An Update of the Decomp. Physical Model (DPM): The largest AM Assessment in USACOE History.

Fred Sklar,
Director and Section Administrator
Everglades Systems Assessment

Joint Working Group and Science Coordination Group Meeting
Nov. 19, 2013

sfwmd.gov

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

S. Hagerthey
C. Saunders
S. Newman

S. Baisden
S. Wilcox
M. Davis
D. Crawford

J. Trexler
D. Childers

J. Harvey
L. Larson
B. Rosen
G. Noe

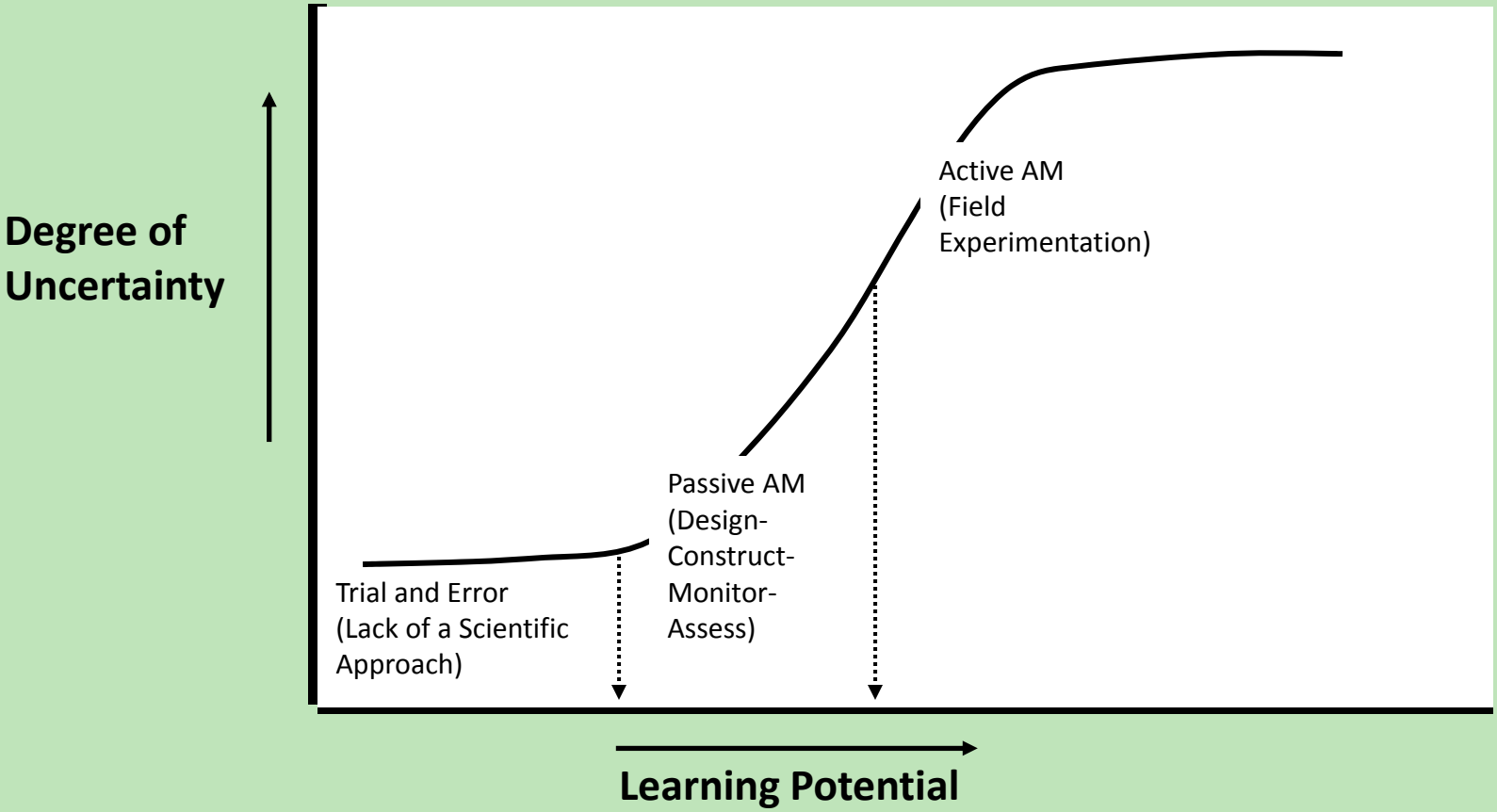
D. Ho

What is Adaptive Management?

(Holling, Gunderson and Light)

- **It is a scientific, systematic approach for finding answers to ecosystem management questions.**
- **It can be implemented at <u>any</u> point within the planning, design, construction and operation of a restoration project.**
- **It is "learning by doing" - it involves the scientific analysis of natural resources and environmental impacts of large-scale restoration or management plans, designs, constructions, and operations.**
- **It is an organized and inclusive means for identifying and addressing key uncertainties (often an alternative to numerical models), allowing managers to move forward in the face of inadequate knowledge.**
- **It is a directive of Section 601(h)(3) of WRDA 2000.**

Passive and Active AM



Active AM involves actual field testing and experimentation addressing high levels of uncertainty.

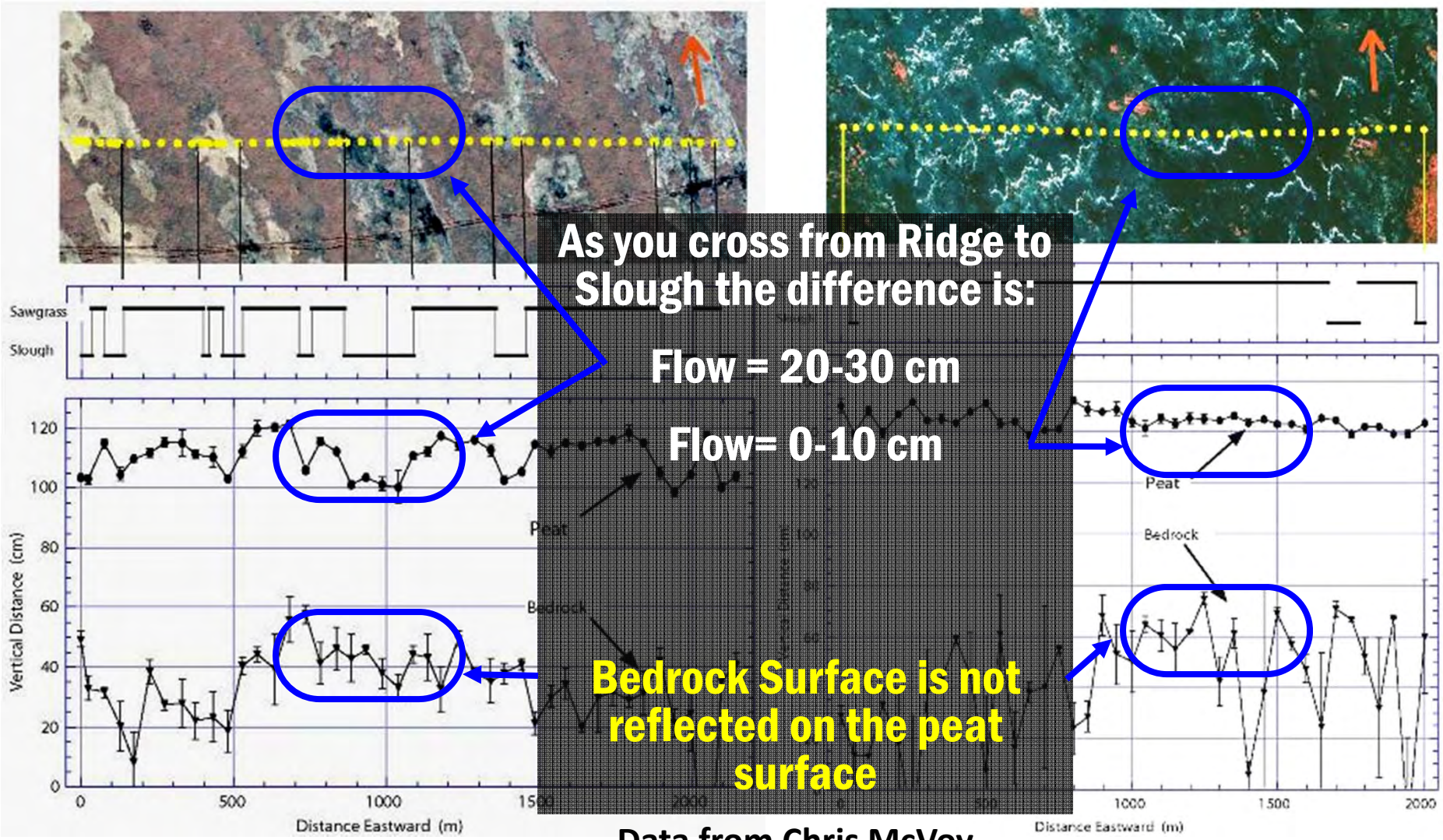
Scientific Uncertainties of DECOMP (now CEPP)

1. Ecological effects of levee modifications
2. Effects of partial versus extensive backfilling of canals
3. Water depth and hydroperiod tolerance of tree islands
4. Quantification of benefits of sheetflow
5. Assessment of seepage
6. Calibration of hydrologic models

