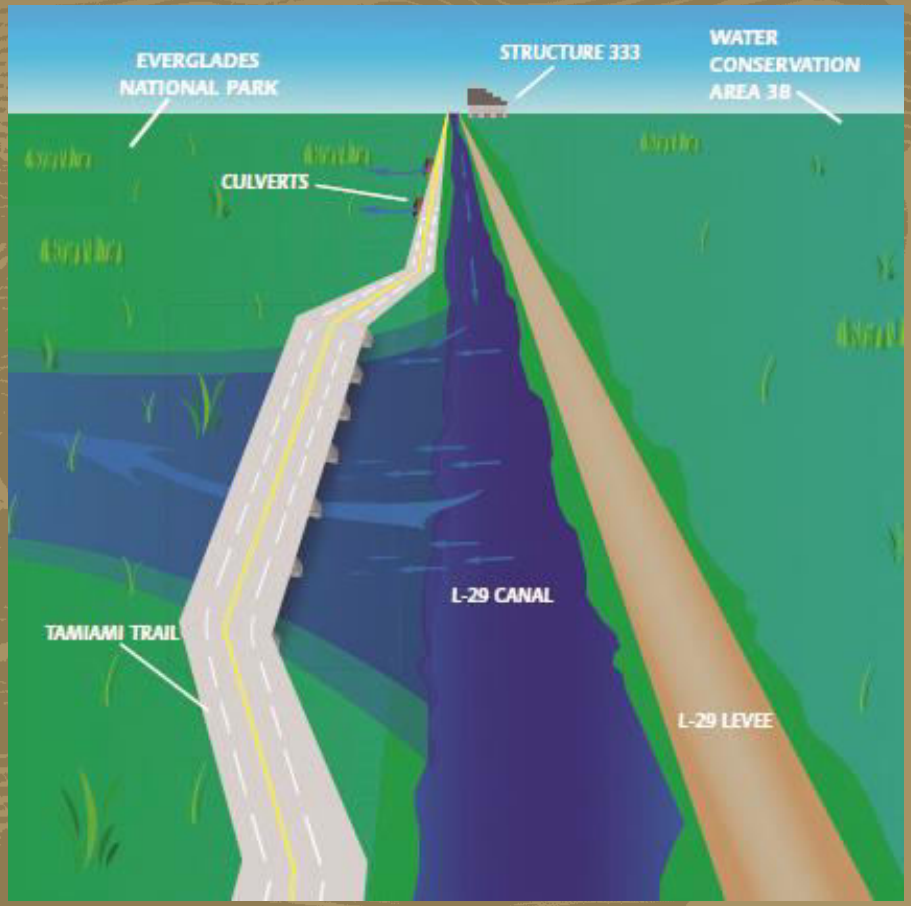
G-3273 and S-356 pump test objectives and flow-stage monitoring

Jed Redwine (ENP)



Pump test - expectations

Modified Water Deliveries: Improving Hydr...

Modified Water Deliveries:

Phased Implementation – Three Increments

The resulting plan includes three steps, or increments, to allow phased implementation of operations. Increment 1 is expected to produce small but important hydrologic benefits based on the additional water flow and seepage return. Increment 2 is expected to provide additional hydrologic and ecological benefits to NESRS and data collected during the first two increments will be used in Increment 3 to design a new operational plan for the system.

Increment 1 (2015-2017)– Relax constraints on gage G-3273, and test seepage control pump S-356, while maintaining the L-29 Canal at the current level, or stage, of 7.5 ft

Increment 2 (2017-2019) – Relax constraints on G-3273, and test seepage control pump S-356, while allowing the L-29 Canal to reach a maximum stage of 8.5 ft

Increment 3 (2018-2021) – Develop a new operational plan for the system using data collected during Increments 1 and 2.

Pump test - actual

Dryer than average wet season, followed by a wetter than average dry season (and record rainfalls in January 2016):

Increment 0: cycle testing of the pumps
Sept 9, 2015 – Sept. 20, 2015

Increment 1: raising stage in L29 canal
Oct. 15, 2015 – for a while, with some interesting challenges due to high rainfall

2/15/2016: Emergency deviation – up to 8.5 stage level may occur*

* "The U.S. Army Corps of Engineers South Atlantic Division has approved a request from Florida Governor Rick Scott for deviation from its water control plan for a key Everglades reservoir located west of Miami…. The deviation raises the levels as high as elevation 8.5 feet, which would allow more water to flow from WCA-3 to Everglades National Park."

