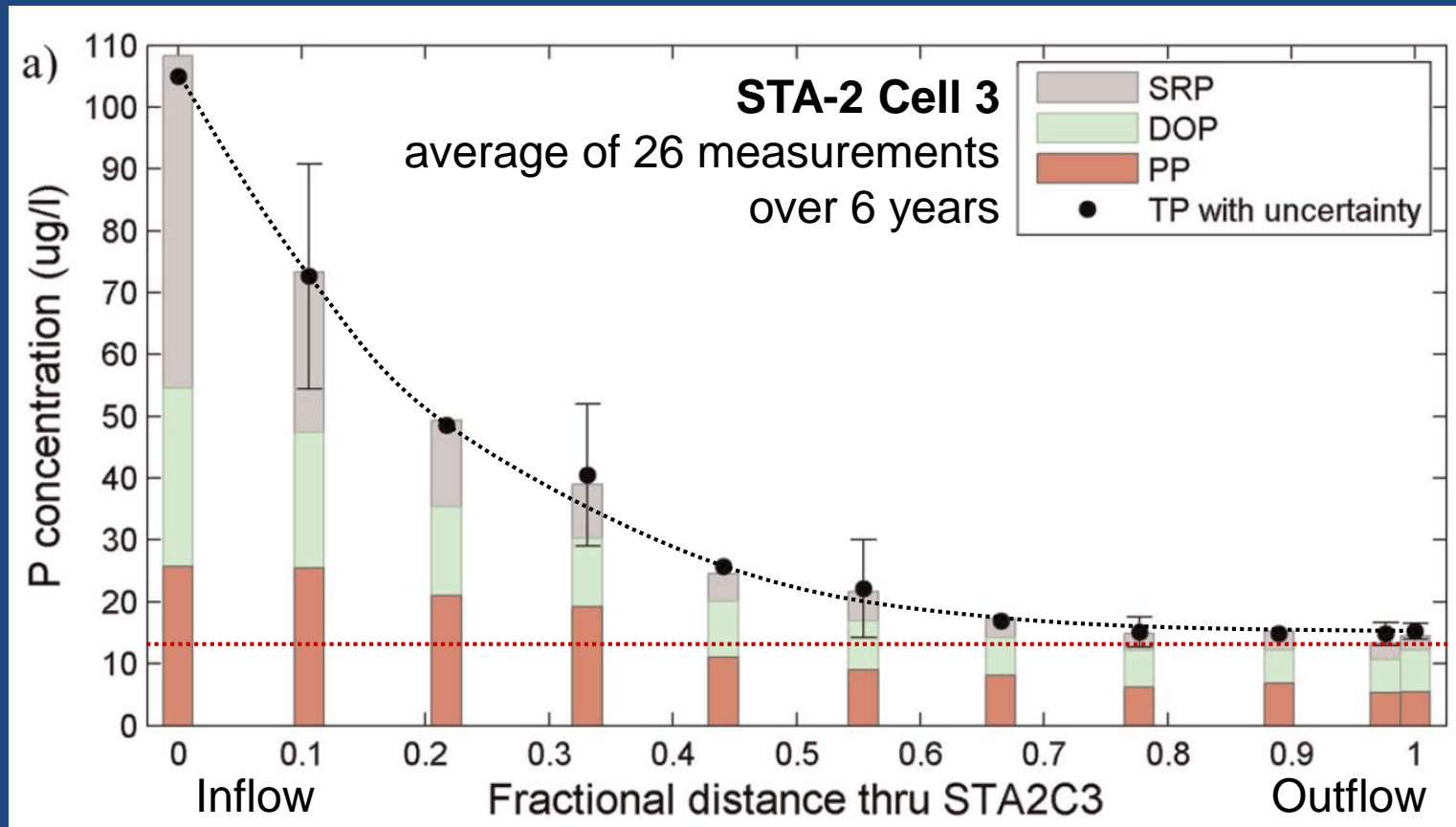
Mike Jerauld, Senior Scientist
DB Environmental, Inc.

