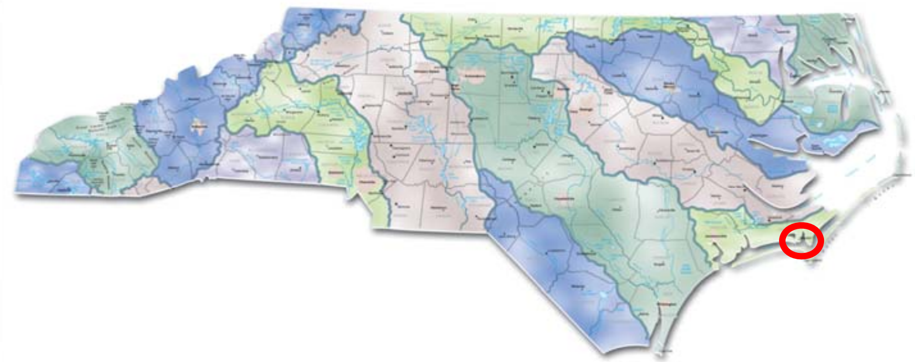
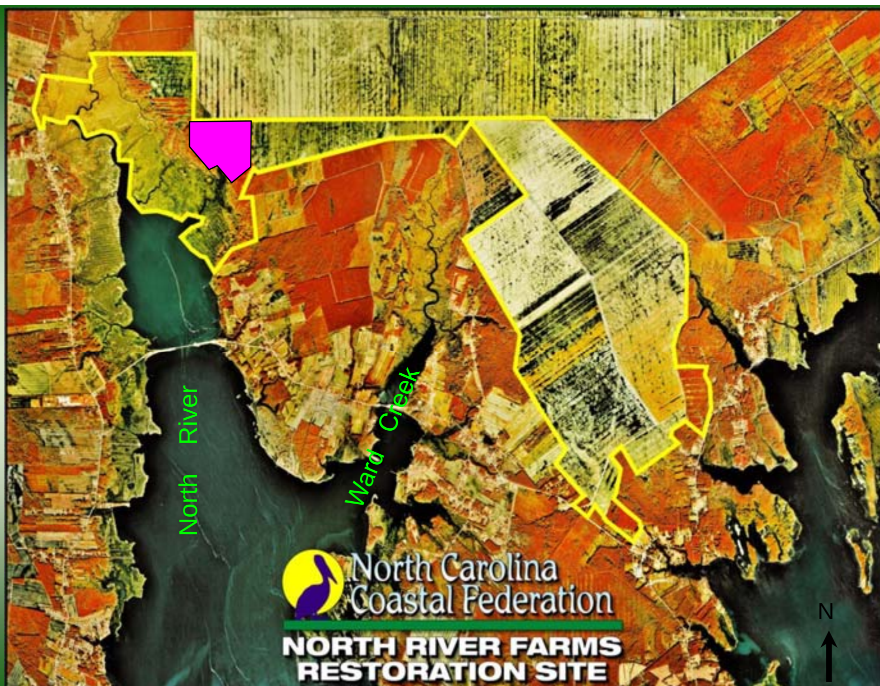
Benefits and challenges of continuous flow and nitrogen monitoring in a restored salt marsh in North Carolina

J. Randall Etheridge, François Birgand, Michael R. Burchell II

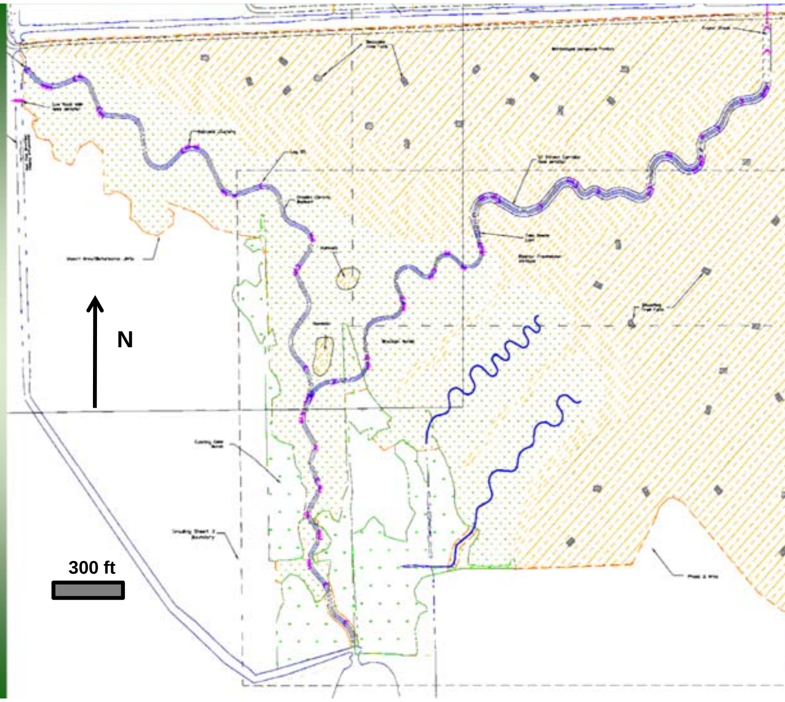
Site Location





Restoration Goals

- Improve water quality in the North River
- Restore habitat
- Provide design guidance for future salt marsh projects in coastal North Carolina



Construction

Restoration

Research Questions

- Can continuous monitoring be used to quantify the ability of a restored salt marsh to retain excess nutrients?
- Are there seasonal, daily, or tidal trends in nutrient release or retention?
- Is there a relationship between nutrient retention or release and the type of organic matter present in the stream?

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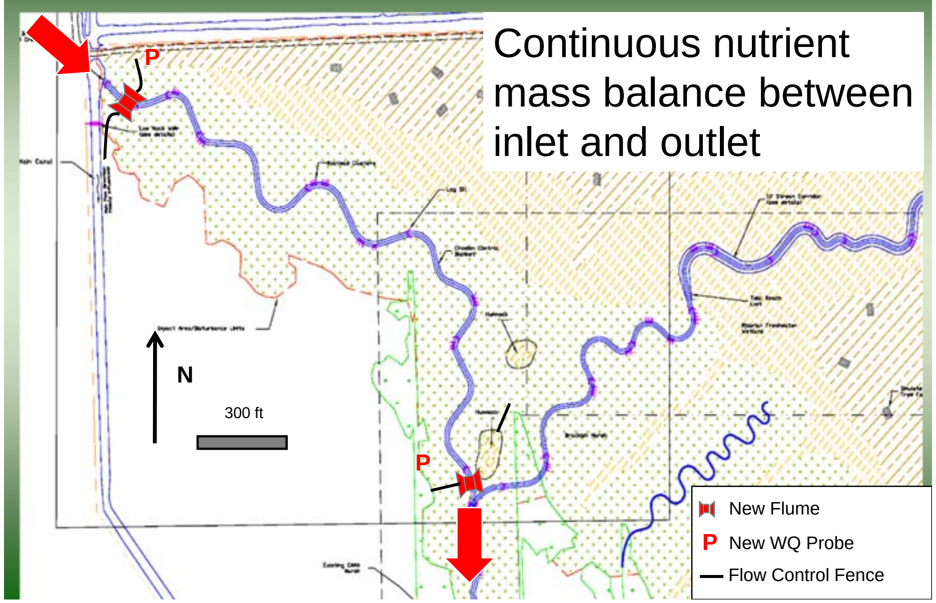
Research Objectives

- Quantify the ability of a restored salt marsh to dissipate excess nutrients
- Quantify the timing and kinetics of nutrient dissipation and/or release
- Correlate the dissipation and/or release of nutrients to the type of organic matter

Methods

Continuous nutrient mass balance between inlet and outlet



Flow Monitoring in a Tidal Stream

- Cannot use normal rating curve due to bi-directional flow
- Flumes serve as a constant cross section – cross section area measurement creates the most error in flow monitoring