The relevance of Adaptive Management

Managing expectations vs. managing the critical path toward restoration

"Adaptive management is a formal process for continually improving management policies and practices by learning from their outcomes (Taylor et al., 1997). In the context of Everglades restoration, CERP adaptive management is a structured management approach for addressing uncertainties by testing hypotheses, linking science to decision making, and adjusting implementation, as necessary, to improve the probability of restoration success."

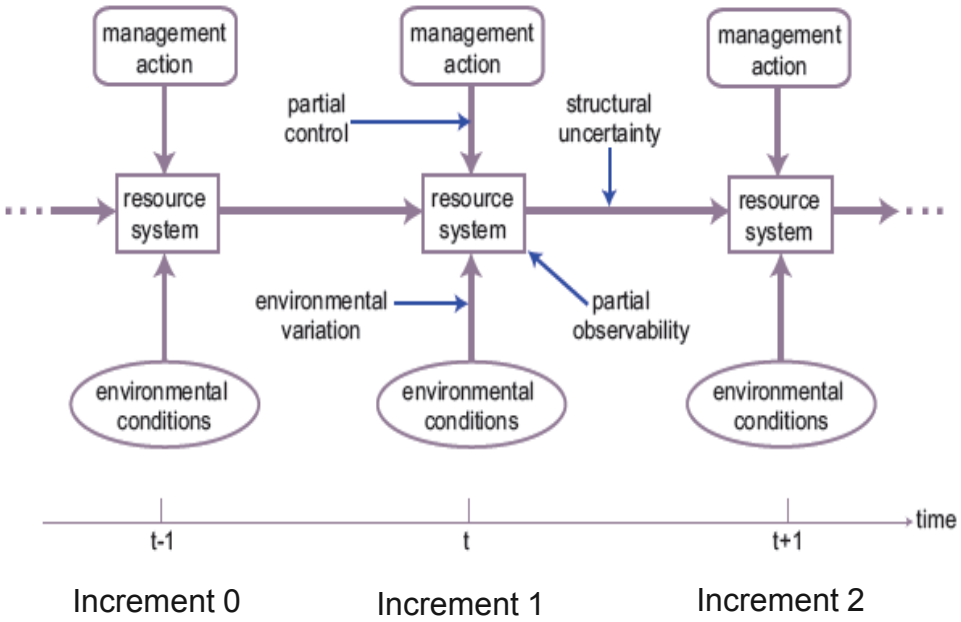


Figure 5.2. Uncertainty sources in natural resource management. Partial control limits the influence of management actions. Environmental variation affects resource system status and dynamics. Partial observability limits the recognition of system status. Structural uncertainty limits the ability to characterize system change.

From Williams et al. 2007: this figure identifies the sources of uncertainty associated with management decisions of large scale/complex systems.

Ecological Monitoring Goals and Objectives

Overarching goal
Assess restoration successes and problems, contributing to adaptive management process

Short-term Objectives (for 1st and 2nd Increments, and future projects and ops)
1. Quantify and assess effects of tests on:
   - Nutrient inputs, legacy accumulations, transport into un-impacted marsh
   - Ecosystem restoration indicators, including
     - Hydropatterns – depths, duration, directionality, and magnitude of flows
     - periphyton
     - soil condition (accretion)
     - plant community structure and biomass
     - prey base (fish and invertebrates)
     - wading birds and alligators
   - Threatened and endangered species
   - Invasive exotic species
   - Downstream salinity (with S-197 operations)

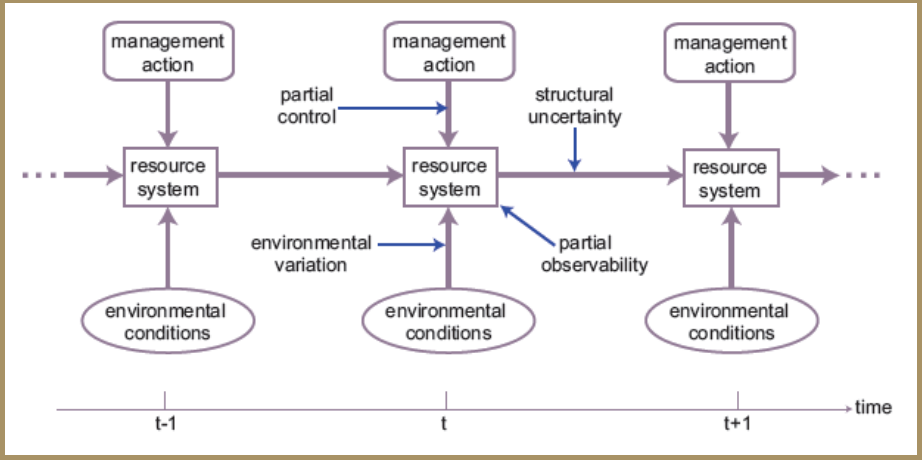
2. Improve “baseline” documentation and understanding for long-term assessment