Flux chambers at STA-2 Cell 3 mid region

Provisional conceptual model

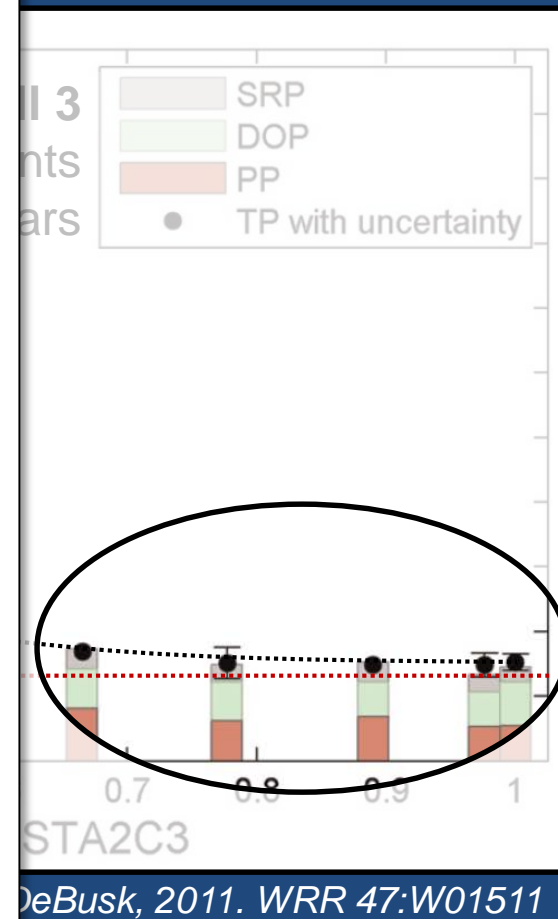
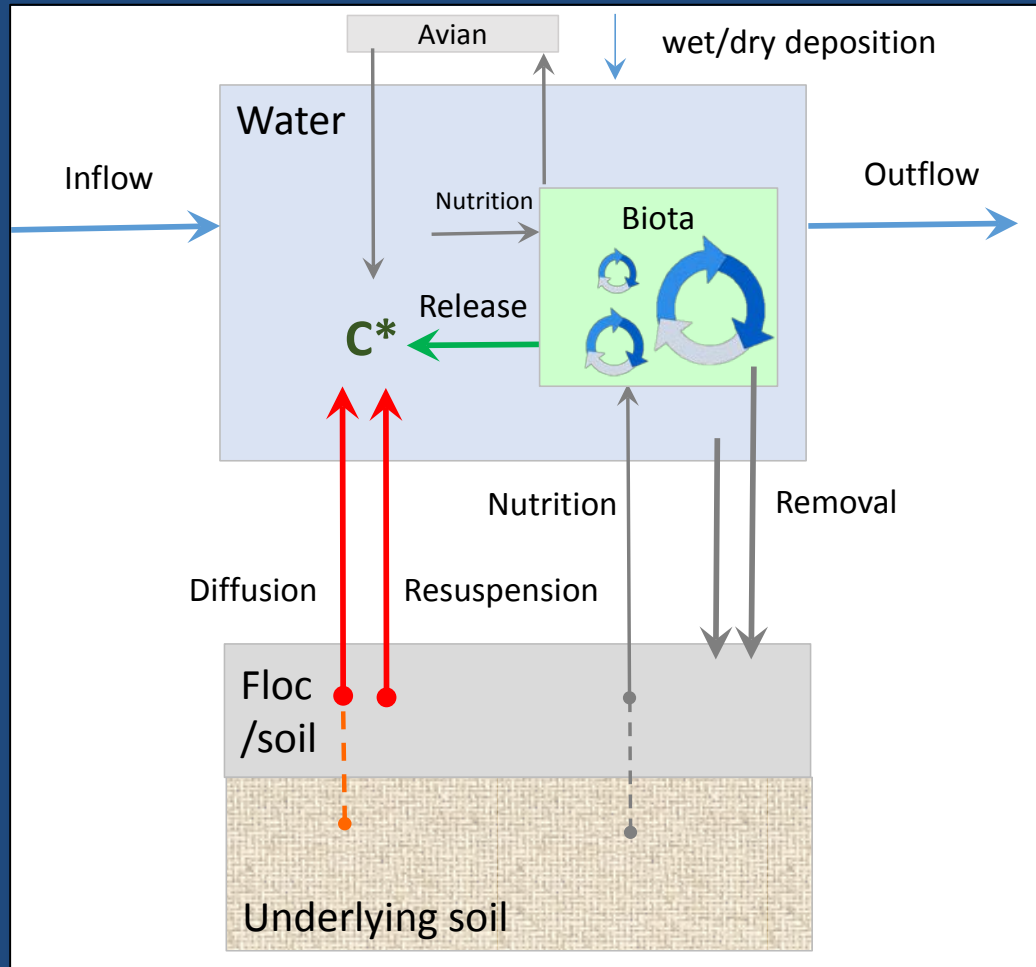