The Flow Hypothesis: The Everglades is on the Verge of Structural Collapse

With Flow

Without Flow



Data from Chris McVoy

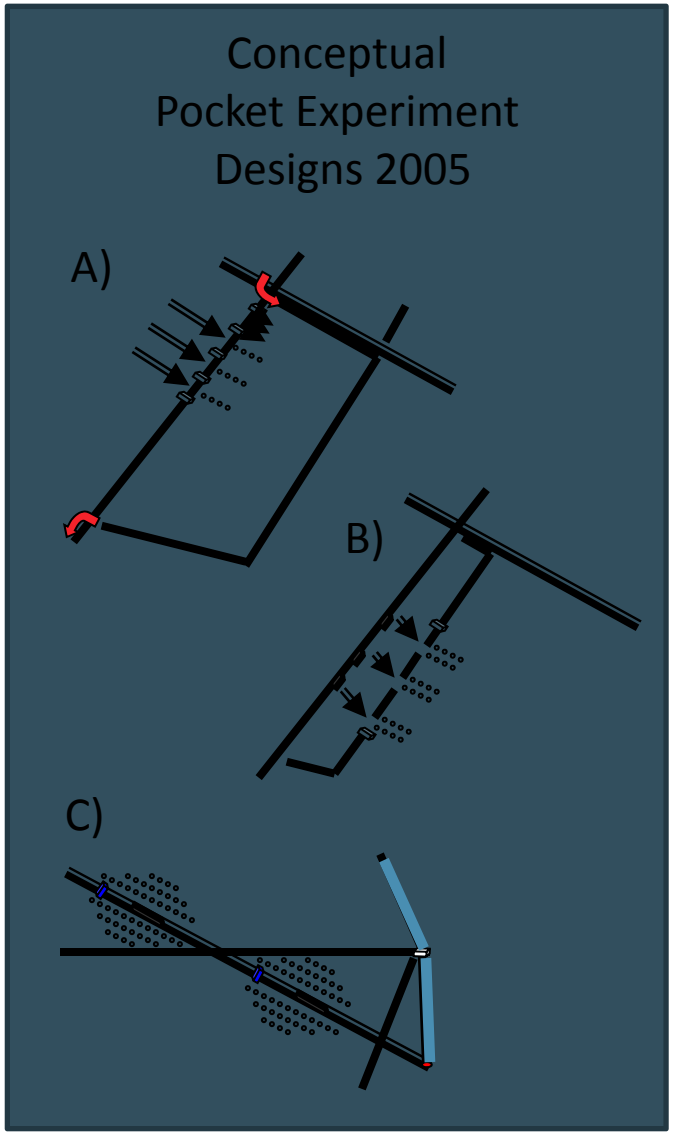
A Brief History (DECOMPozoic Era: DAMPary Period)

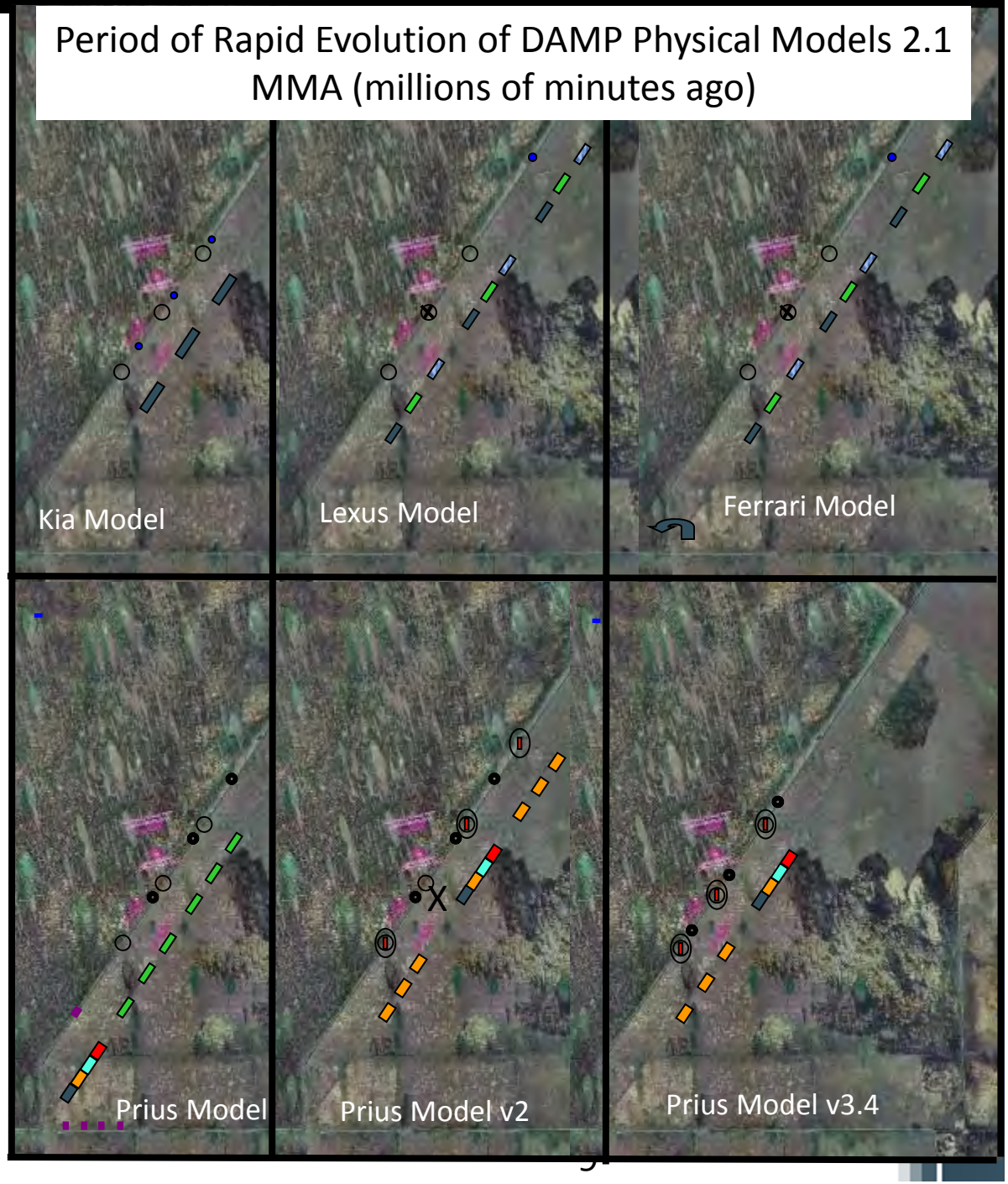
- **Fall 2004 - Concept development to use large-scale field experiments (Physical Models) to reduce DECOMP uncertainties.**
- **January 2005 - DECOMP Project Adaptive Management Strategy Development Workshop (DAMP).**
- **February 2005 - DAMP, including physical models, *approach* presented to Quality Review Board (QRB) (Taplin).**
- **April 2005 - DAMP presented to the NRC (Sklar)**
- **September 2005-January 2006 - DECOMP scientific uncertainty, hypothesis, and physical model development.**
- **March 2006 - "Description of the Physical Model Design Parameters" (Sklar, Newman, Hagerthey, Engle, Noe, Childers, and Trexler).**

Details of the DAMPary Period

- **April 2006 -** DAMP *concept* presented to the QRB. Includes Physical Model design options with the PRIUS model being favored.
  - Proposed design relied on Modified Water Deliveries (MWD) conveyance/seepage feature (C&SF) (S-345)
  - Estimated cost of $10.3 Million over 5 years
    - $3.4M Levee Removal and Canal Backfill (assumed MWD in place)
    - $6.9M Monitoring and Field Assessment
- **2006-2007 -** Physical model design work progressed based on MWD C&SF features. This was also the period of "Bigger & Bolder" and Integrated Adaptive Restoration (IAR).
- **April 2007 -** Physical Model presented at the National Conference on Ecosystem Restoration (Sklar).

Punctuated Equilibrium Physical Model Theory

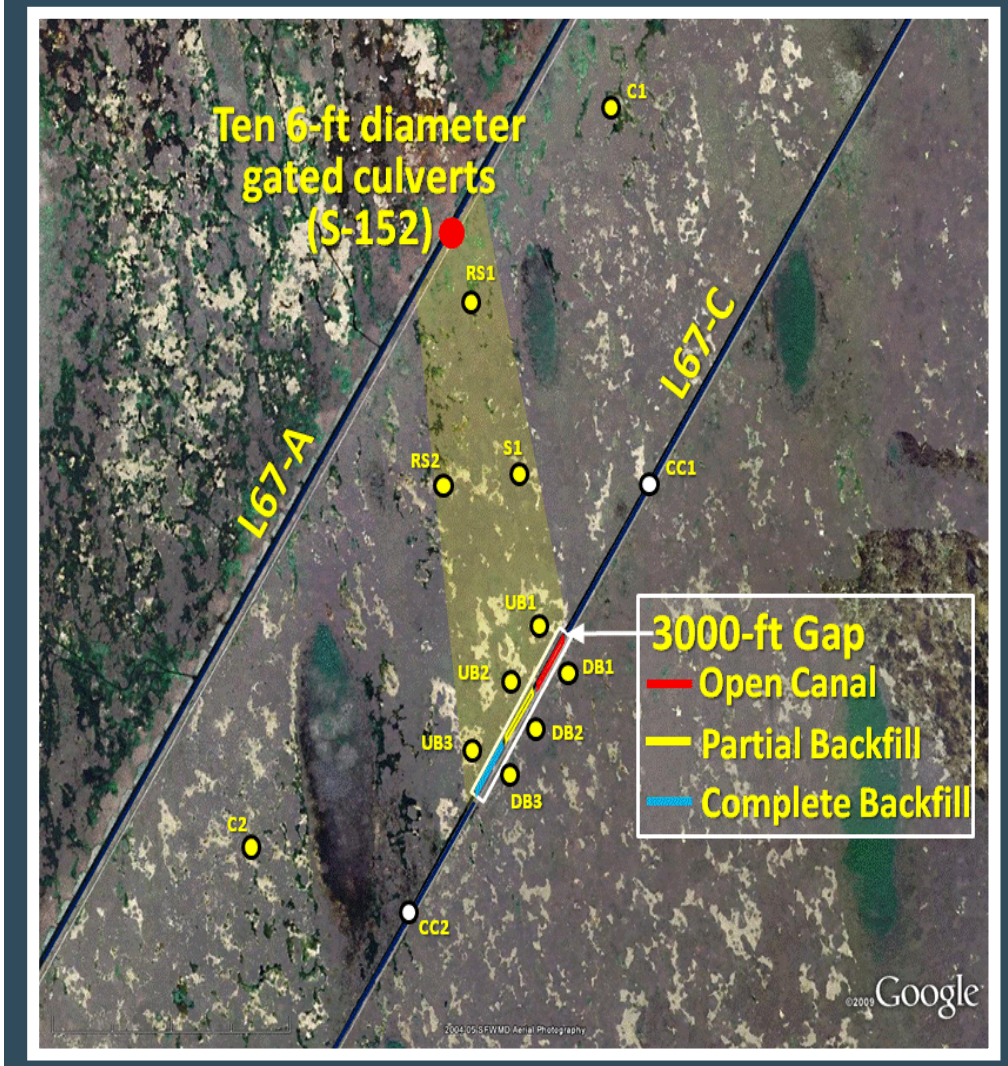




A Brief History (Enter the DPModelocen Epoch)