3. Provide ecological information supporting water control plan development and implementation

Monitoring Strategy

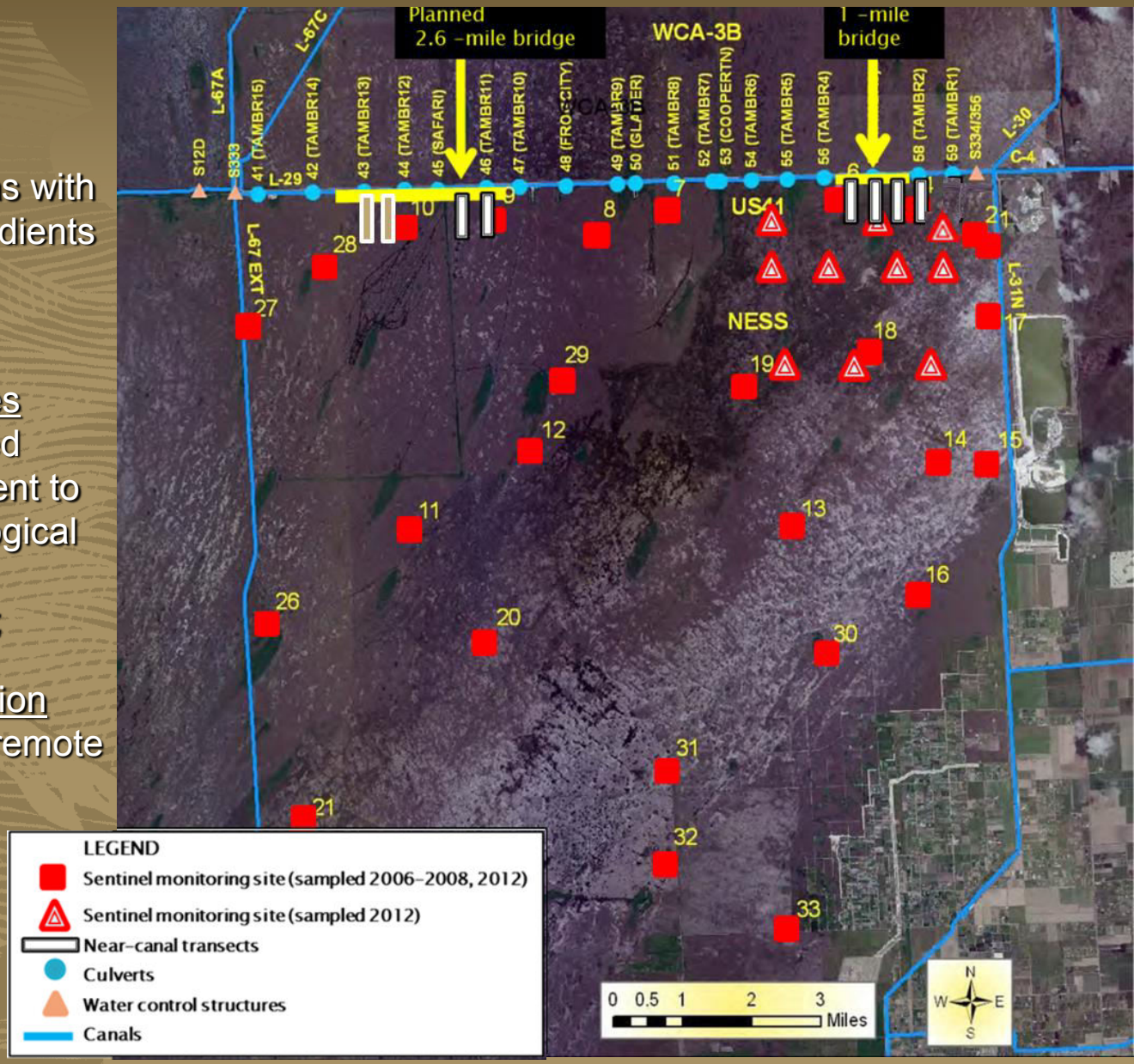
- Maximize use of established ecological indicators
- Maximize use of existing stations with data collection history
- Priority on rapid response metrics and rapid reporting for test period assessment
- Include critical, slower response metrics (plant habitat, soils) to assess long-term change with MWD-TTNS-CEPP implementation