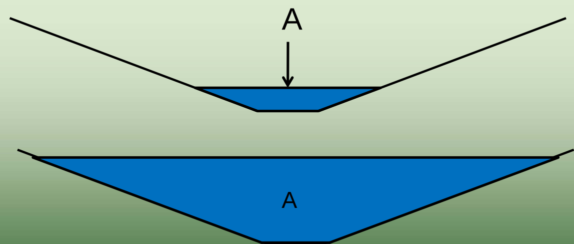
Downstream flume at high tide

Downstream flume between tides

Flow Calculations

$Q = V \times A$

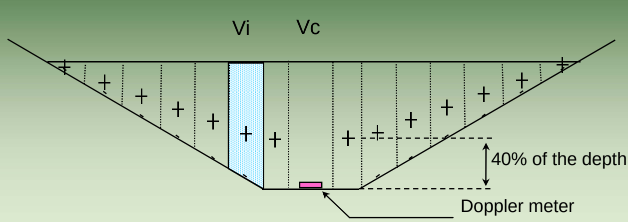
- Q: flow
- V: velocity
- A: cross-section area

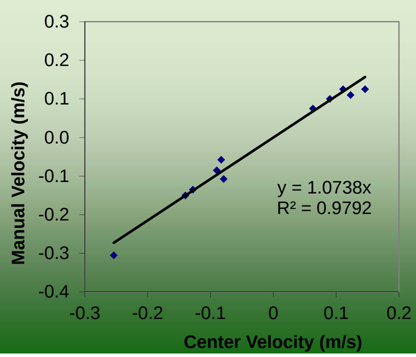


Continuous Flow Monitoring

- Doppler velocity meter records velocity and water depth in flume
- Average velocity and water depth recorded every 15 minutes
- Use manual stream gaging to relate Doppler velocity to actual flow in the flume

Flow Calibration

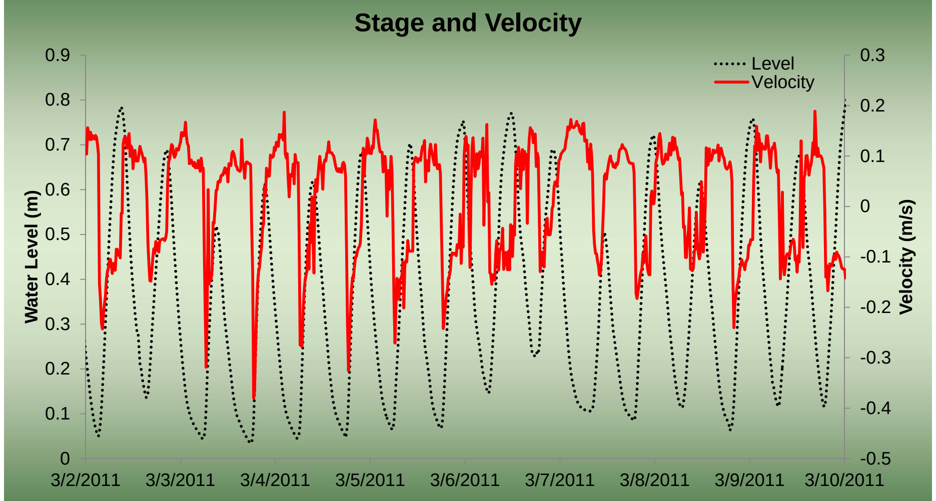




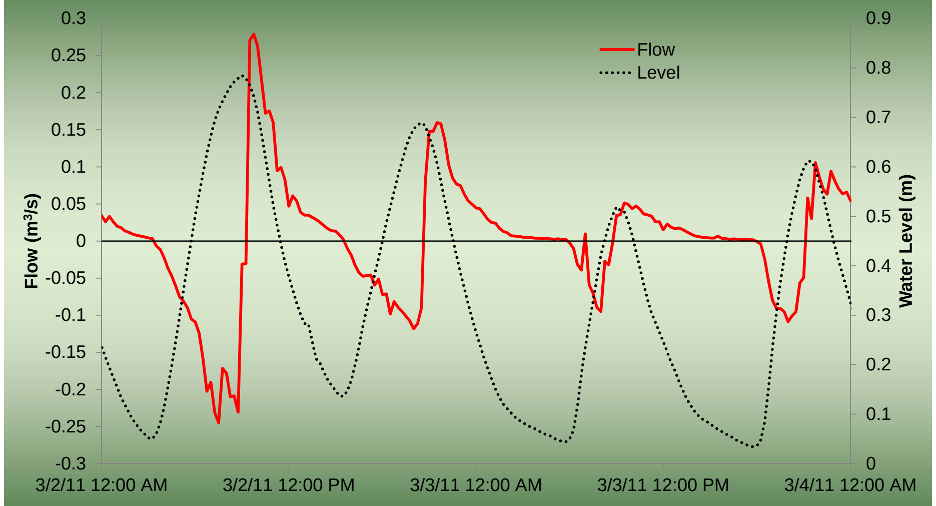
Flow Monitoring in a Tidal Stream

- One challenge presented in the marsh: high tide or water level above the flumes
- Solution: direct flow through the flume using impermeable fence

Downstream Flume



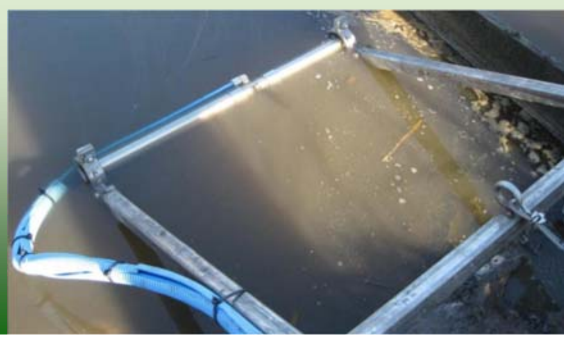
Downstream Flume Flow