Relevance to STA outflow concentrations



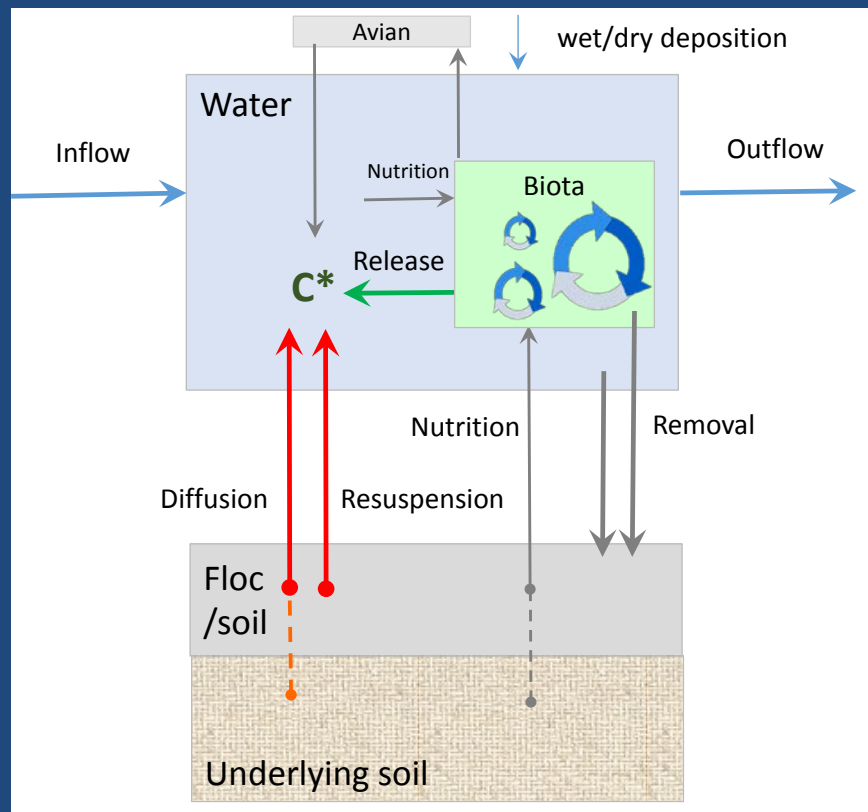
Juston and DeBusk, 2011. WRR 47:W01511

Relevance to STA outflow concentrations



From conceptual model to experimental design

Objective: quantify and apportion net flux rates, and identify controlling variables



- Net flux vs diffusive flux

Working hypotheses

Flux rates affected by:

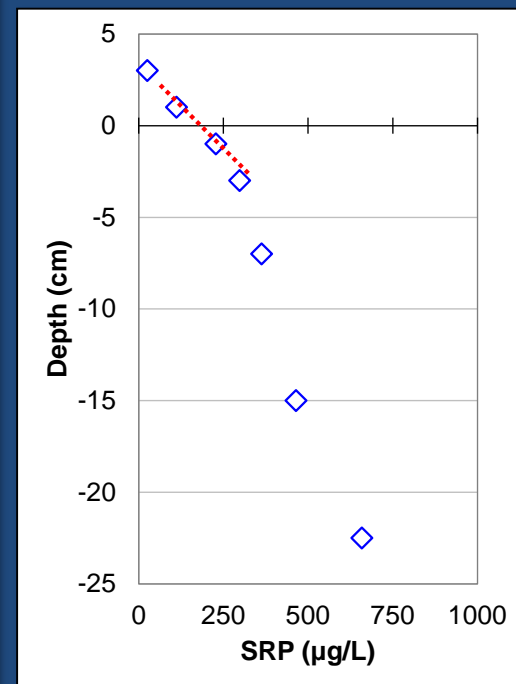
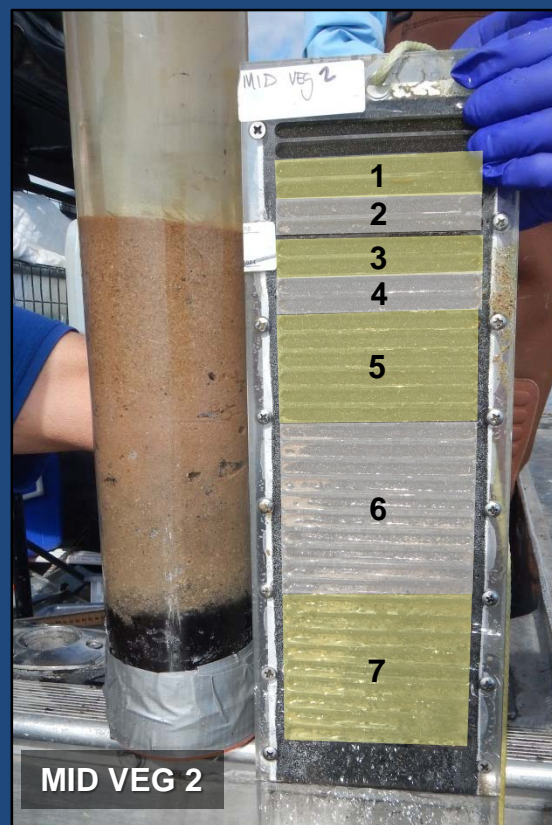
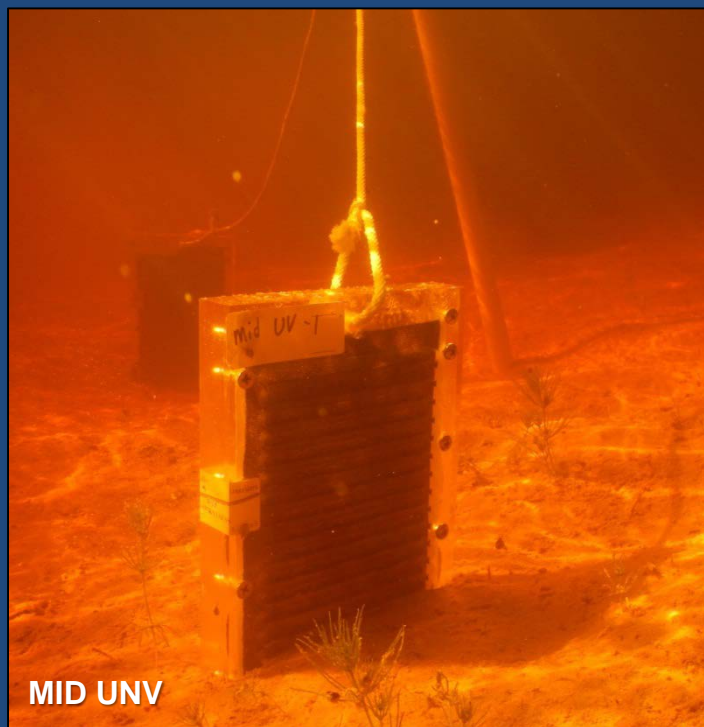
1. Vegetation
2. Soil characteristics
3. Antecedent loading

Overview of DBE P Flux Project efforts

| Task | Effort | Status |
|------------------|---|-----------|
| Task 4 | Data mining analysis of historical DBE data <ul style="list-style-type: none"> • Soils, porewater, and surface water P datasets • Modelling of internal P profiles | completed |
| Task 7 | New P flux field measurements and related analyses <ul style="list-style-type: none"> • P flux chambers • Porewater P gradients • Related soil conditions • Other related variables | ongoing |
| Data integration | P-Flux project data integration and synthesis <ul style="list-style-type: none"> • Discharge P patterns, long-term, monthly-scale • Cross-project data integration | ongoing |

TODAY

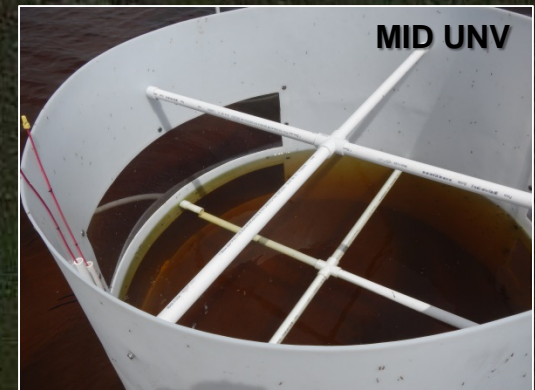
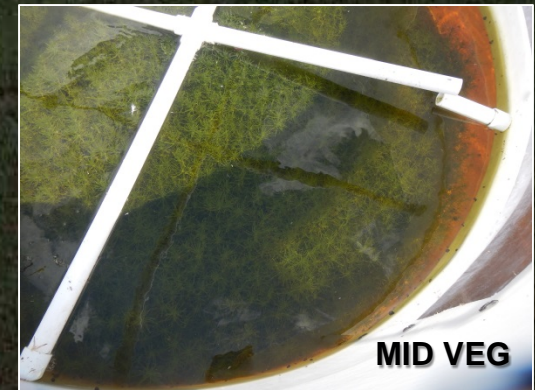
Soil diffusive flux: Peepers



Net flux: in situ flux chambers

STA-2 Cell 3 OUT
Google Earth – Feb 2016

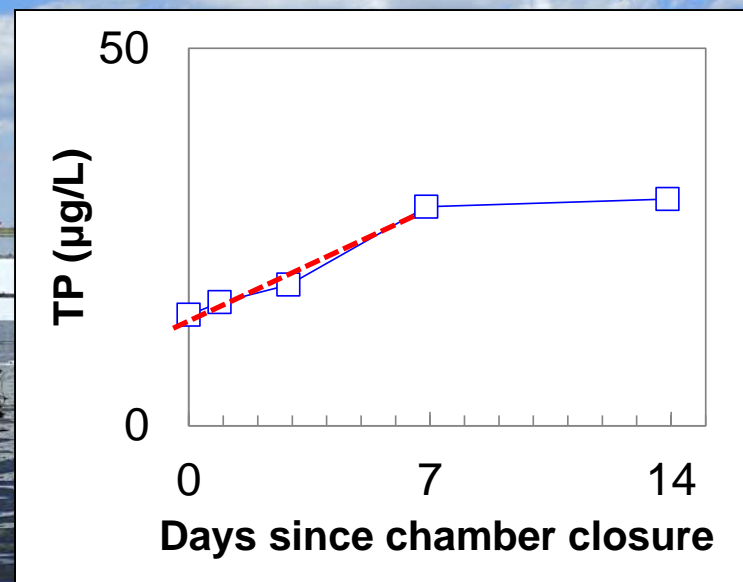
- 1.5 m diameter
- Open top, open bottom
- Installed in marsh “in situ”
- Large openings allow exchange with marsh
- Vegetated & unvegetated



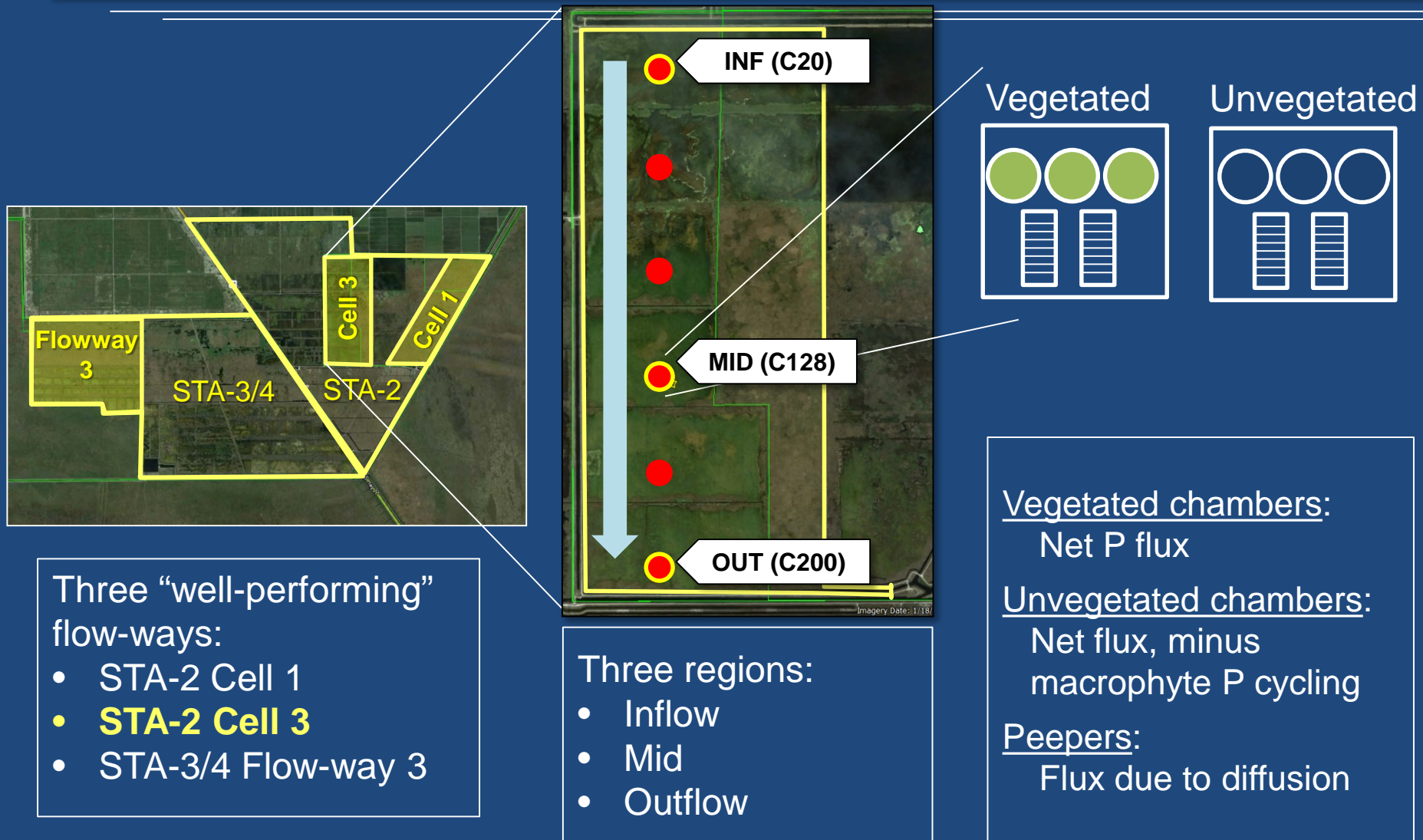
25 m

Net flux: in situ flux chambers

- Openings sealed during 2-wk monitoring events
- WQ sampled at $t = 0, 1, 3, 7$ & 14 days



Study area and experimental design



DBE P Flux Project field work

Activity to date:

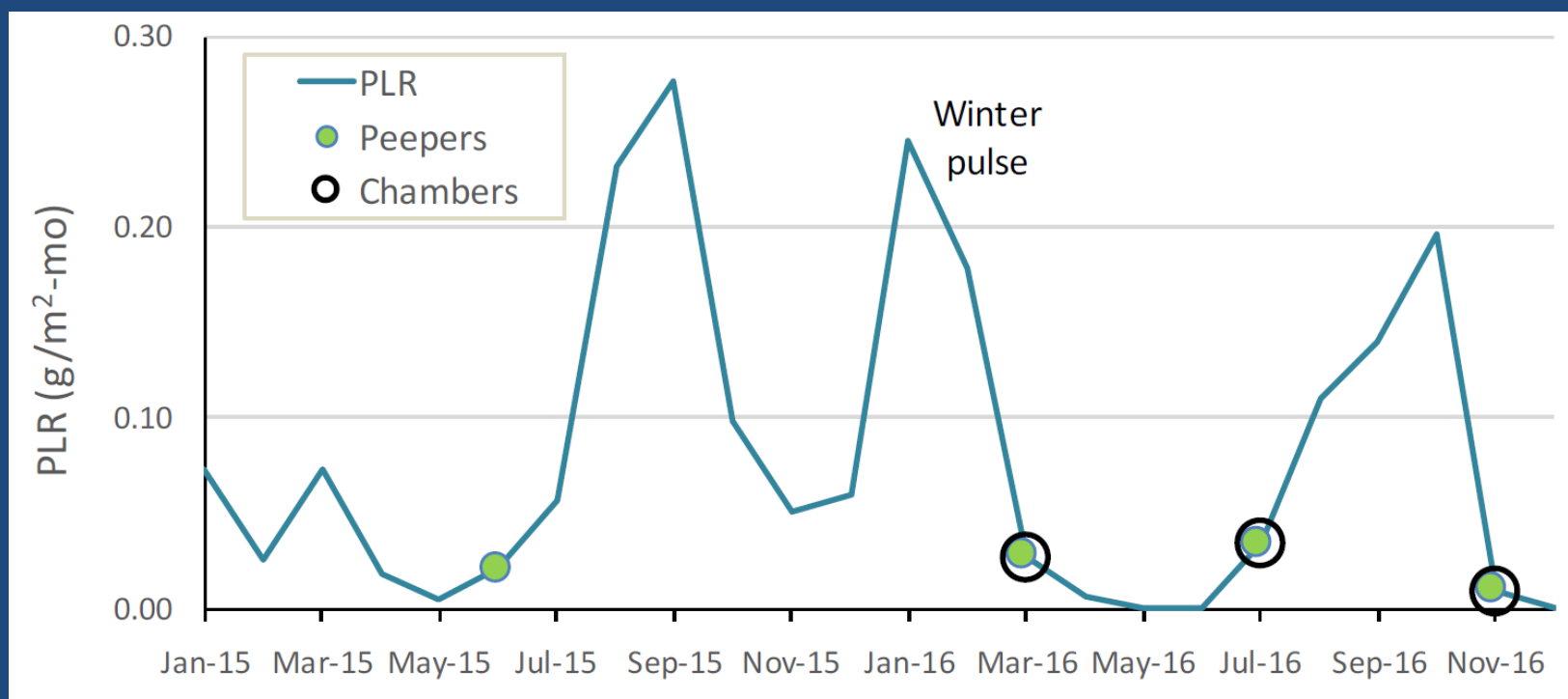
- Advance peeper deployments, Cell 1 (April 2015) & Cell 3 (July 2015)
- Cell 1 chamber event (Sept 2015)
- Lake O. release monitoring (Winter 2015/16)
- Cell 3 “High flow” chamber event (March 2016)
- Cell 3 “Low flow” chamber event (July/Aug 2016)
- Cell 3 “High flow” chamber event (November 2016)
- Cell 3 “Low flow” chamber event (Jan/Feb 2017)

Reporting period:

STA-2 Cell 3 spring, summer & fall chamber monitoring events.

Monitoring event antecedent conditions

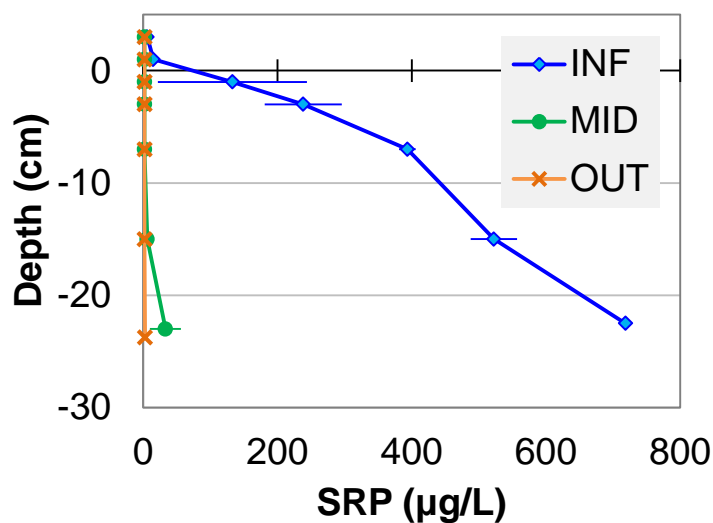
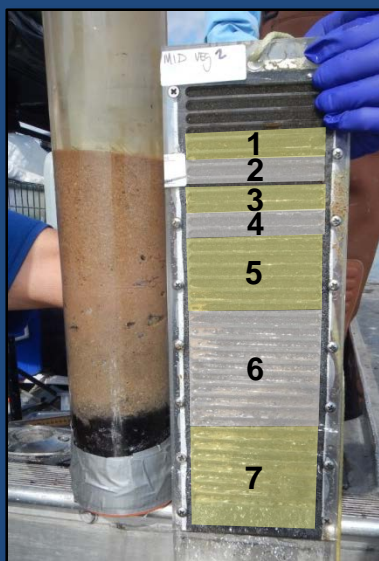
STA-2 Cell 3: Phosphorus loading rate



DIFFUSIVE FLUX MEASUREMENTS

Porewater P profiles

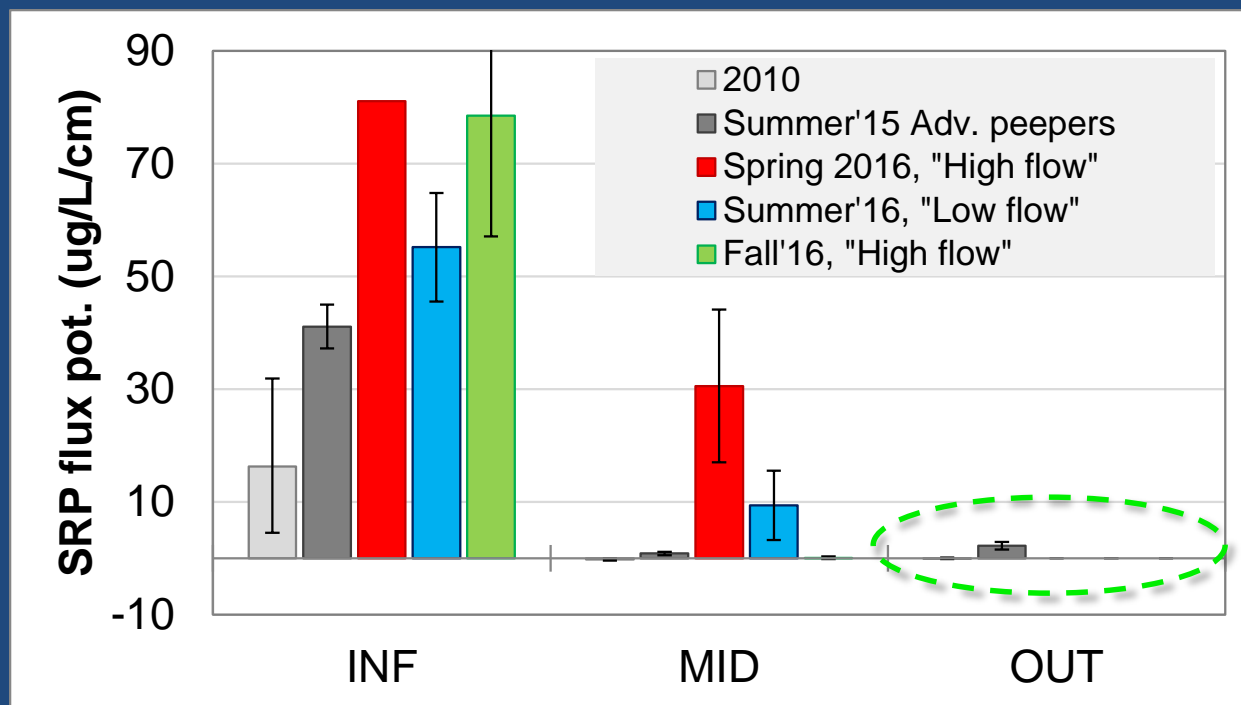
Example data set: November 2016: "High Flow"



General observations

- Inflow → outflow trends
- No discernible effect of vegetation (SAV)
- Negligible gradients of DOP.
SRP key porewater constituent.
- Porewater SRP concentrations at OUT always near or below detection limit.

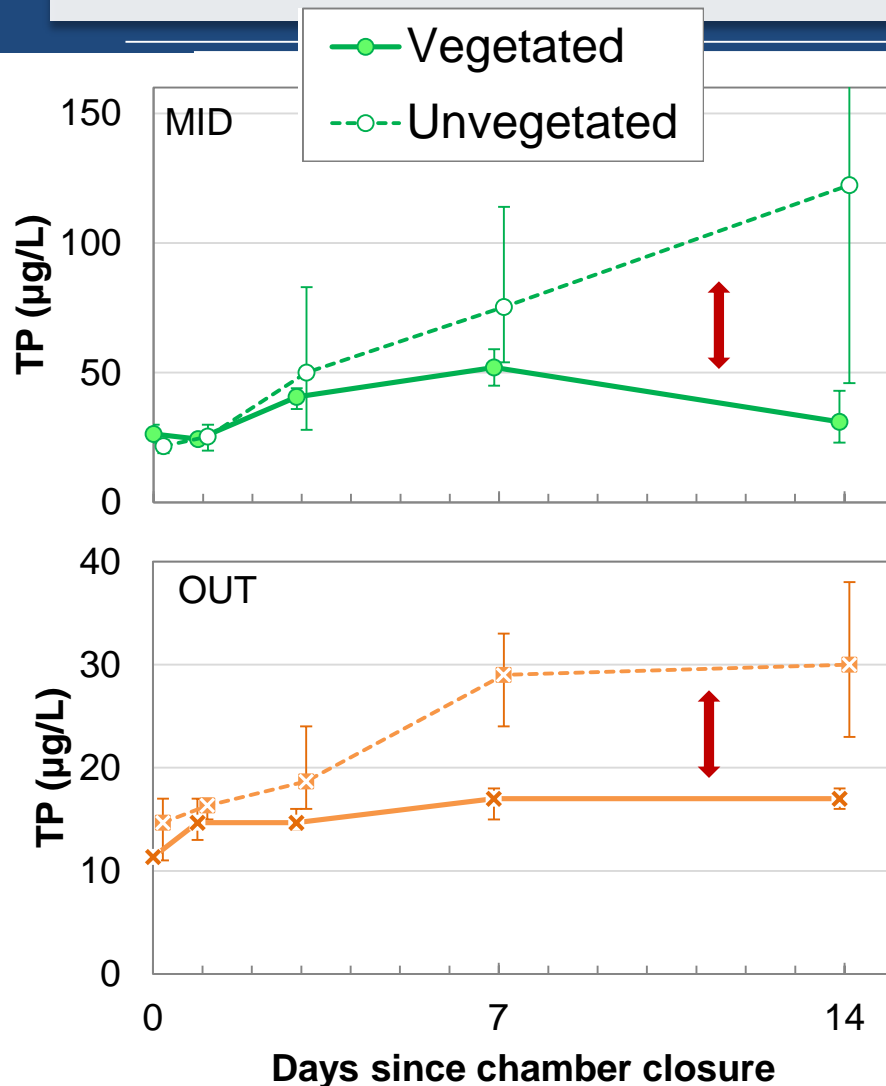
Diffusive flux potential



Consistent, negligible diffusive flux potential at outflow region, even after 17 years of flow-through operation

CHAMBER RESPONSES

Flux chamber TP



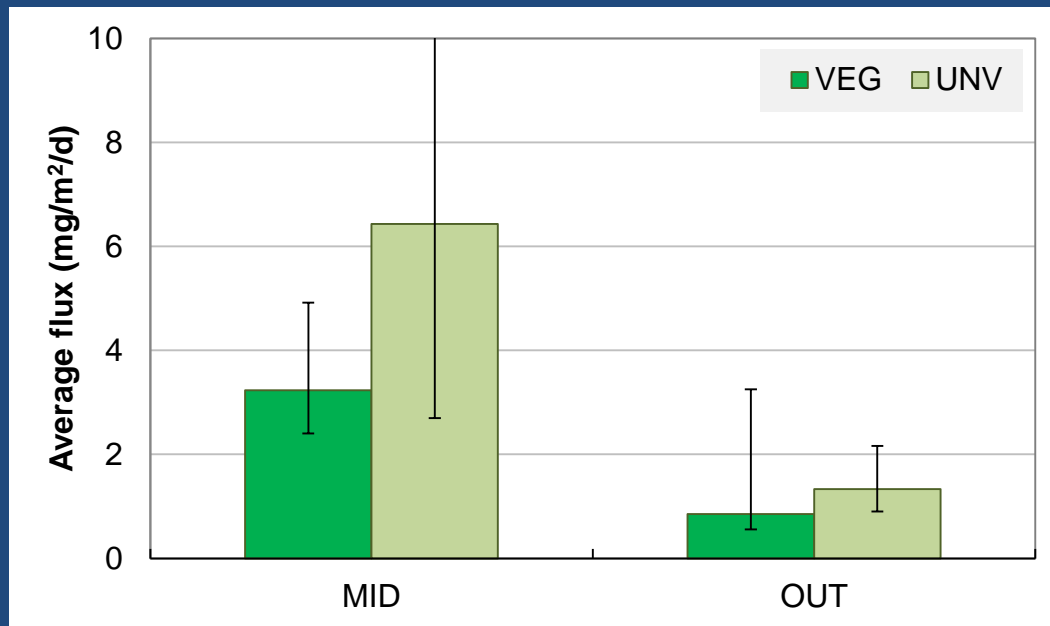
<< Example data set:
November 2016: "High Flow"

General observations

- Inflow → outflow gradient
- Increasing TP concentration over closure period (i.e., positive net flux)
- Recent measurement events suggesting vegetation effect at MID and OUT

Preliminary net flux rates

Example data set: November 2016: "High Flow"

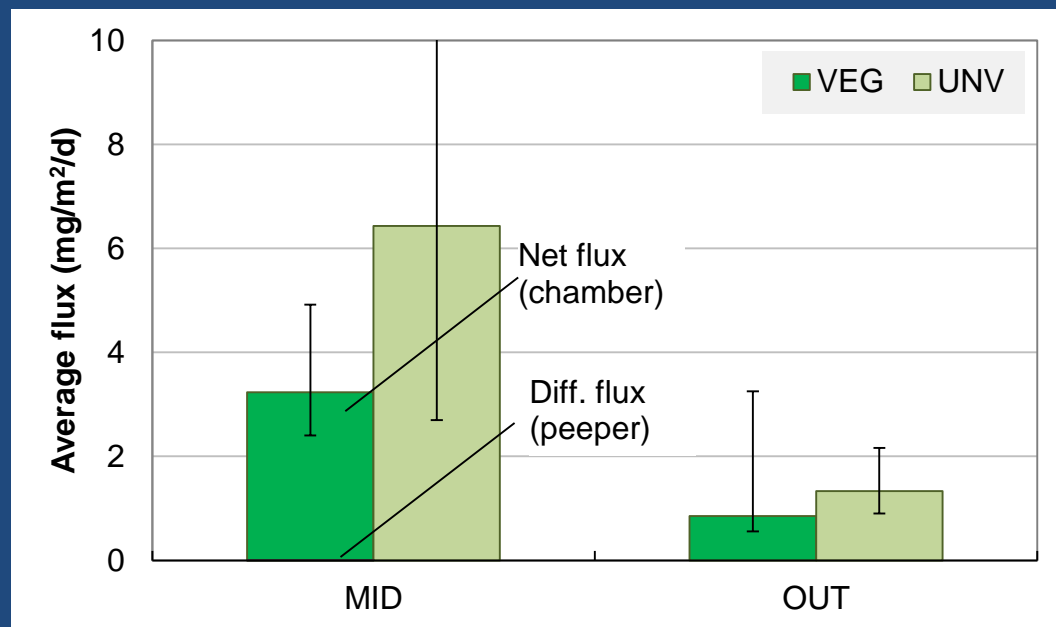


General observations

- Rates comparable to previous work in WCA-2A (*Fisher and Reddy, 2001*)
- Inflow → outflow gradient
- Positive flux rates at outflow

Preliminary comparison of calculated flux rates

Example data set: November 2016: "High Flow"



Not a typo...calculated diffusion rates of 0

General observations

- Rates comparable to previous work in WCA-2A and STAs (*Fisher and Reddy, 2001; Newman and Pietro, 2001*)
- Net flux >> diff. flux

Key findings to date

1. So far, no evidence of strong influence of diffusive fluxes on water TP in the outflow region
2. Yet, strong evidence of positive net fluxes in chambers
3. Net flux apparently insensitive to soil P
4. Effect of vegetation and antecedent load on net flux still under investigation
5. Interpretation of flux complicated by apparent rapid P transformations in the water column

Key question going forward

What sources contribute to net flux in STA outflow regions?