We monitor because careful observation is an elegant way to address the major sources of uncertainty that are enduring challenges for natural resource managers



Monitoring Design

- Near-canal transects to quantify changes in areas with sharp environmental gradients (notably to track legacy phosphorus);
- Broad-scale sentinel sites (fixed stations) distributed across the marsh sufficient to assess changes in ecological zones and identify management influences;
- Broad-scale, fine resolution mapping vegetation via remote sensing.



Vegetation Mapping

Spatially extensive, focused on changes in functional types

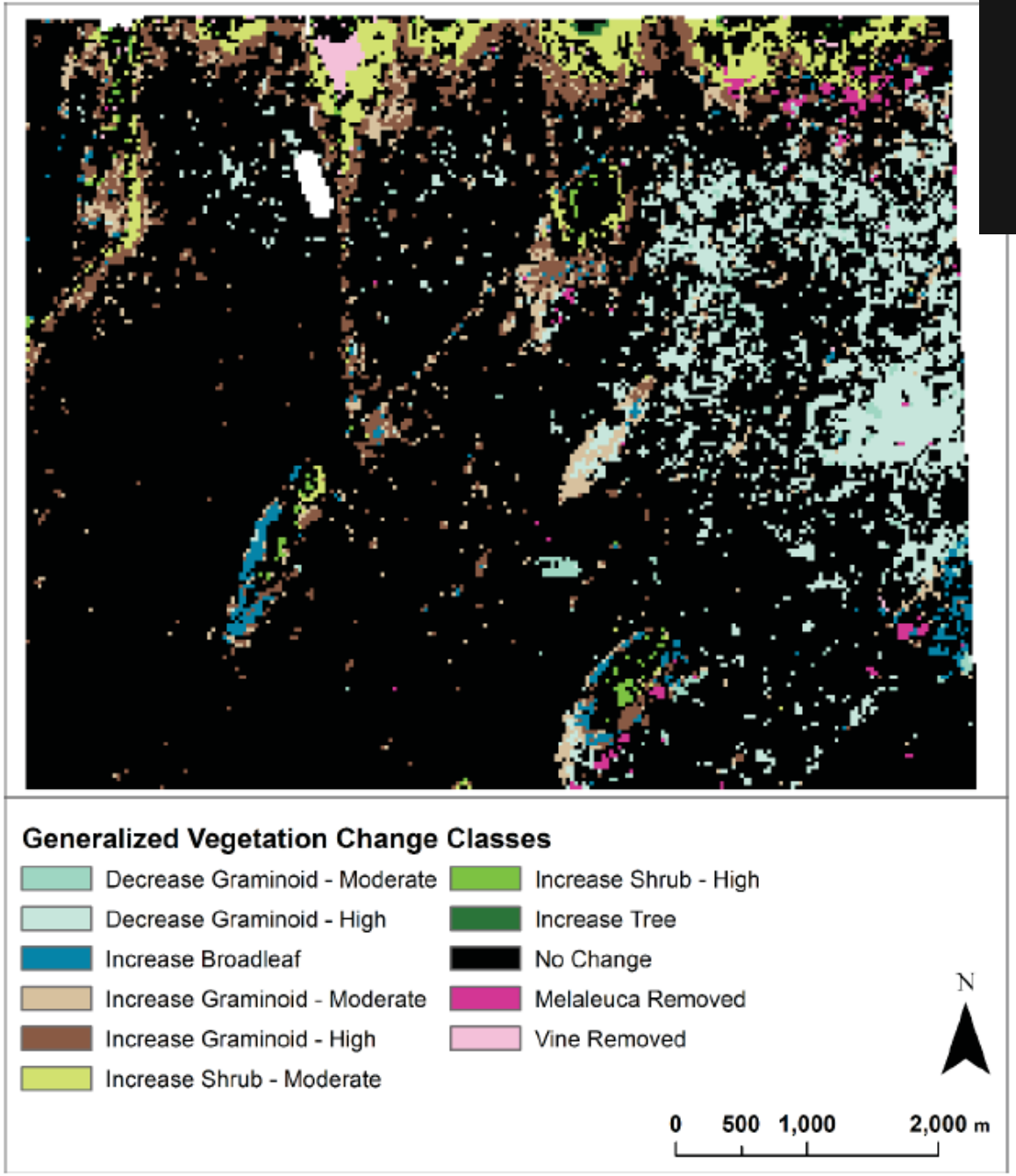


Figure 16 Map of Landsat-derived generalized vegetation classes for NE Shark River Slough, documenting no change (black) or change in vegetation class of 30x30 m pixels between 1999 and 2009.