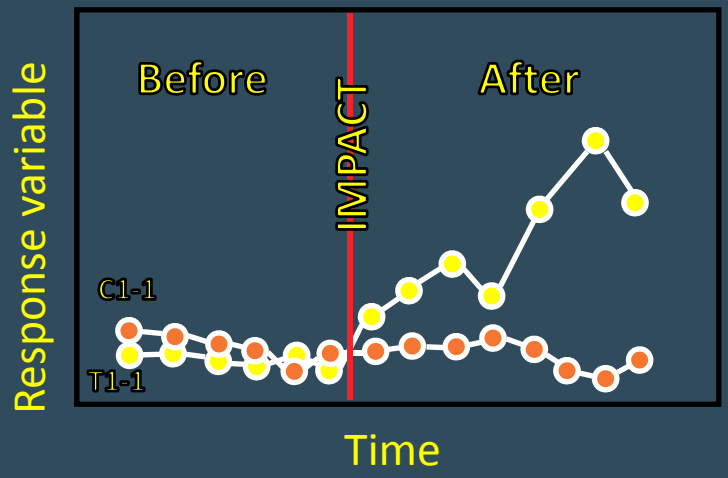
- **February 2008 - Physical Model design put "on-hold" due to MWD financial and legal uncertainties.**
- **July 2008 - DECOMP PDT decides to reinitiated project decoupled from MWD C&SF.**
- **September 2008 - DECOMP Physical Model (DPM) design begins. (Reduce uncertainties; $10.3M cost cap; Reduced in scale)**
- **October 2009 - DECOMP Physical Model (DPM) Science Plan is completed (Eleven authors; Thirteen sheetflow hypotheses, nine canal backfill hypotheses)**
- **October 2011 - Final EA; NEPA Complete and DECOMP Physical Model (DPM) Science Plan is implemented (Before Impact monitoring begins)**

DECOMP Physical Model (DPM)



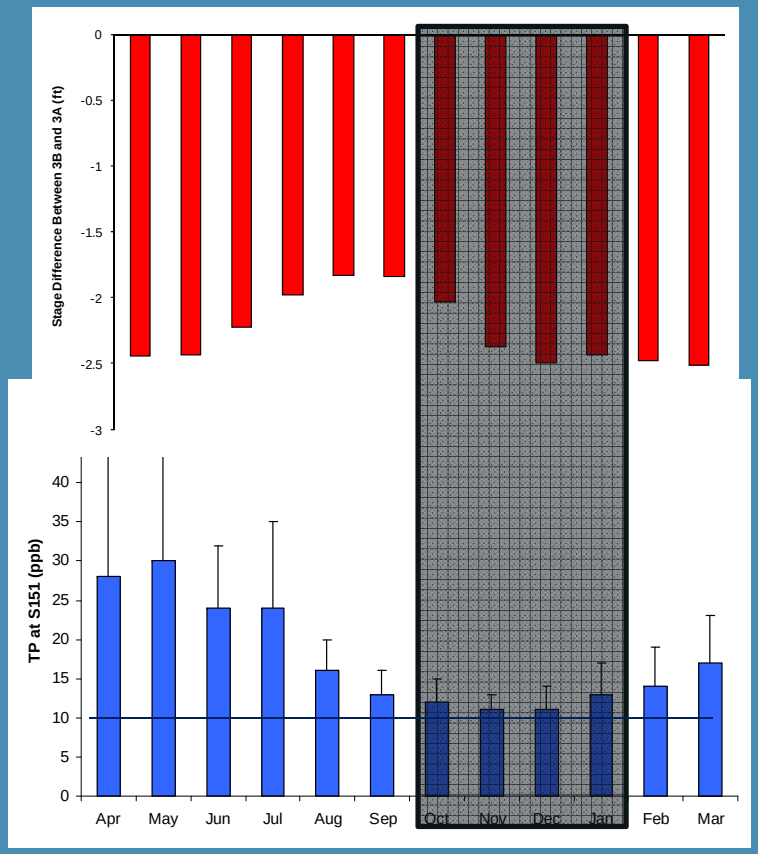
- Address uncertainties associated with hydrology, canal backfilling, sediment transport, and ridge & slough restoration
- Ten gated culverts (750 cfs) on L-67A
- 3,000 ft of L-67C levee removed
- Three canal "treatments"

BACI Design



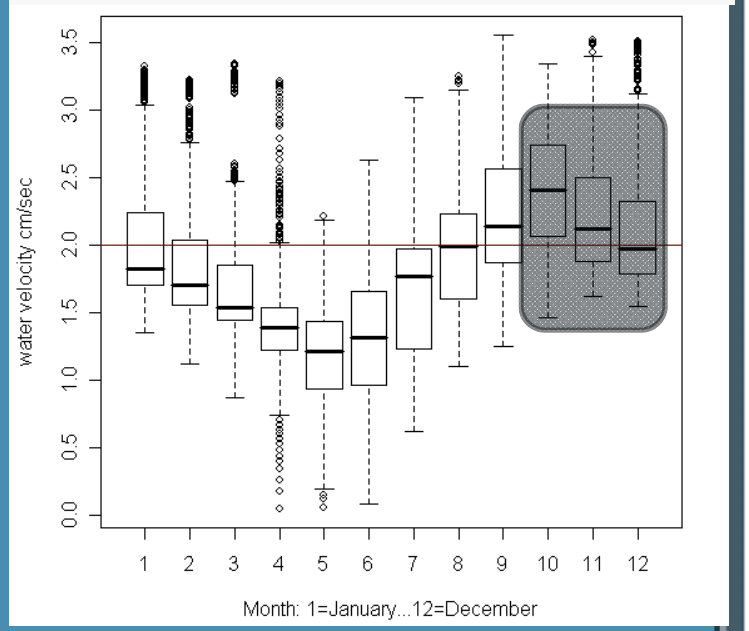
Operational Window (OW)
October-January
Estimated 17-41 days of Operation

Monthly Mean Stage Difference WCA-3the B-WCA-3A

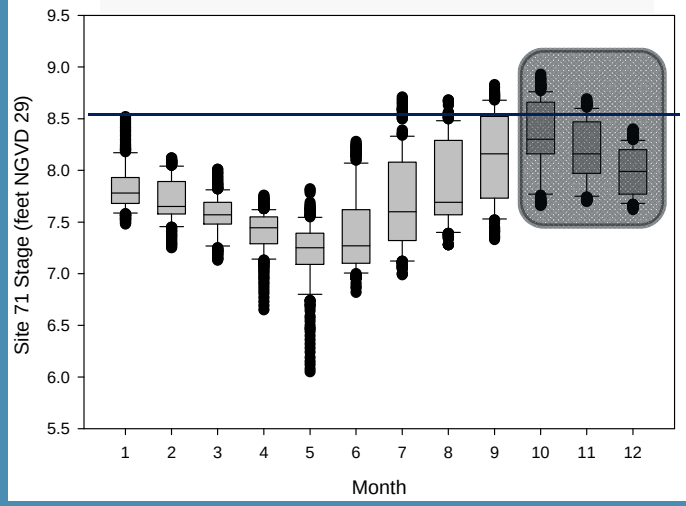


Monthly Mean TP Concentration at S-151

Mean Monthly Predicted Velocity at S-71 Gauge



Mean Monthly Stage at S-71 Gauge

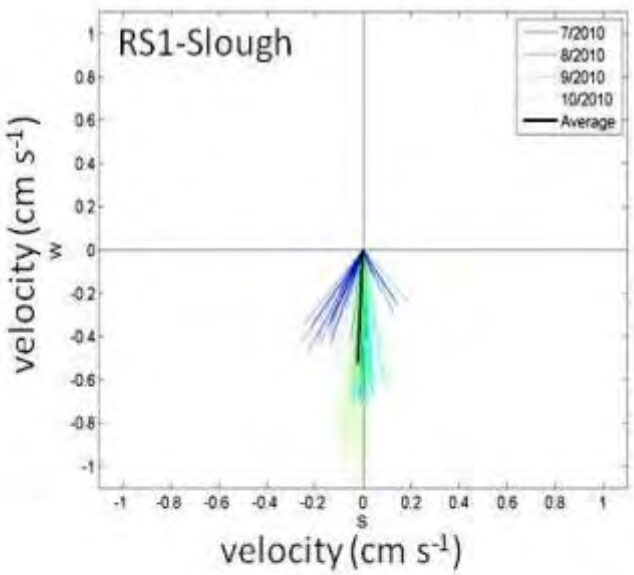


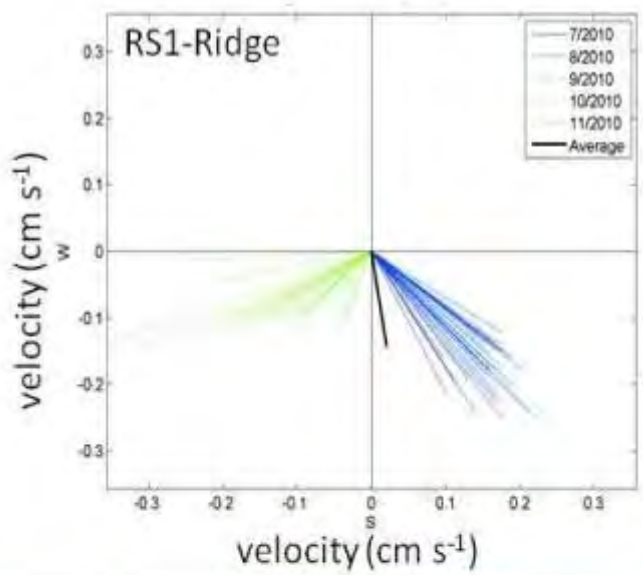
L67-A
S-152
USACOE Construction
Contract Awarded
to Leno Dredging: May 3, 2012
L67C canal
backfill &
levee removal

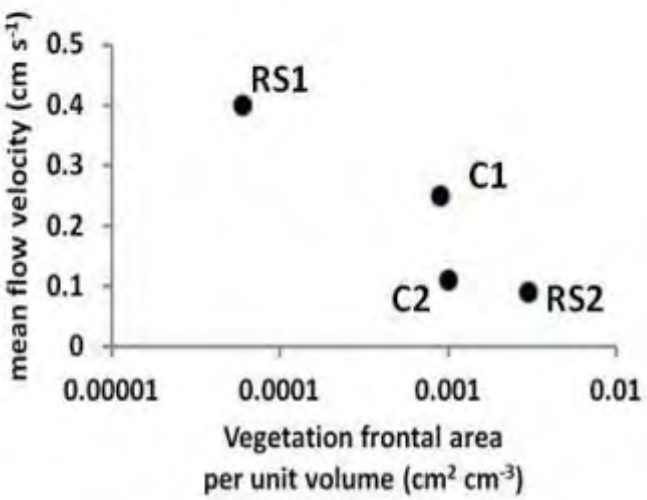
What is Being Measured?