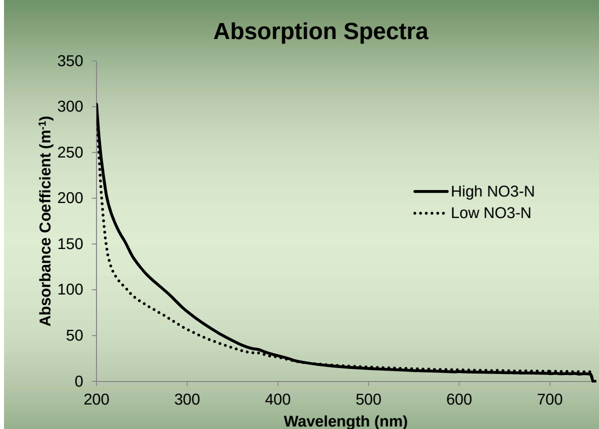
Continuous Water Quality Monitoring

- Monitored using UV-visual spectrophotometer placed in the stream
- Absorption spectrum and parameters measured every 15 minutes

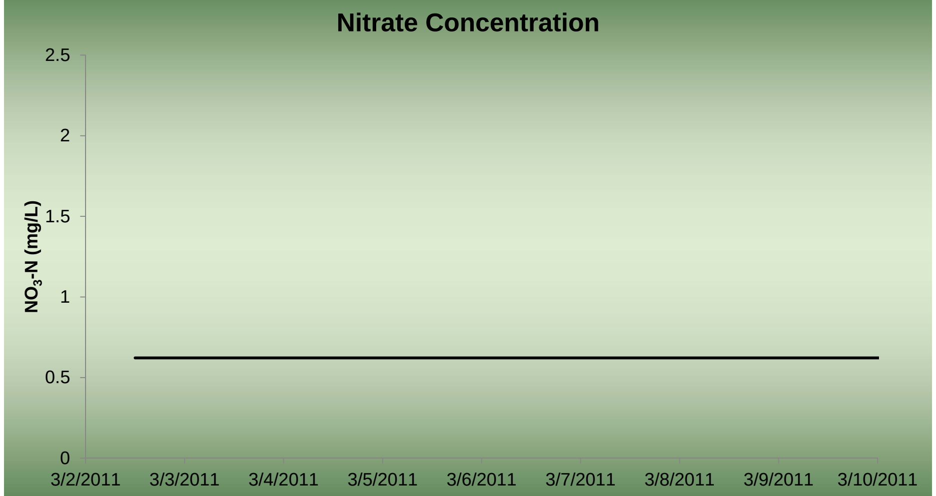
Parameter	Maximum	Resolution
NO_3^-N	70 mg/L	0.1 ±mg/L
TOC	150 mg/L	0.2 ±mg/L
DOC	90 mg/L	0.2 ±mg/L
Turbidity	1400 FTU	1.3 FTU



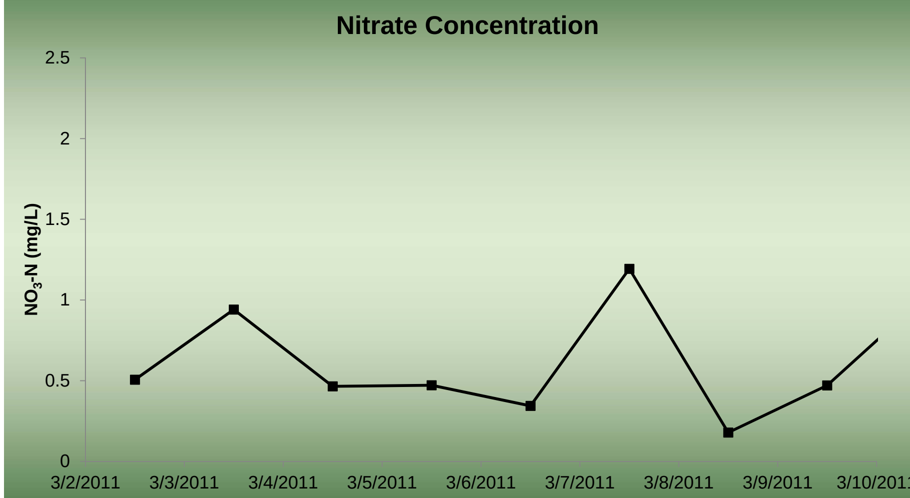
Continuous Water Quality Monitoring



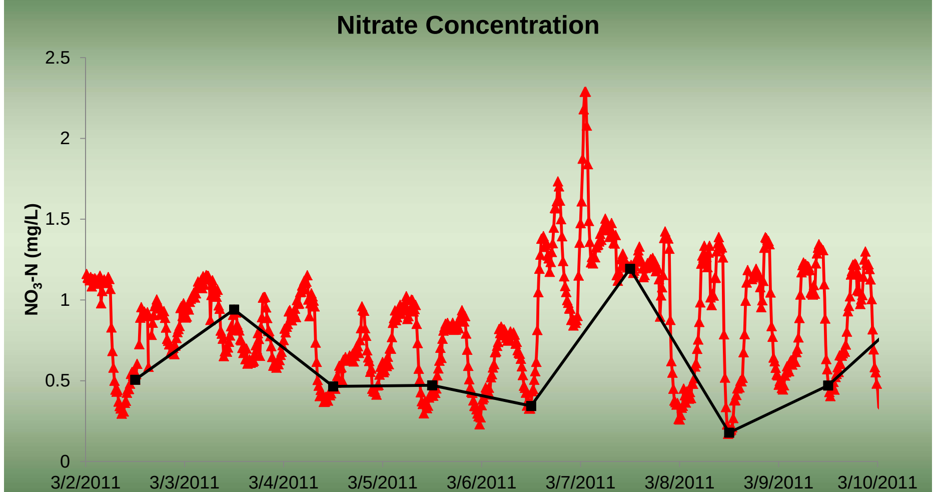
Downstream Flume – Weekly Sample



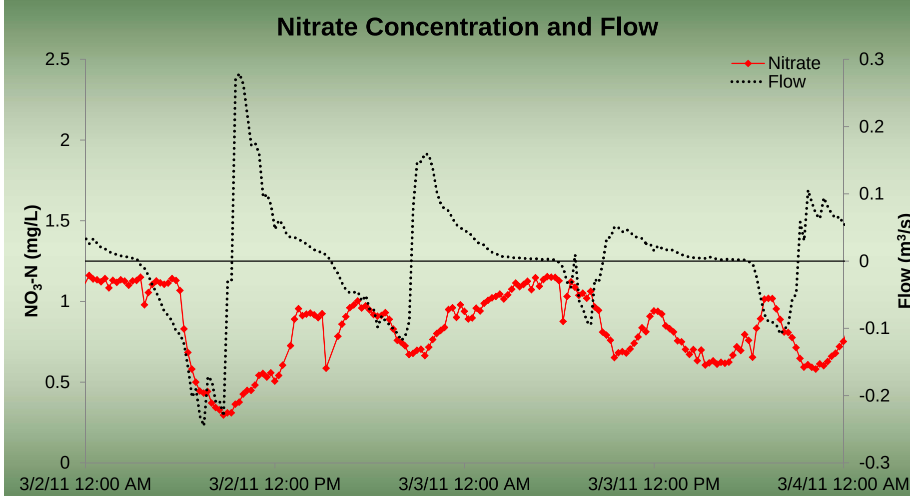
Downstream Flume – Daily Sample



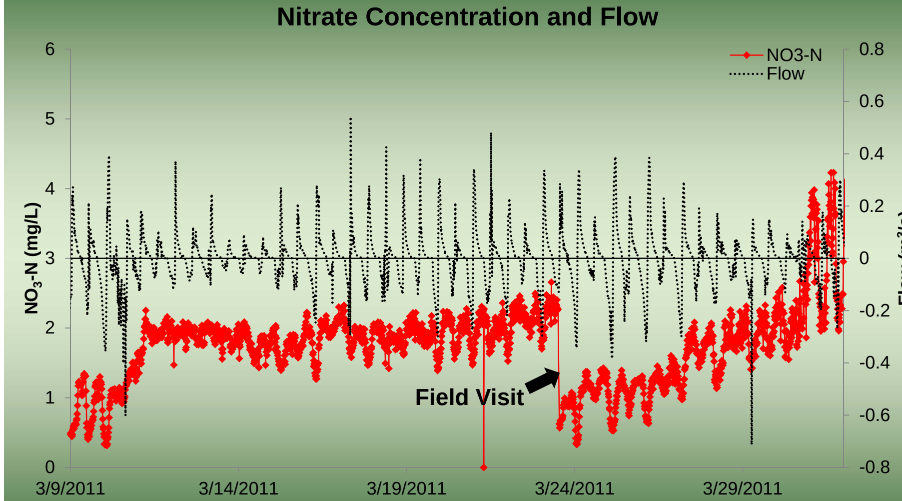
Downstream Flume – 15 minute sample interval



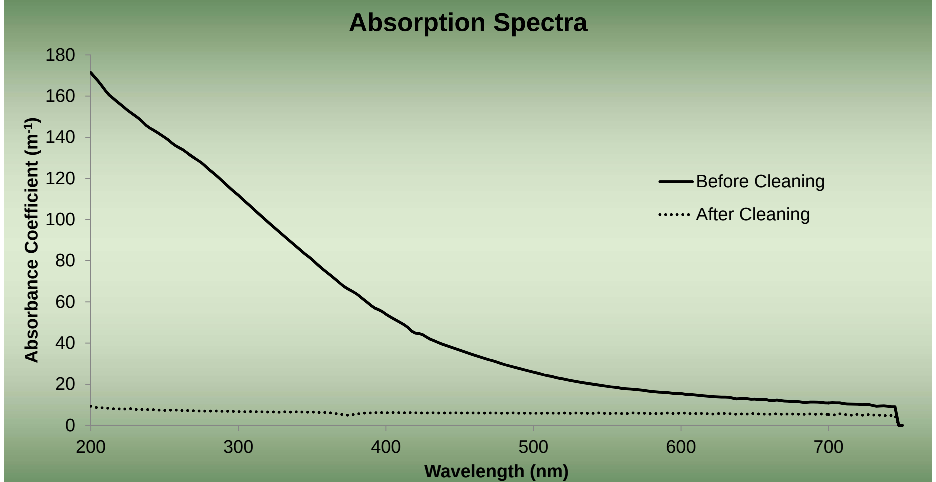
Downstream Flume



The Problem



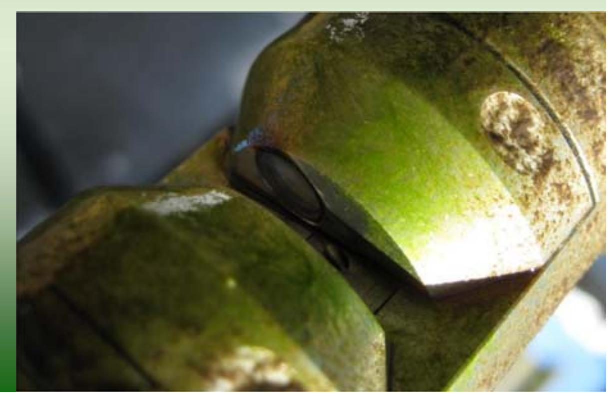
The Problem

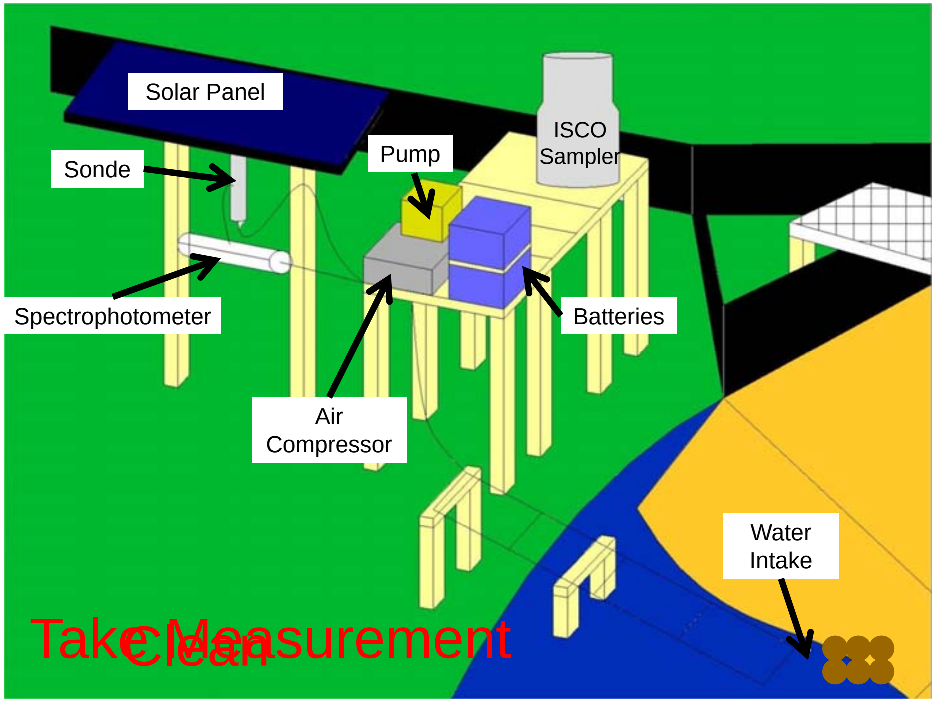


After Installation

Two Weeks Later

Fouling





Challenges of Continuous Water Quality Monitoring

- **Preventing/reducing window fouling**
- Calibration
- Solar power

What We Hope to Accomplish

- Calculate the amount of nitrate entering or leaving the marsh every 15 minutes
- Minimize sources of error
- Use a long-term mass balance to determine the mass of nitrate being retained or released by the marsh

Acknowledgements

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  - Evan Corbin
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  - Molly Mikan
  - Dr. Ken Krauss
  - Nicole Cormier
  - Rebecca Moss

Other Research

- Continuously monitor:
  - DOC
  - pH
  - Conductivity/Salinity
  - Dissolved Oxygen
  - DOM Fluorescence
- Gas fluxes
- Stream stage using machine vision and web cams