Model-based expectations of water depths

Figure courtesy of Long et al. 2015

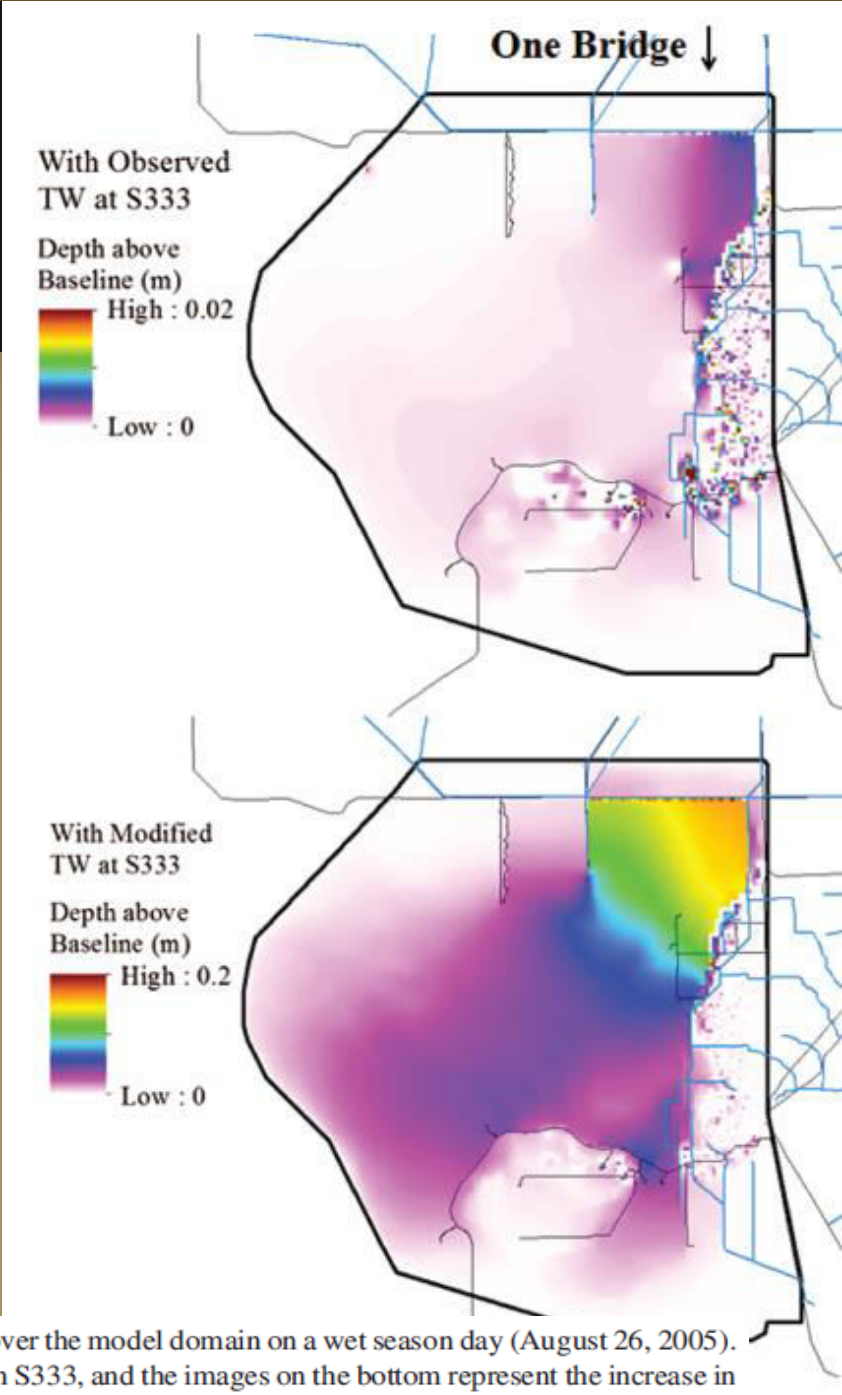
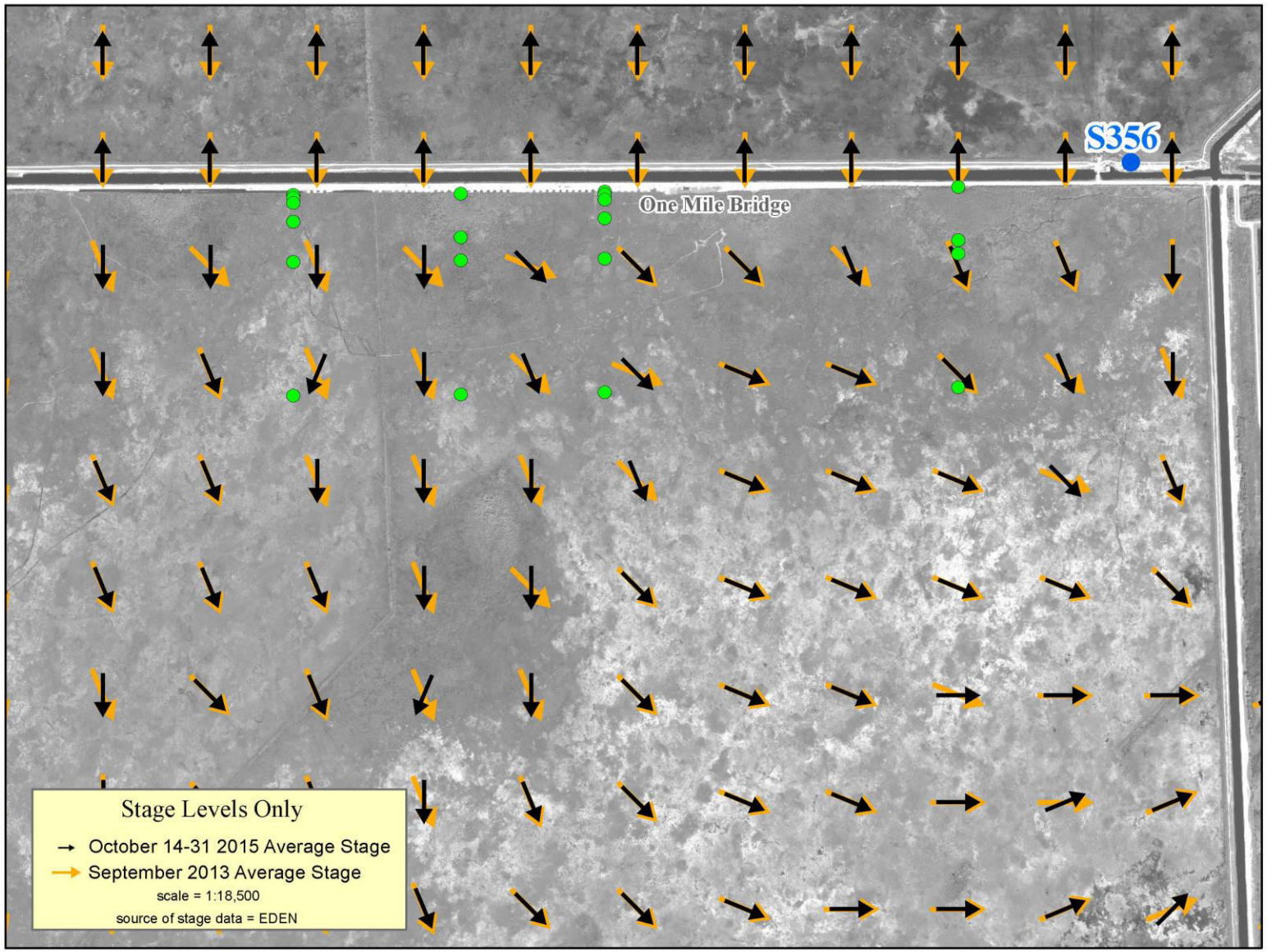