- **Hydrology (Laurel Larsen, Jud Harvey, David Ho)**
  - A network of sites for stage, water depths, flow direction, and velocity
  - Hydraulics of L-67A culverts (head and tail water stages and cfs)
  - Synoptic mapping of water depth and velocity in conjunction with flow manipulations
  - Vegetation mapping for hydraulic resistance
  - Tracer studies (SF6 tracer and dye)
  - Canal hydraulics
- **Physical Transport (Colin Saunders, Laurel Larsen, Sue Newman)**
  - Synoptic mapping of surface water biogeochemistry and sediment erosive properties
  - Resuspension and deposition of natural particles (LIST)
  - Particle transport (Floc tracers, sediment traps, biogeochemical markers)
- **Biological (Joel Trexler, Sue Newman)**
  - Environmental monitoring (dissolved oxygen, pH, temperature, specific conductivity)
  - Fauna characterization (native and exotic) and movement
  - Vegetation structure

Water velocity and direction: Data in adjacent slough (top left) and ridge (top right) habitats at RS-1







Pre-construction SF6 (gas) Tracer Does Not Follow Ridge-Slough Directionality

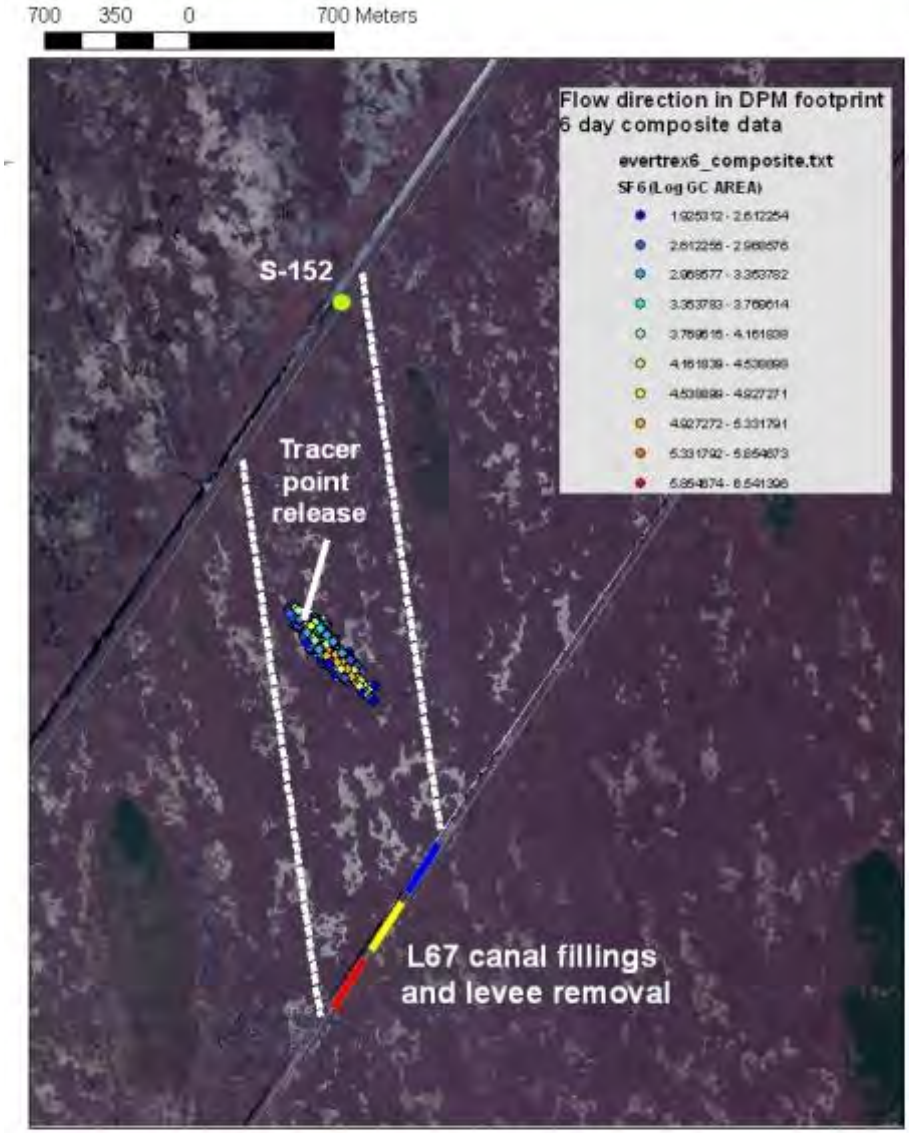


Figure 1. Surface water tracer release and recovery in the DPM footprint over a period of 5 days (Oct 8-12, 2009). 5L of the tracer was released and mixed by hand in the middle of a remnant slough on October 7th. Flow direction is southeast.

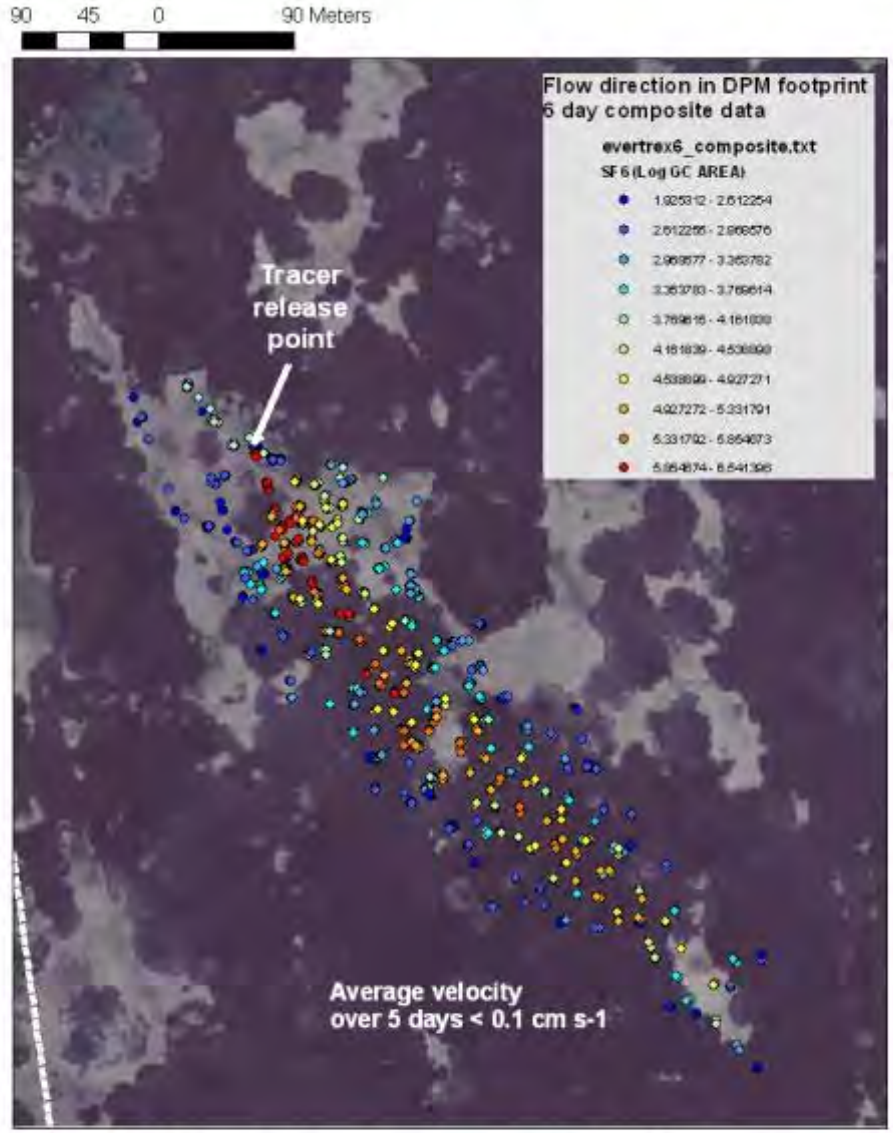
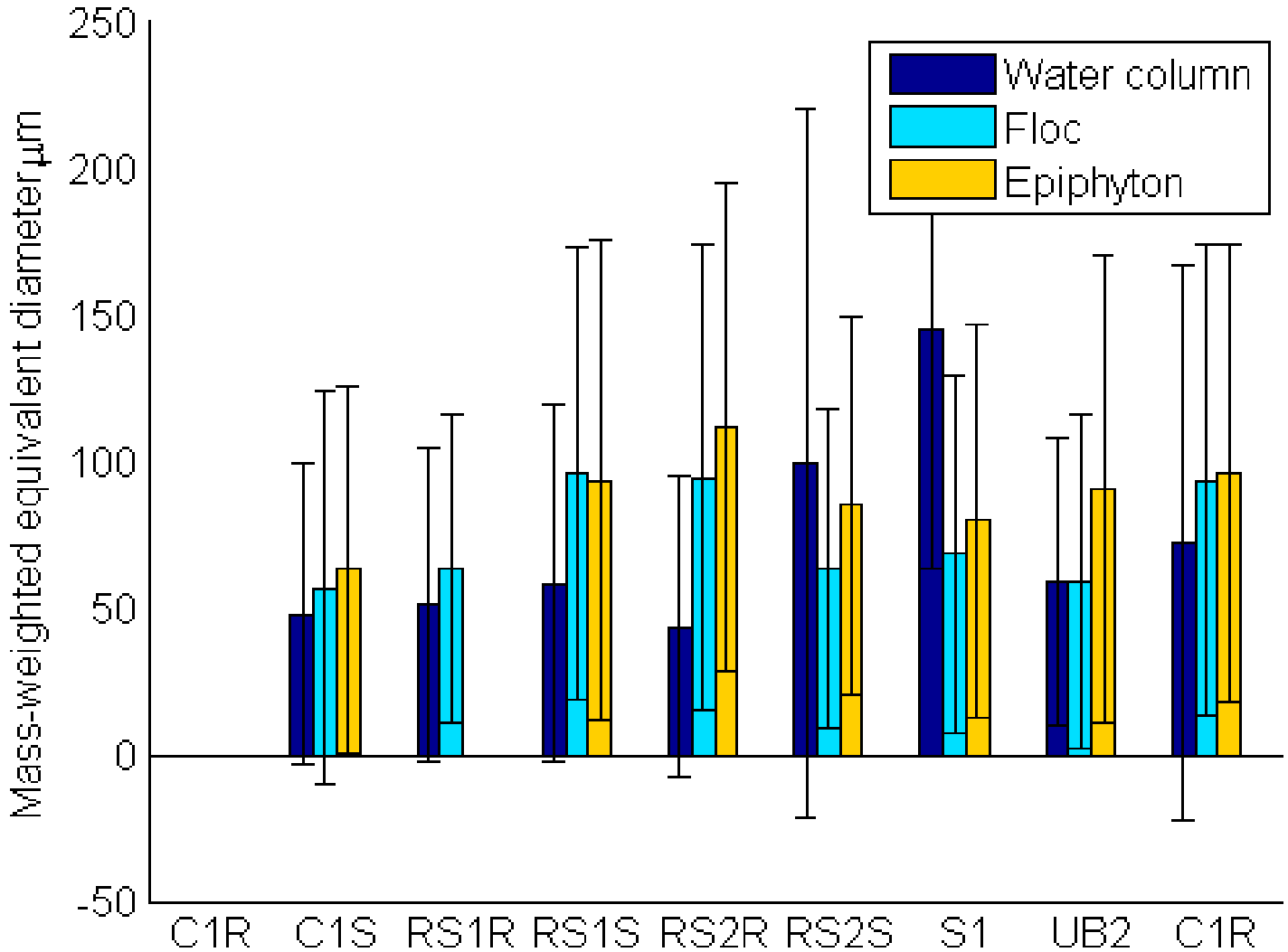


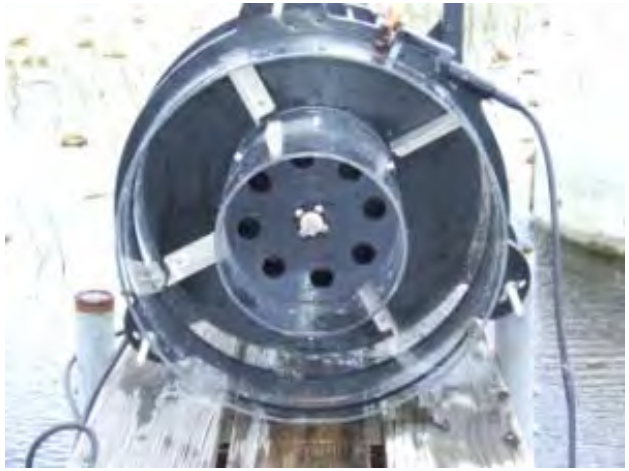
Figure 1. Surface water tracer release and recovery in the DPM footprint over a period of 5 days (Oct 8-12, 2009). 5L of the tracer was released and mixed by hand in the middle of a remnant slough on October 7th. Flow direction is southeast. Highest tracer amounts shown in red, lowest in blue.

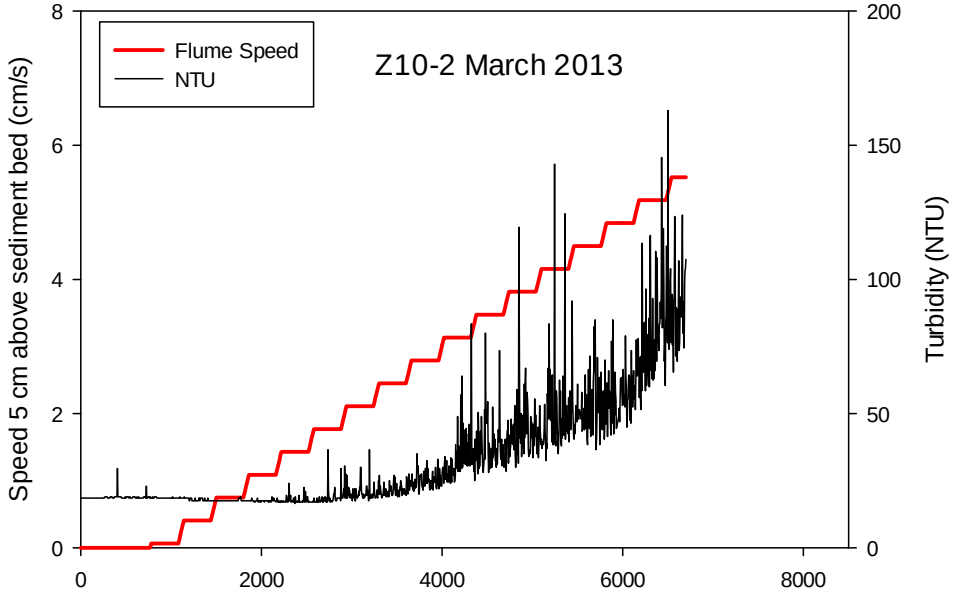
Ho and Engel unpublished data

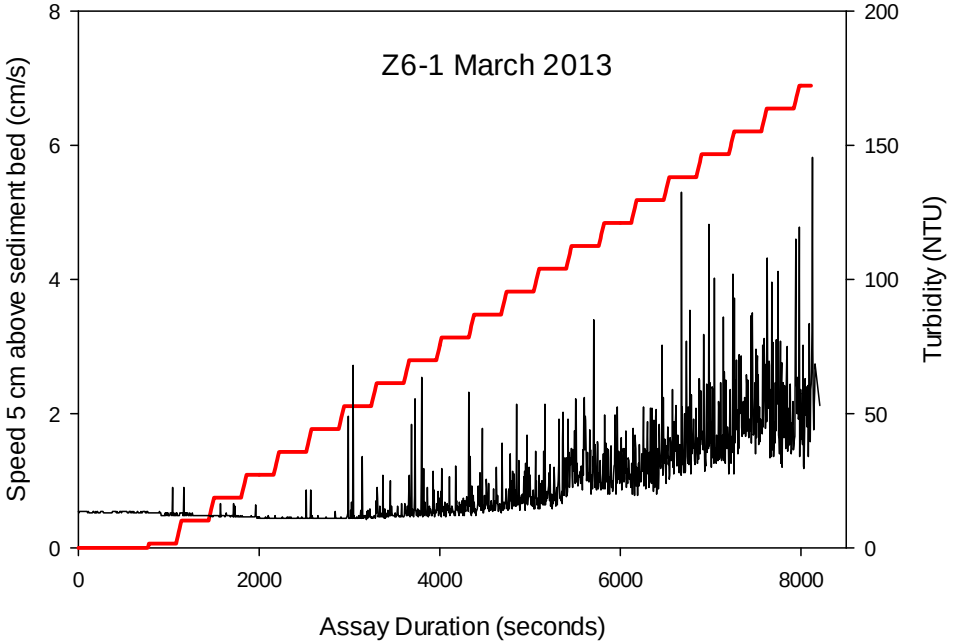
Sediment Characteristics: Mass-weighted equivalent diameter of particles



Sediment Characteristics-erosion: Time series measured using the benthic annular flume at sites with mineral floc (site Z10-2) and organic floc (Z6-1)







Sediment Characteristics: Under the microscope

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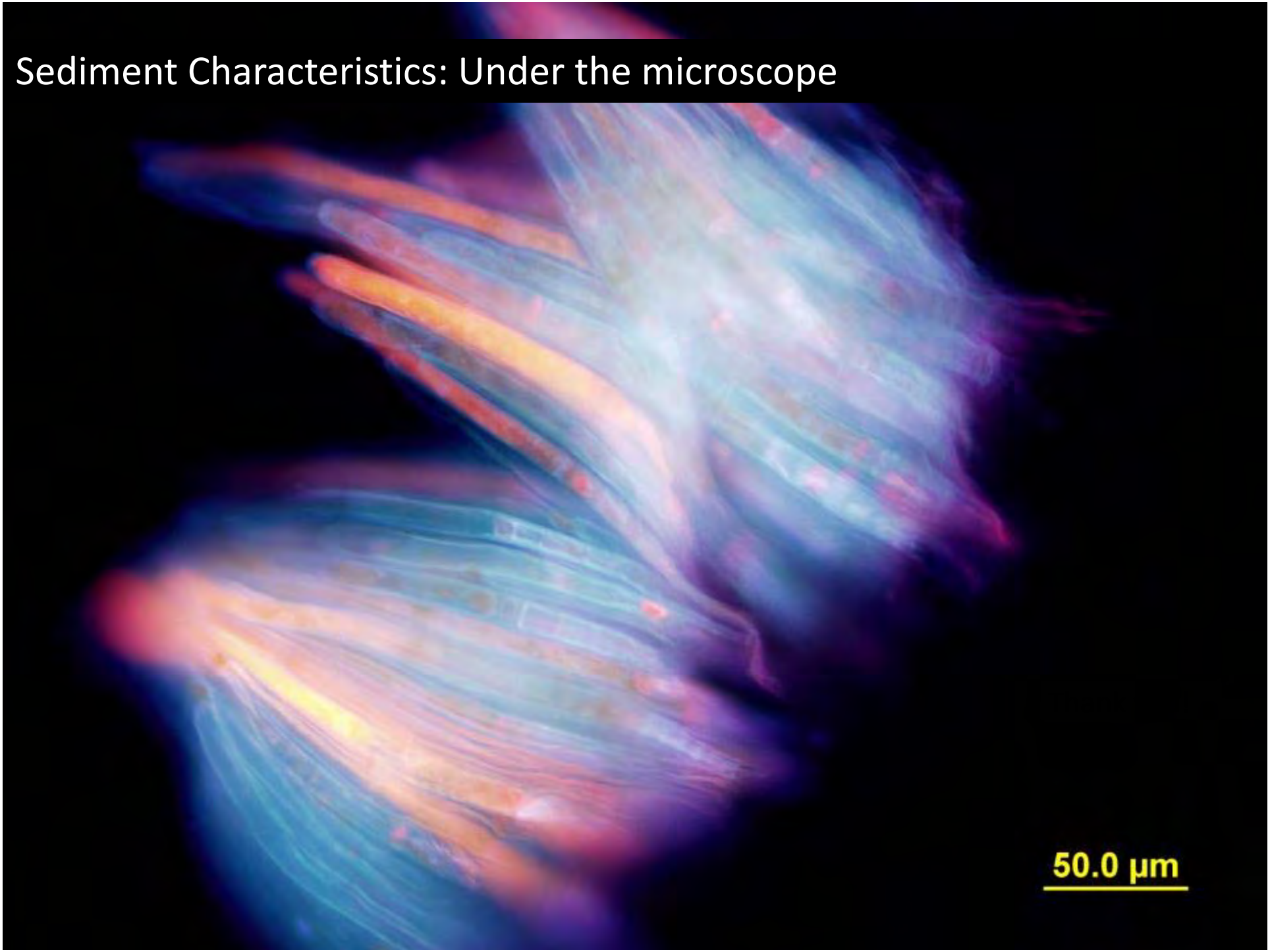
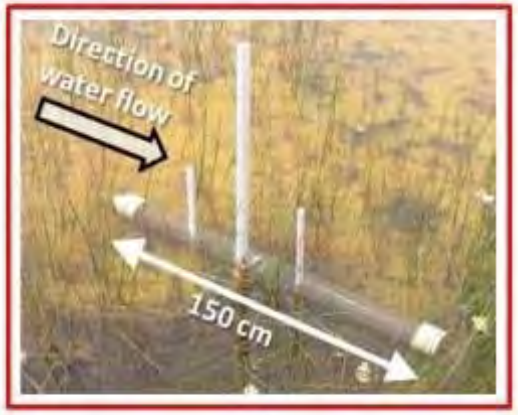
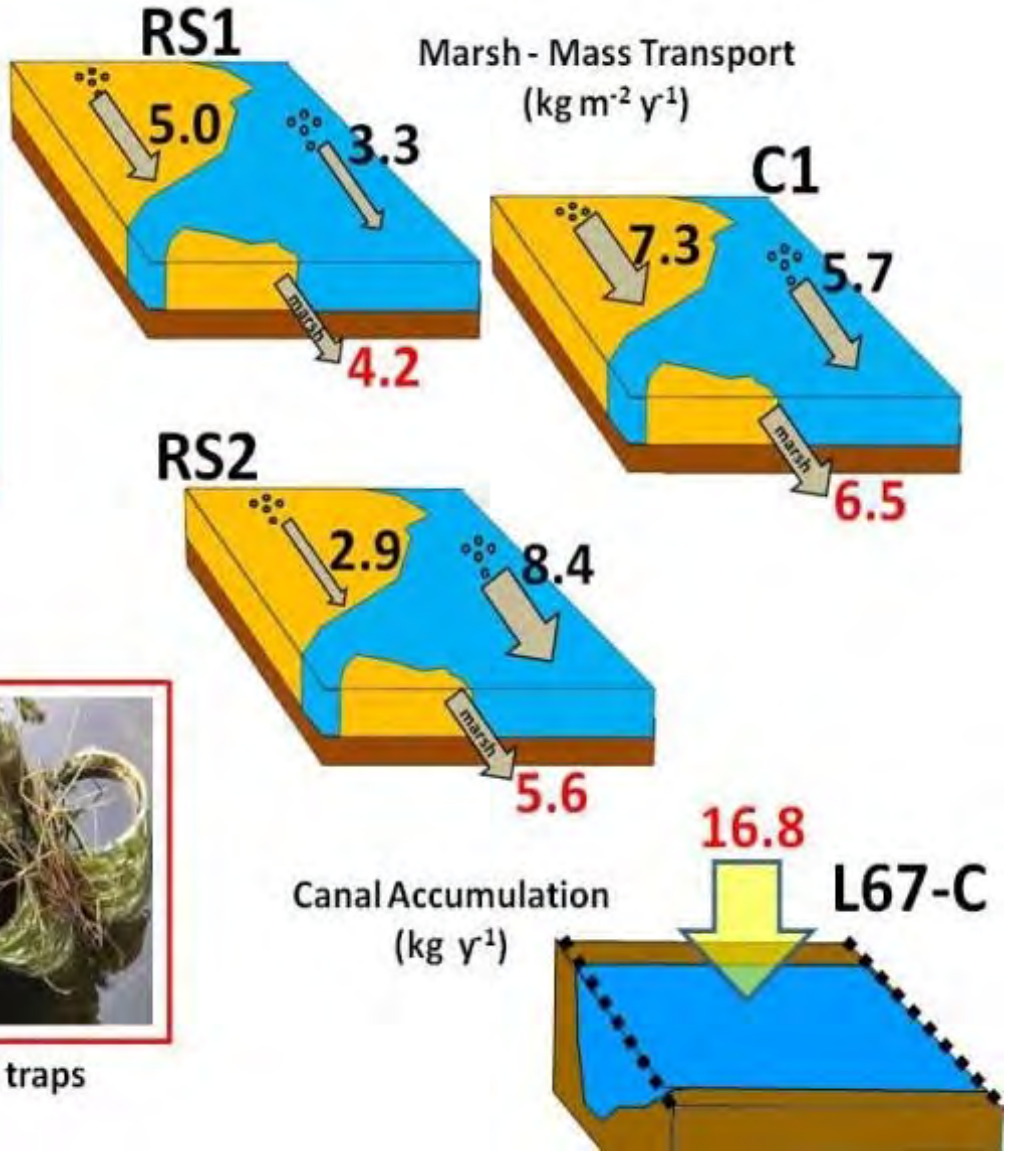


Sediment Characteristics-budget: marsh and canal sites, based on sediment trap data

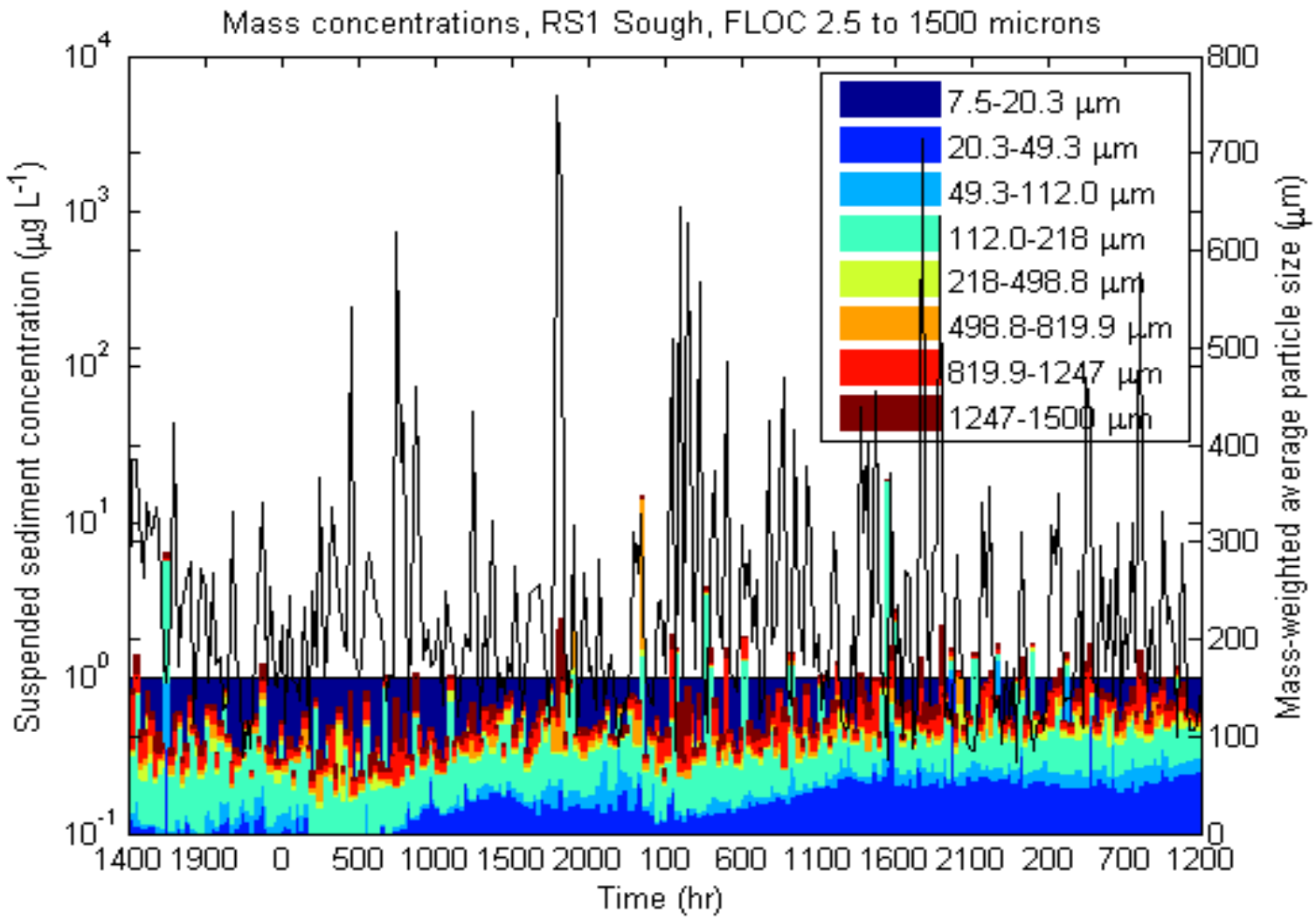


Marsh sediment traps

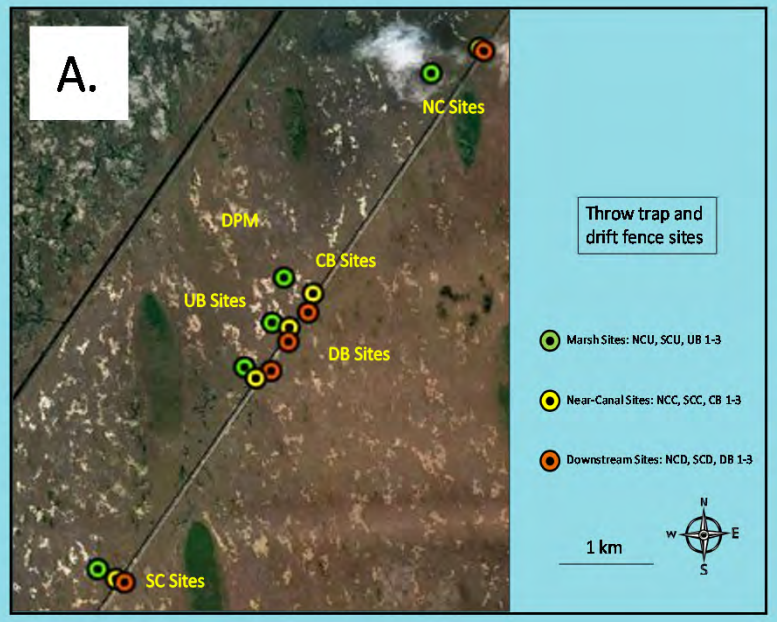


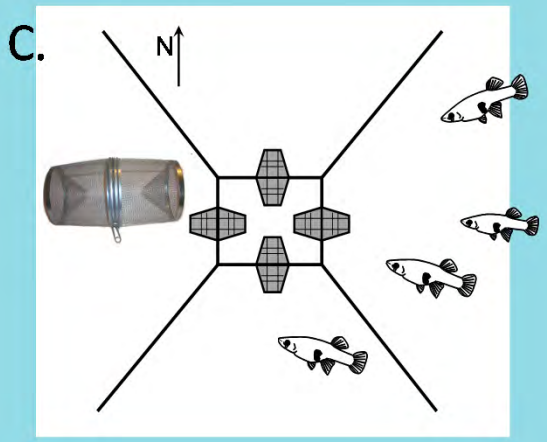
Canal sediment traps

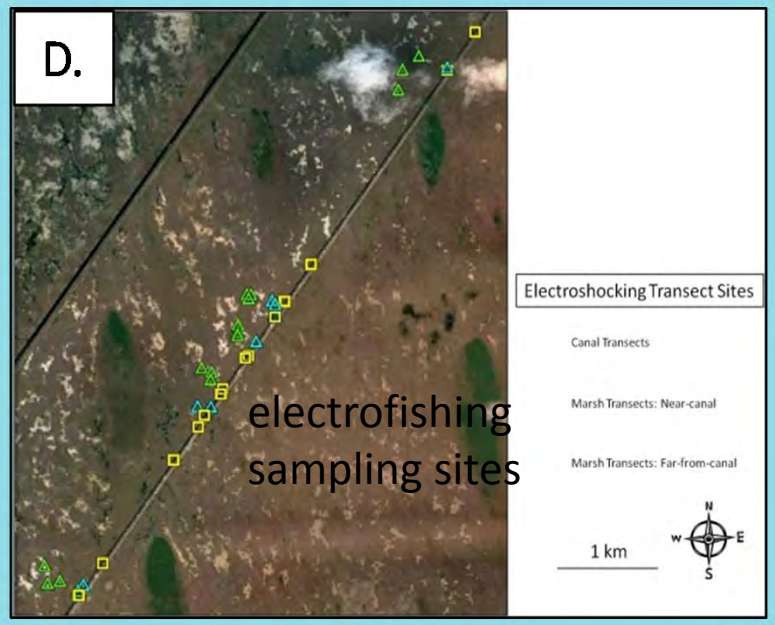
Sediment Characteristics: Mass-weighted suspended sediment concentrations and particle size of small component of sediment over forty hours at RS1 Slough site. (Data was binned in the 7 size classes from 1.25 microns to 250 microns)



Anglers want to know: Fish response to canal treatments



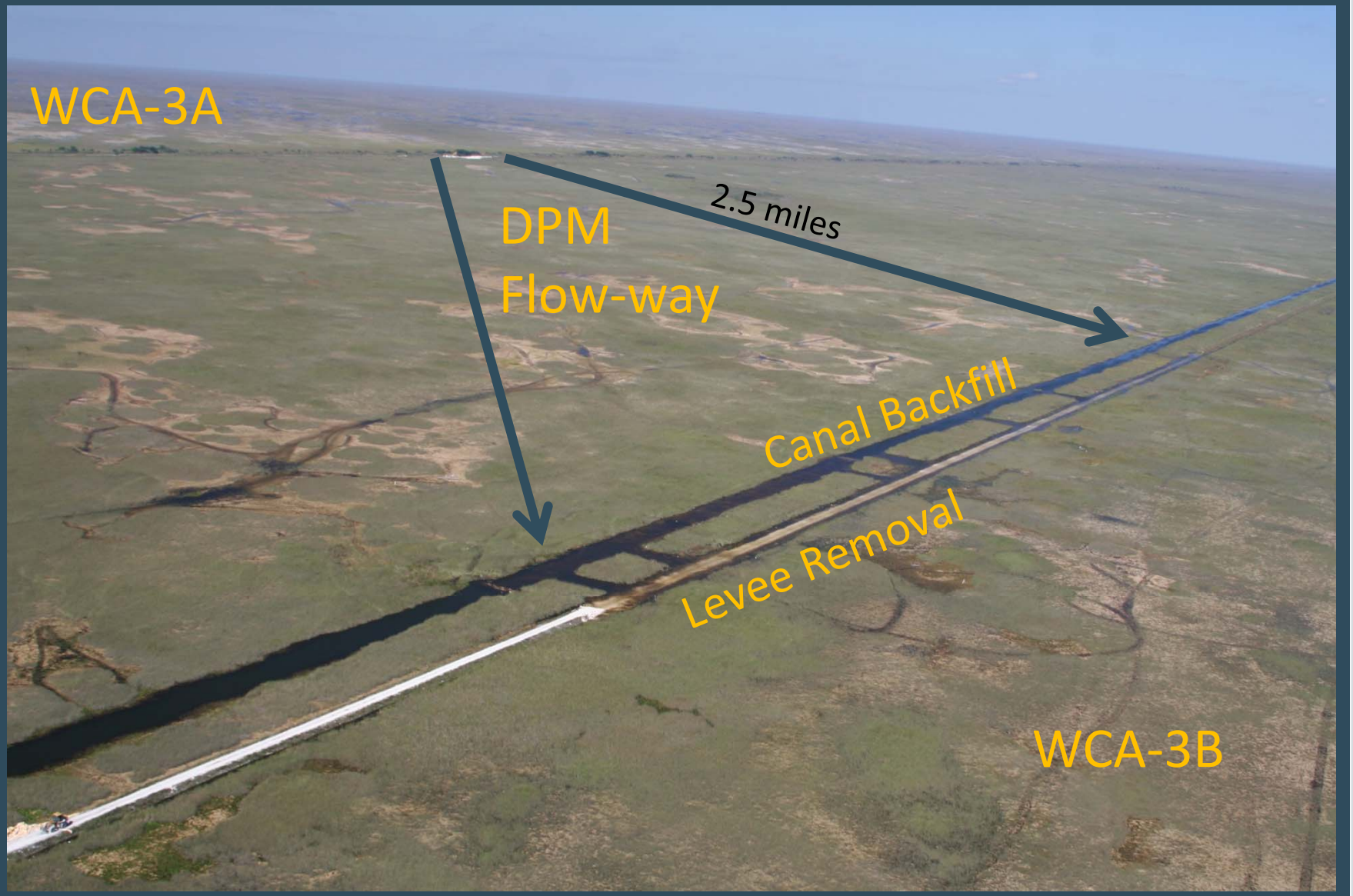




Opening Day: Nov. 5, 2013

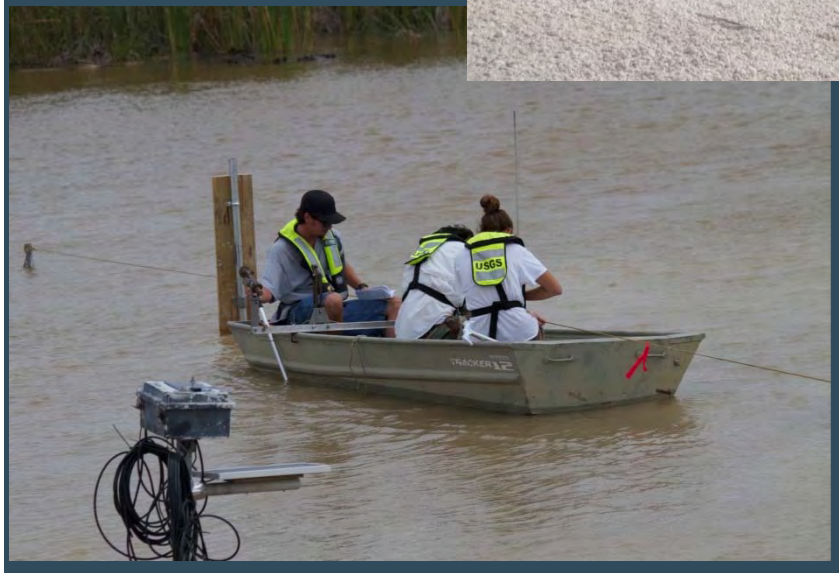
USACOE and SFWMD Open Culvert Gates

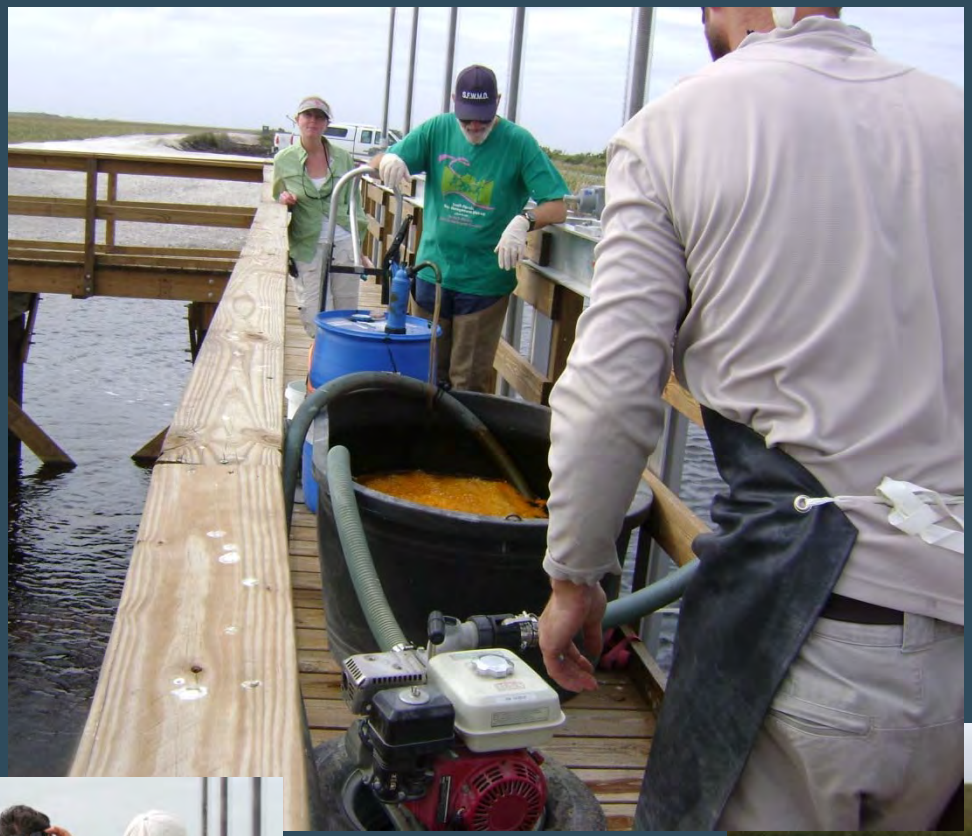
At 4:00 am, King Colin Saunders directs traffic


WCA-3A
DPM
Flow-way
2.5 miles
Canal Backfill
Levee Removal
WCA-3B

Downstream equipment and people get ready for the Fluorescein dye.

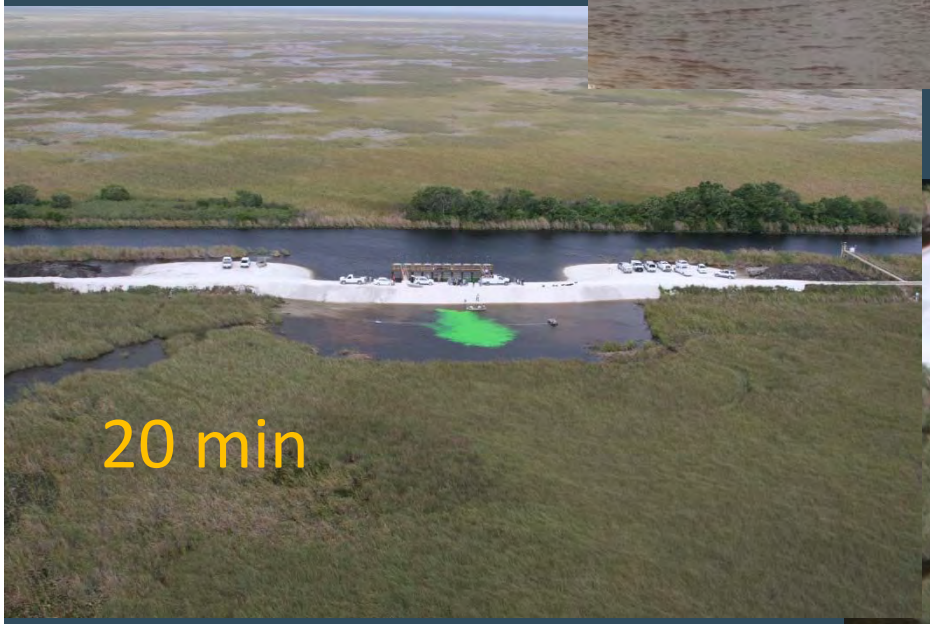
USGS

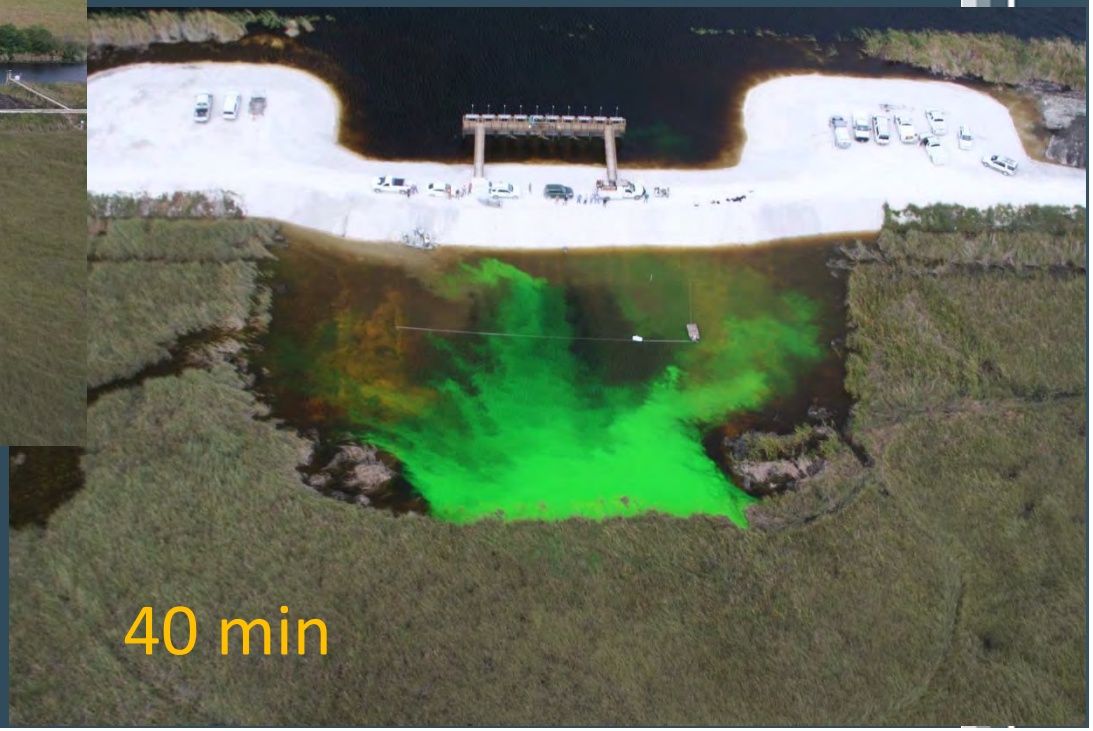

USGS
TRACKER 12



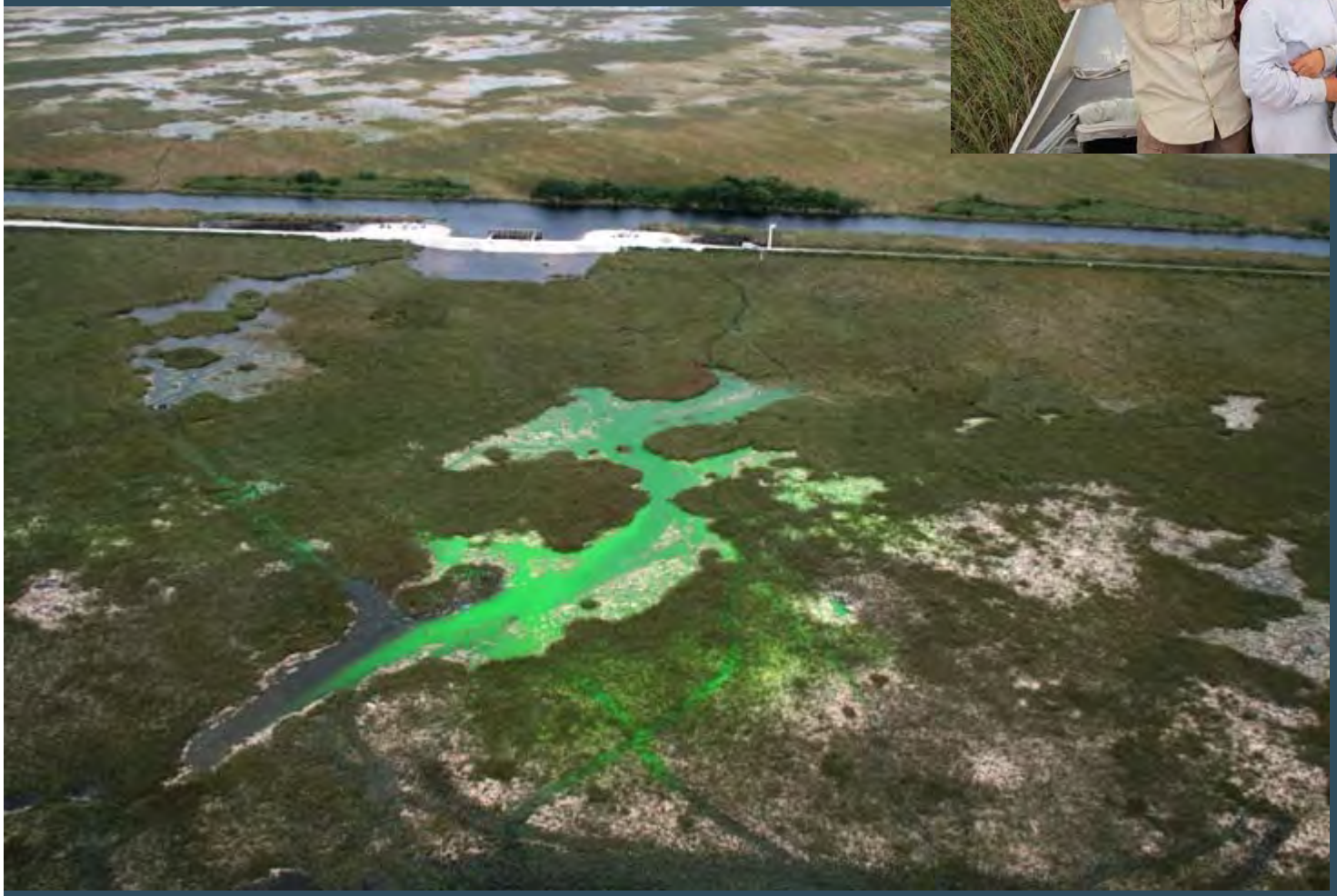
Getting the Fluorescein dye mixed.

10 min
USGS


20 min


40 min

Happy to see 3-5 cm/sec in the slough at 1300 hrs.



Thank You for Your Attention