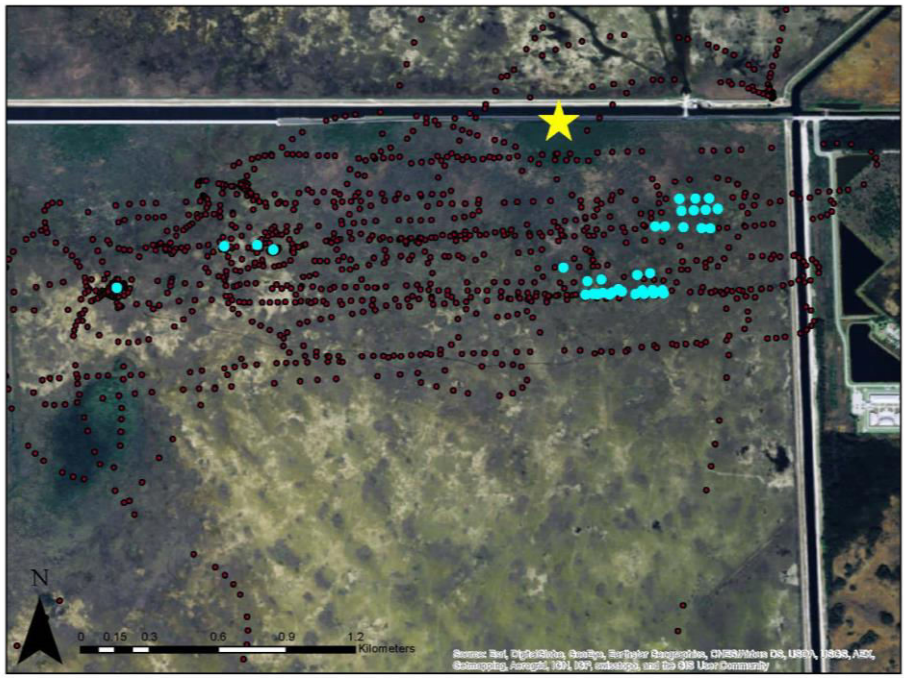
Fig. 8. (Color) The depth above baseline for the One Bridge and Two Bridge scenarios over the model domain on a wet season day (August 26, 2005). The images on the top represent the increase in surface water for the observed tailwater in S333, and the images on the bottom represent the increase in surface water using the modified tailwater conditions for S333

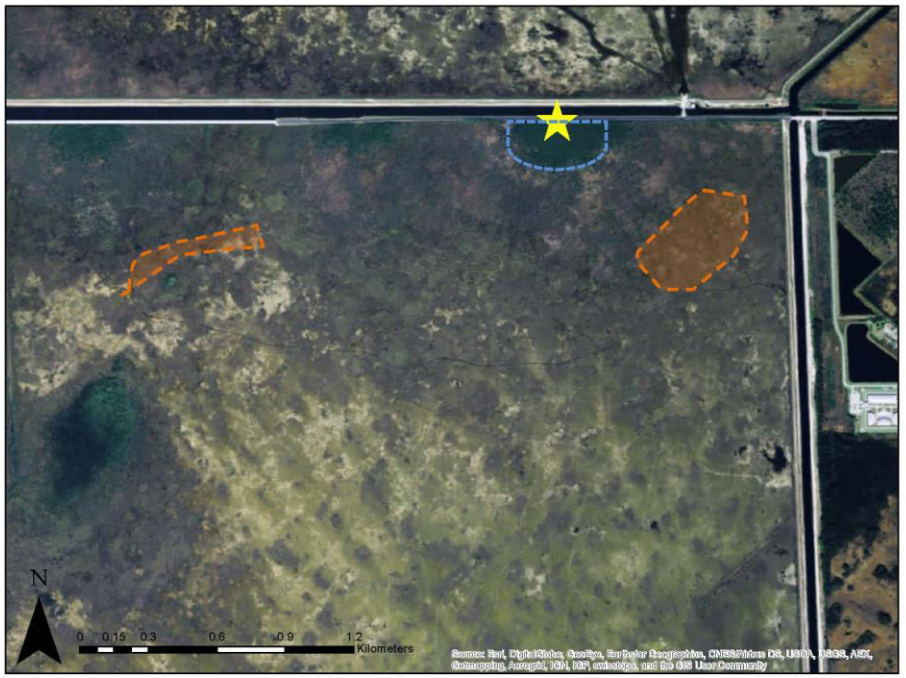
Initial Flow Direction During S-356 Pump Test Compared to High Water Month, Estimated from EDEN



From: Troy Mullins

SFWMD Fluorescein Dye Test at Tamiami Canal Culvert (October 9, 2015)

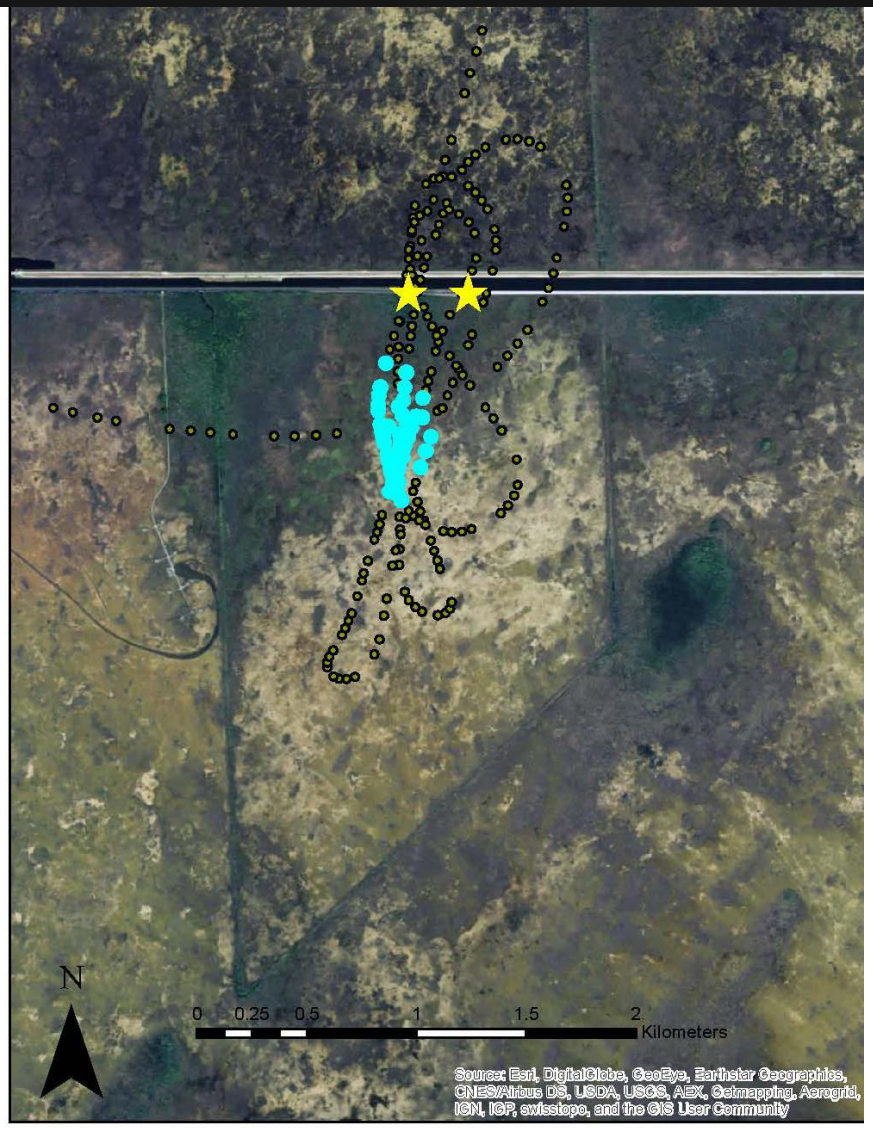




Star: dye release location
Red dots: aerial photo position
Blue dots: photos with dye observed

Information and summary images
Courtesy Christa Zweig (SFWMD)

SFWMD Fluorescein Dye Test at Tamiami Canal Culvert (western edge of 1-mile bridge; November 13, 2015)



Stars: two dye release locations; Yellow dots: aerial photo position; Blue dots: photos with dye observed

Information and summary images Courtesy Christa Zweig (SFWMD)

Thanks so much

Special thanks to: David Rudnick, Christa Zweig, Dilip Shinde for contributing information, figures and slides.

Long, S. A., A. Cook, R. Fennema, G. Tachiev, V. Villamiza, K. Kotun, and F. Miralles-Wilhelm. 2015. Analysis of bridge construction as a restoration technique for Everglades National Park, FL, USA, using hydrological numerical modeling. J. Hydraul. Eng. 05015005: 1-10.

Williams, B.K., R.C. Szaro, and C.D. Shapiro. 2007. Adaptive Management: The U.S. Department of the Interior Technical Guide. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC.