

Governing Board Meeting
February 9, 2012



Kissimmee River Restoration *Project Update*



Lawrence Glenn

*Section Administrator, Lake and River Sciences
Applied Science Bureau*



Kissimmee Chain
of Lakes

Kissimmee River

2008 Osceola County Aerial Photography
2008 Polk County Aerial Photography
2008 Highlands County Aerial Photography
2004-05 SFWMD Aerial Photography

Streaming 100%

© 2007 Google™

Winter 27°39'27.92" N 81°16'58.76" W

Eye alt 114.27 mi

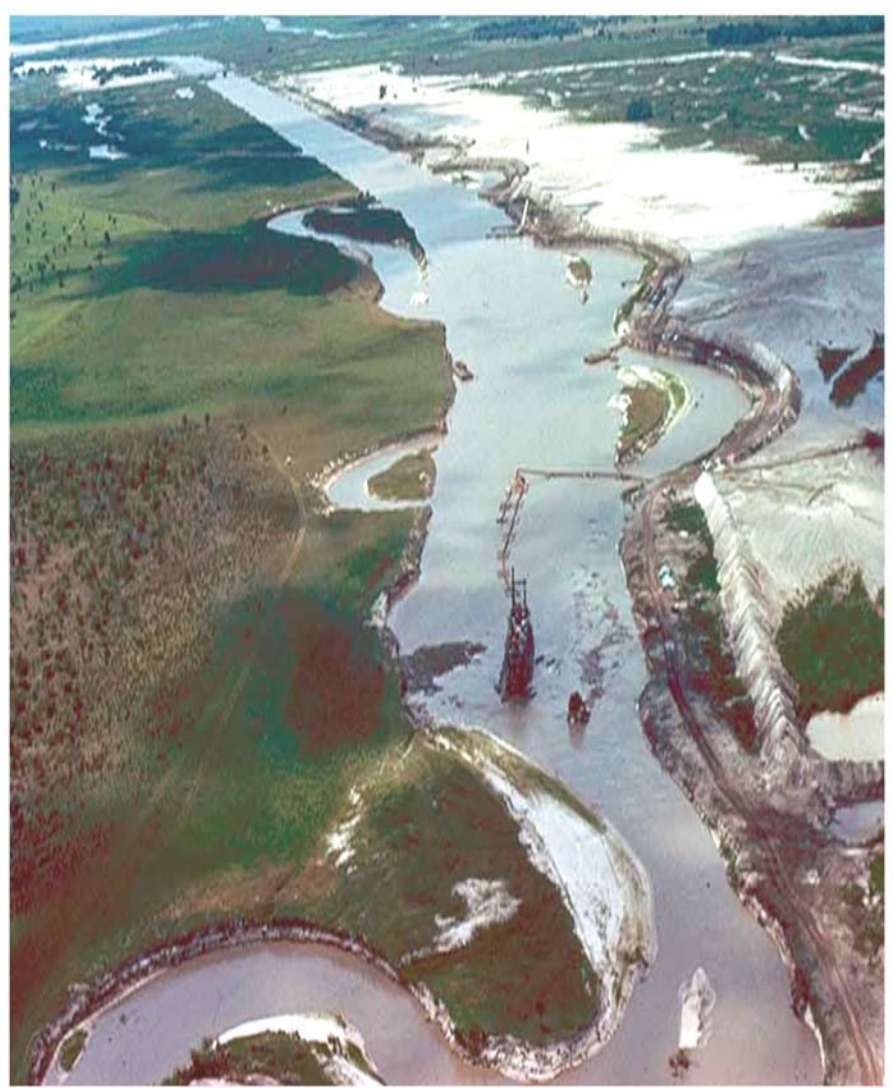




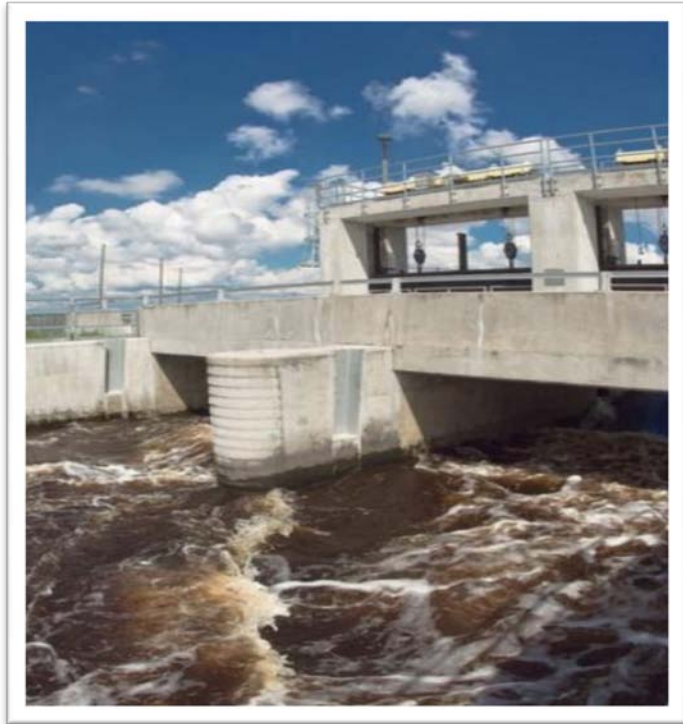
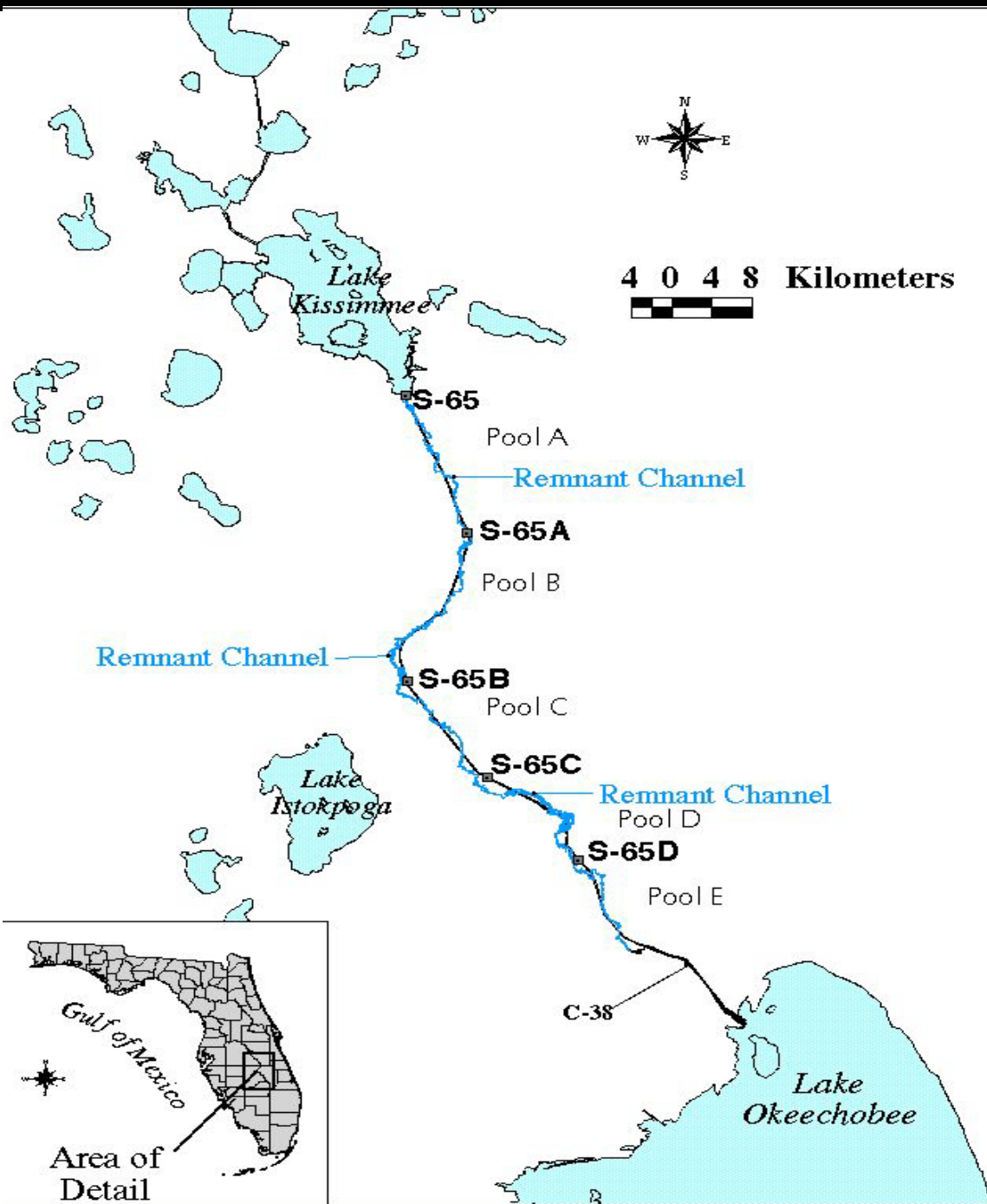
City of Kissimmee Flooding
circa 1948



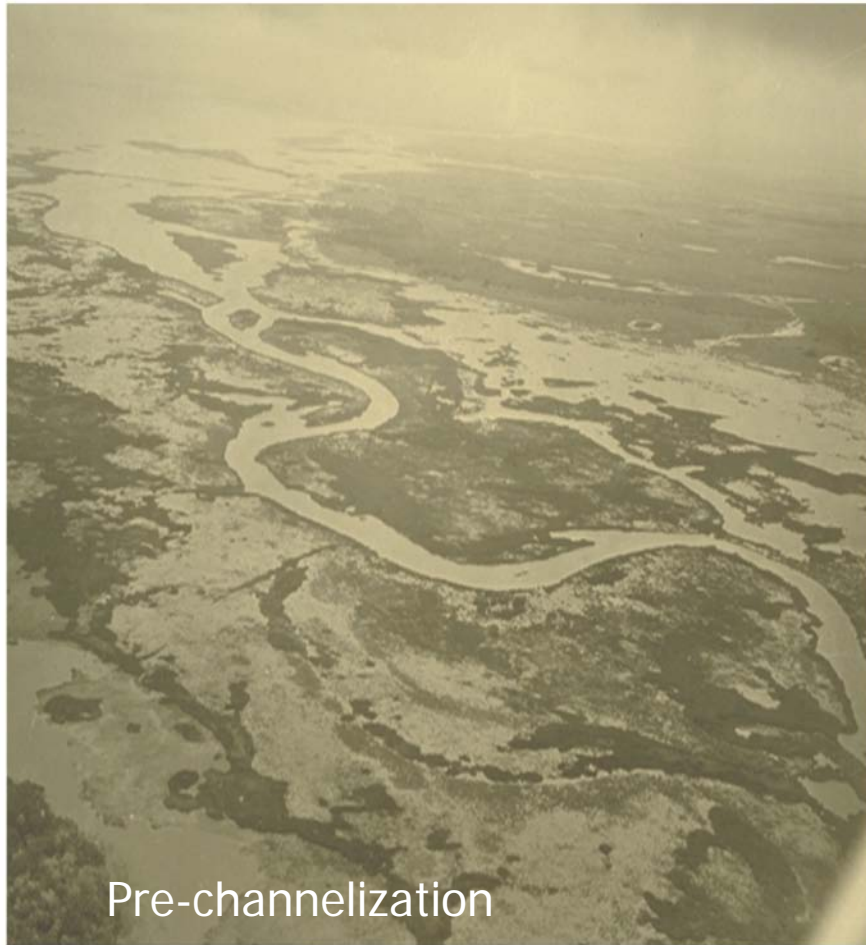
Channelization 1962-1971



Channelized Kissimmee River



Effects of Channelization



Pre-channelization



Post-channelization

Effects of Channelization & Water Regulation

- **Loss of flood pulse**
 - Shift to terrestrial plants
 - Fewer wading birds, ducks
 - Loss of highly productive floodplain habitats
 - Interruption of nutrient cycling and food web dynamics
- **Loss of flow in river**
 - Increases in floating vegetation
 - Increases in organic matter deposition
 - Lower dissolved oxygen
 - Shift in fish, invertebrate communities

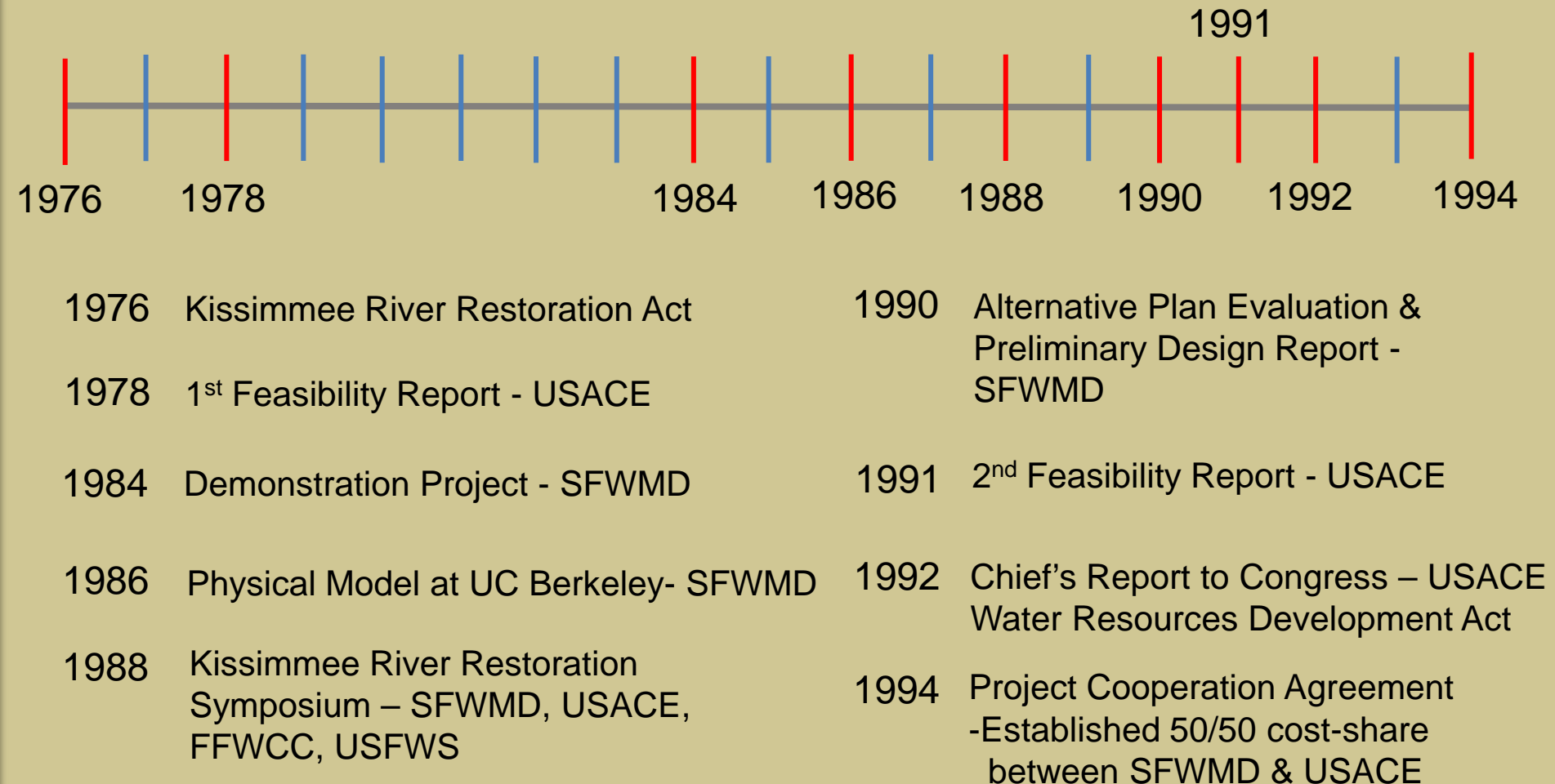


Restoration Mandate

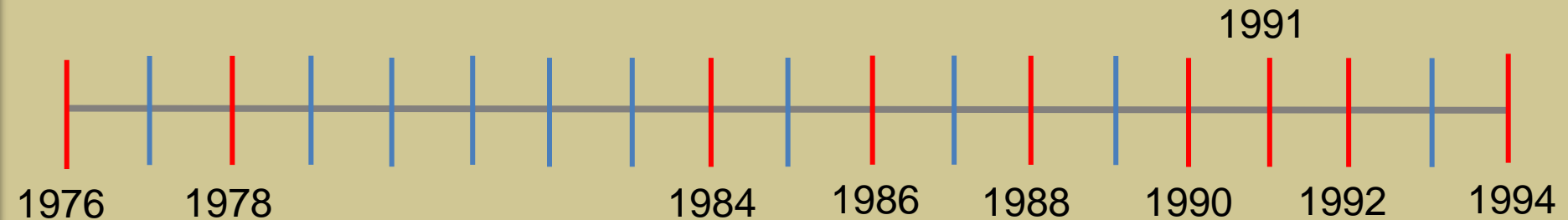
- 1976 Kissimmee River Restoration Act
 - Restore seasonal water level fluctuations in the floodplain

“utilize the natural and free energies of the river system to the greatest extent possible”

Project Timeline

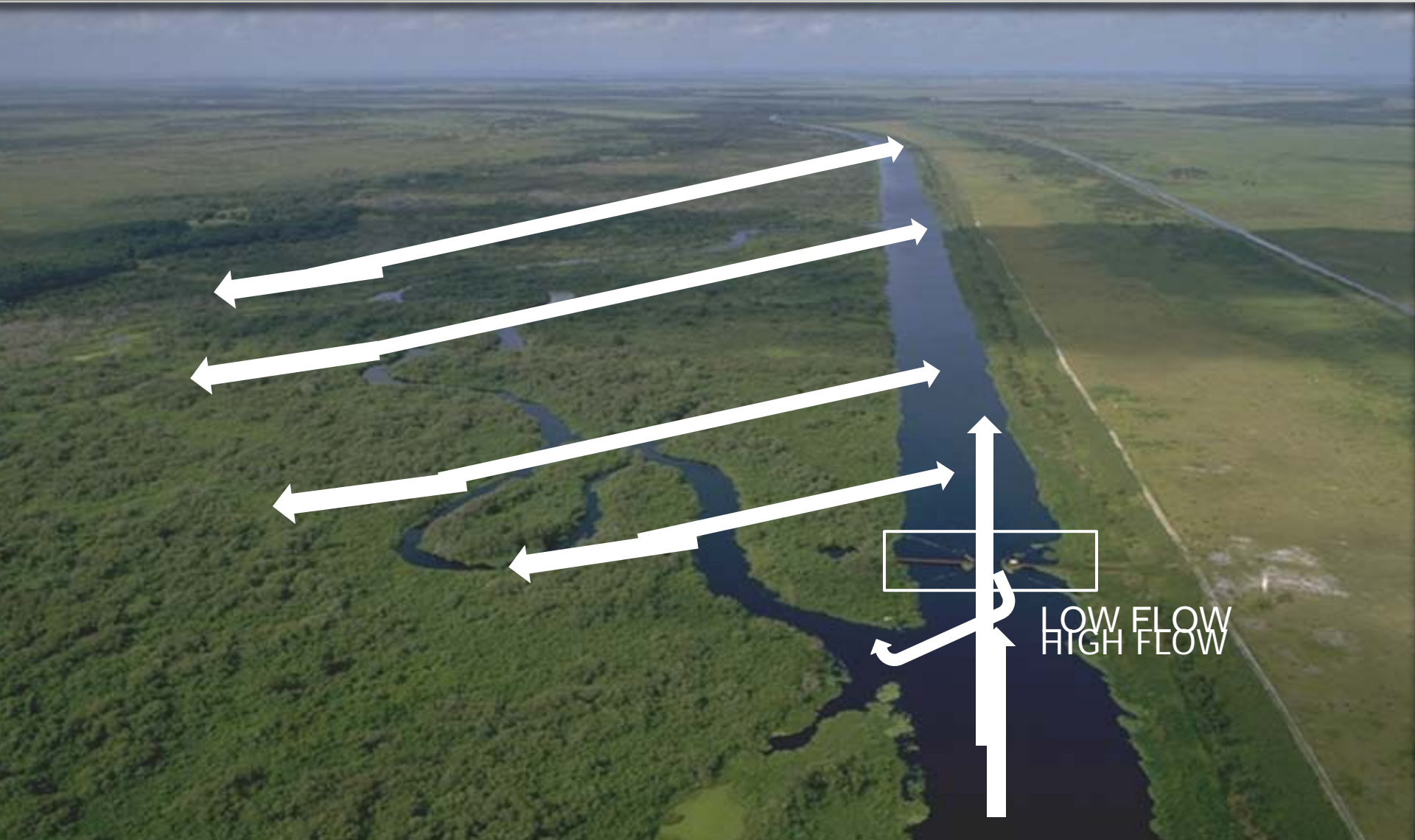


Project Timeline



- 18 years from inception to partnership with USACE
- 5 additional years until “turn-dirt” projects began
- 16 years to complete restoration construction

1984 Demonstration Project Weir

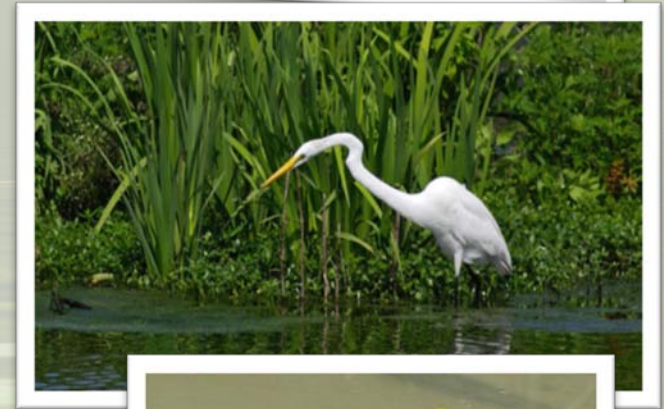


Physical Model at UC Berkeley



1988 Kissimmee River Restoration Symposium

- State and Federal Agencies
- Ecological Responses to Demonstration Project
- Adopted “Ecological Integrity” goal
- Established 5 hydrologic criteria



Ecological Integrity Goal

Defined as “the capability of supporting and maintaining a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to natural habitat of the region”. (Frey 1975, Karr and Dudley 1981)

5 Hydrologic Criteria

- Continuous flow with duration and variability comparable to pre-channelization periods
- Average flow velocities between 0.2-0.6 m per second, when flow within bank
- Stage discharge relationship resulting in overbank flow $>130\text{m}^2/\text{sec}$ and $>185\text{ m}^2/\text{sec}$
- Stage recession rates on floodplain $<0.3\text{ m/month}$
- Floodplain inundation comparable to historic hydrographs



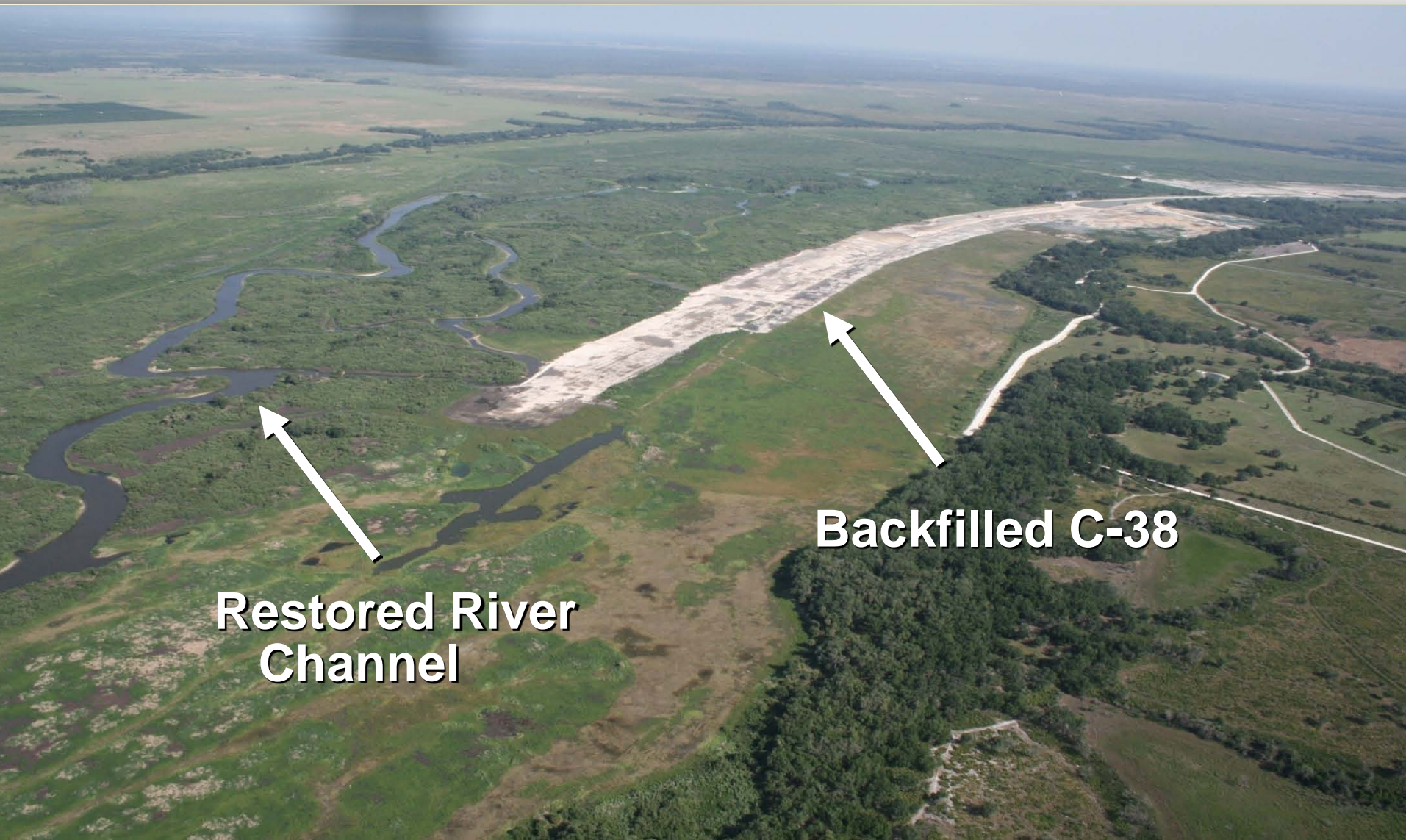
Approach for the Kissimmee River Restoration Project

**Reconnect,
reconstruct
physical form of
the river**

**Modify
headwater
inflows to mimic
historical
patterns**

**Restoration of
ecological
integrity to
central region
of the
Kissimmee
River**

Reconstruct the Physical Form



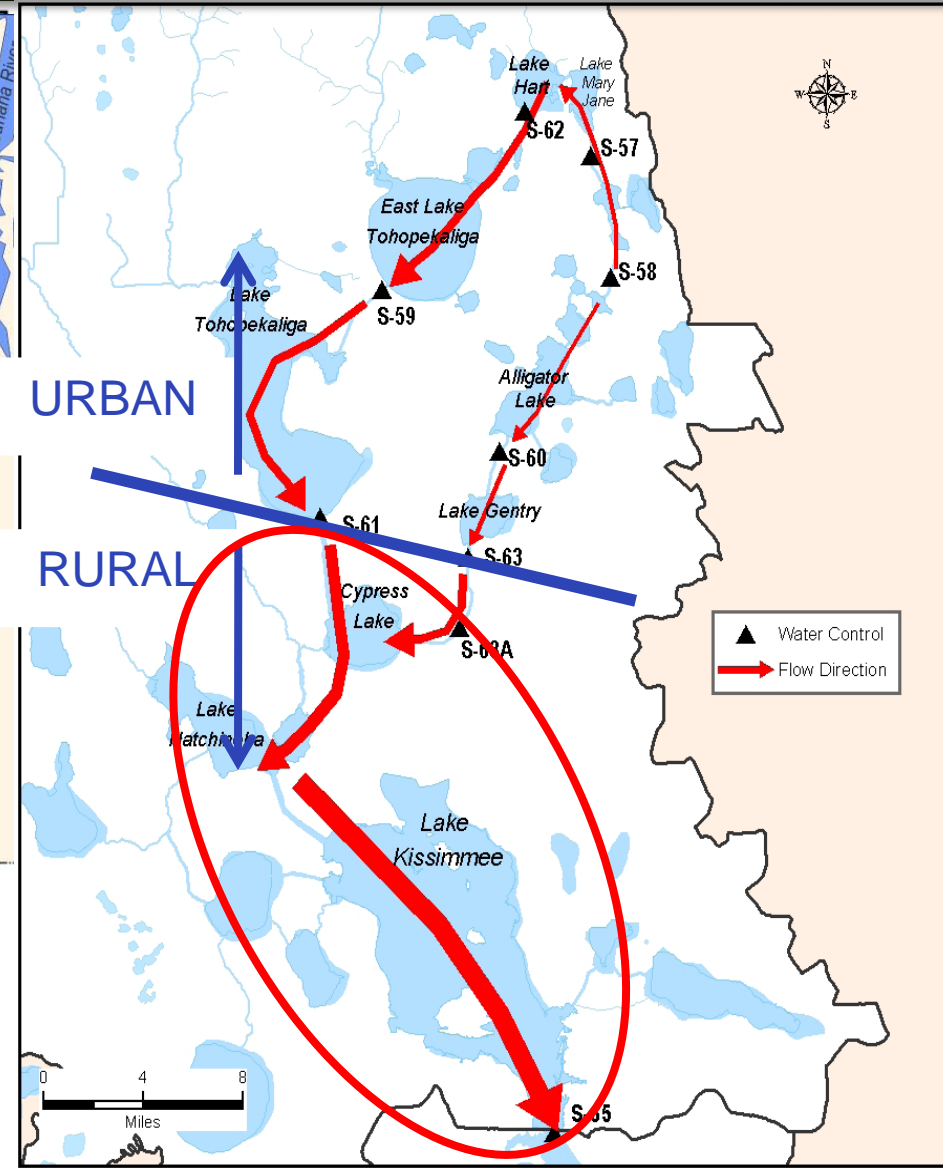
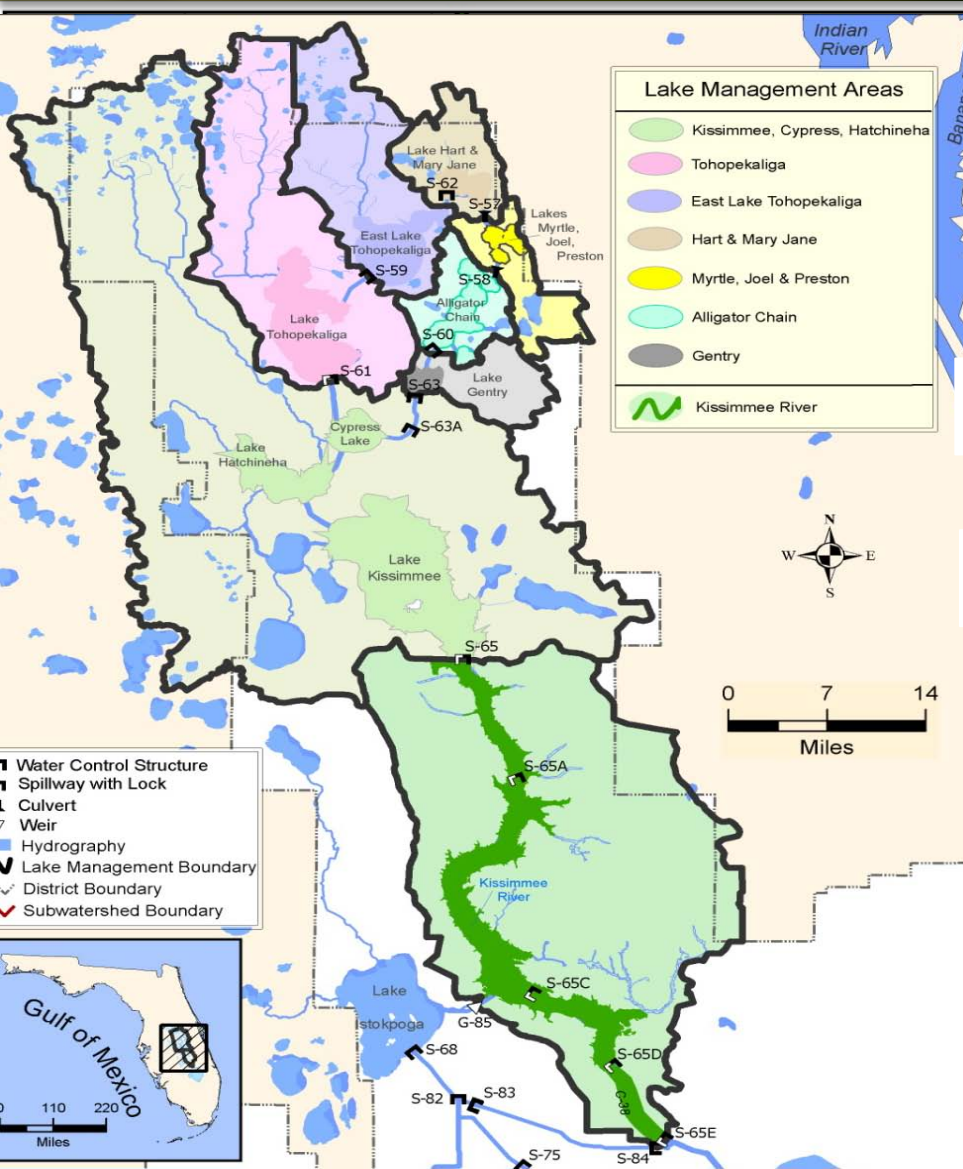
**Restored River
Channel**

Backfilled C-38

Operate the System to Mimic Natural Flow and Stage Patterns

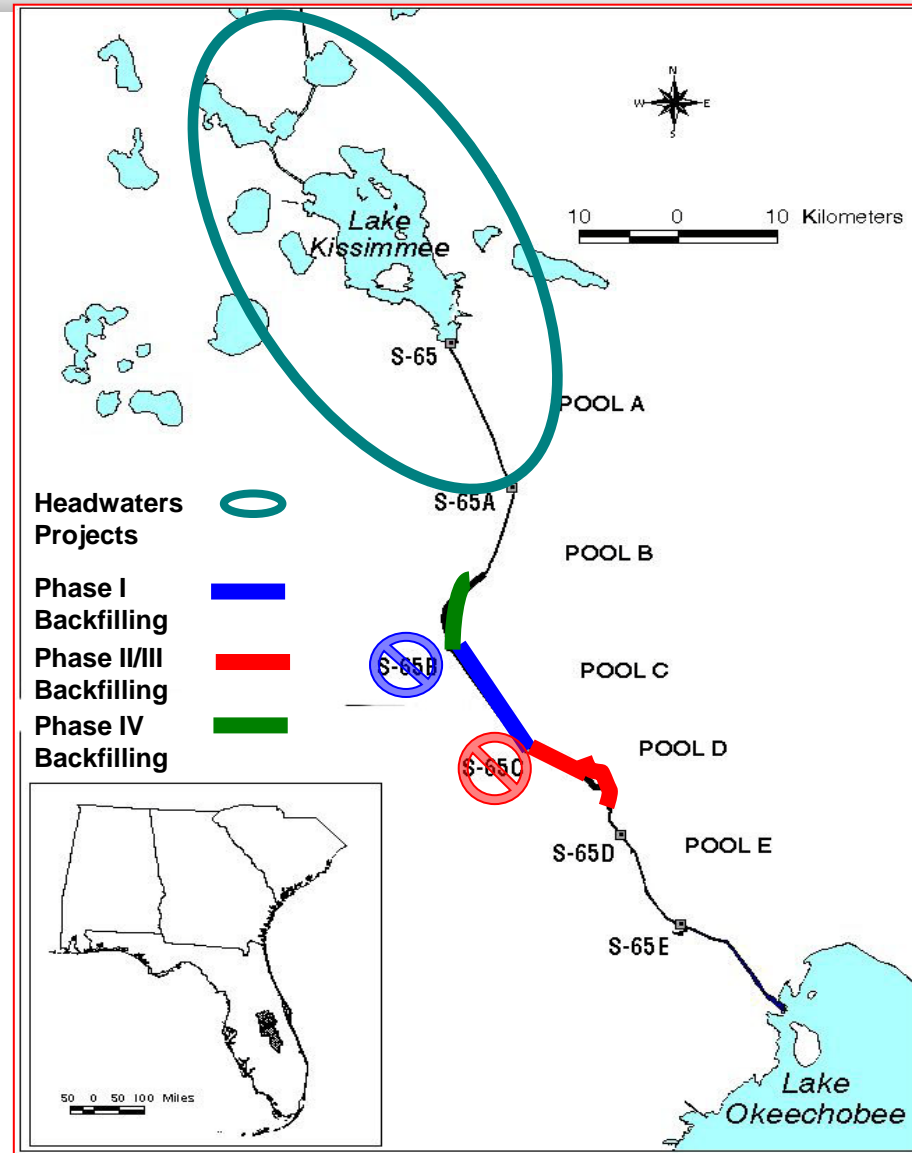


How to get the water?

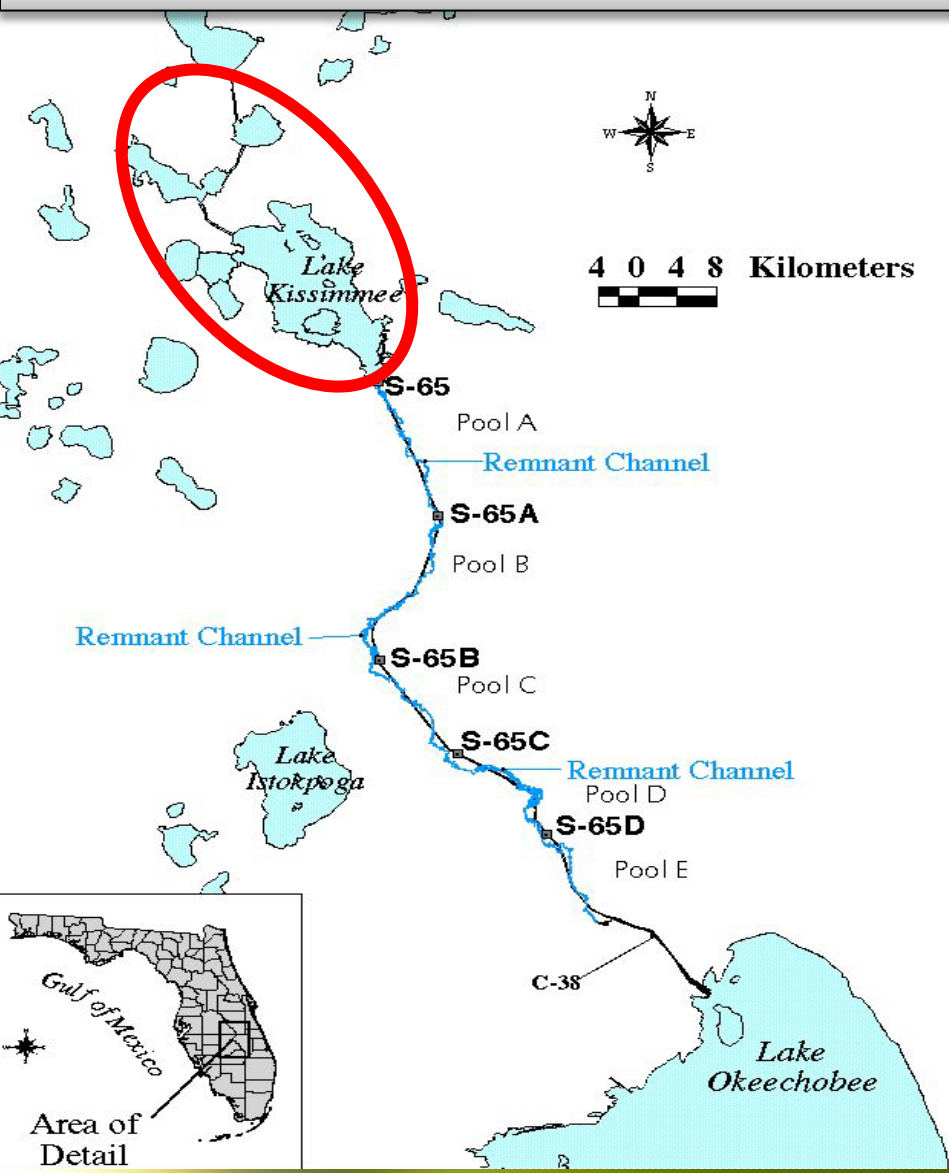


Kissimmee River Restoration Project

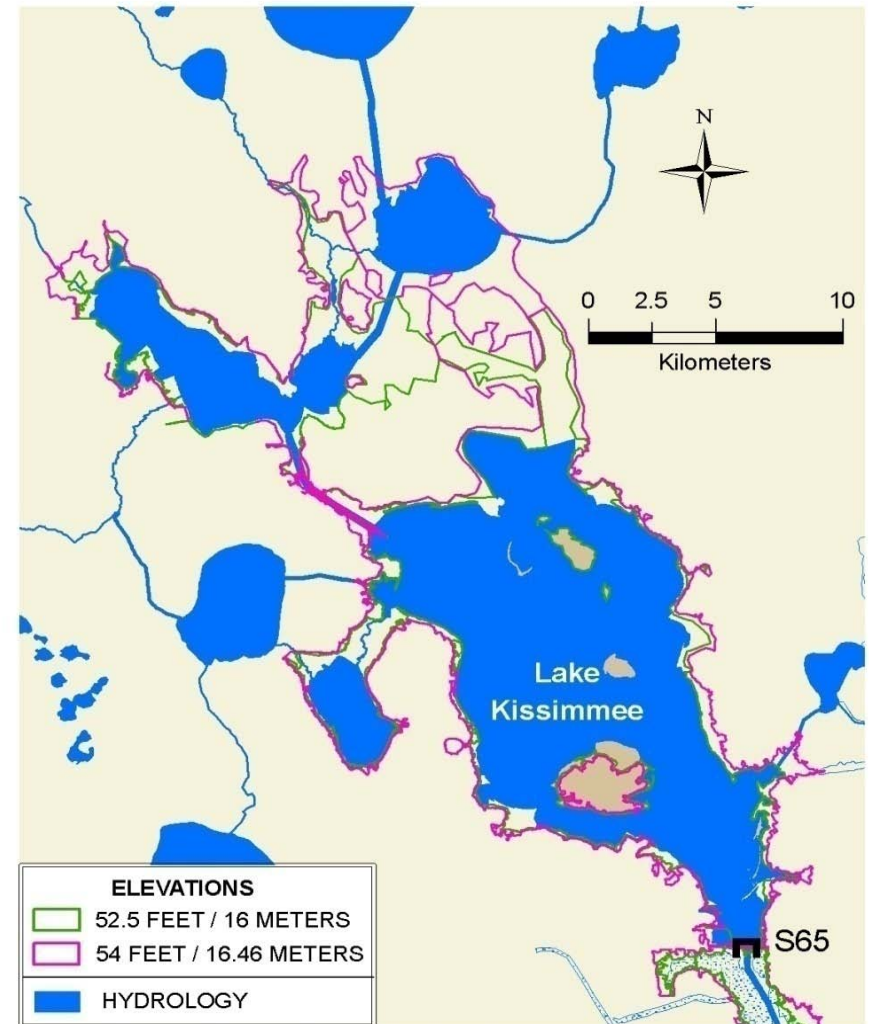
- 50/50 Cost share State/Federal
 - USACE: Engineering planning and construction
 - SFWMD: Real Estate for LERRDS & Restoration Evaluation
- Backfill 22 miles of C-38 canal
- Reconnect 45 miles of river channel
- Remove 2 water control structures
- Mimic historic inflows – 2015
- Restoration Evaluation Program thru 2020
 - Evaluate project success



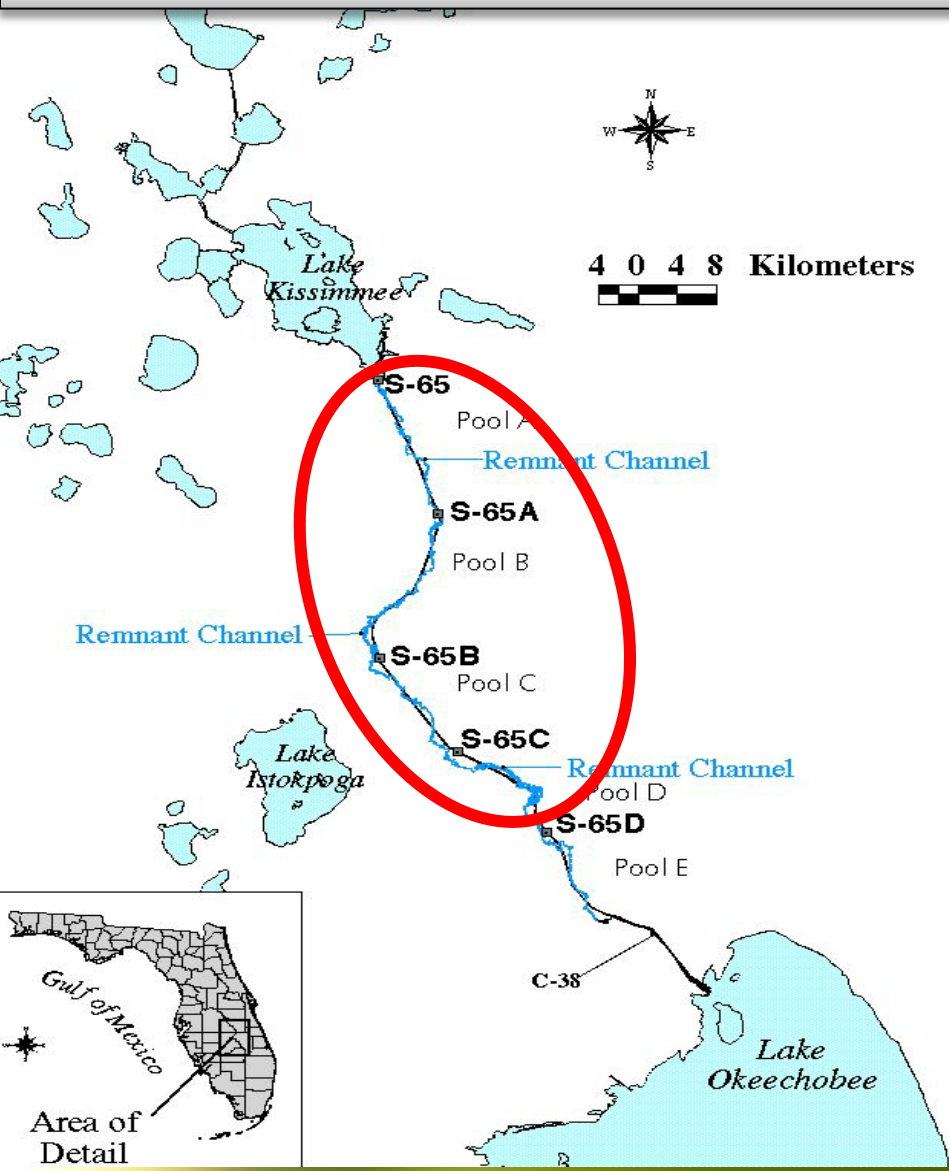
Real Estate Requirements



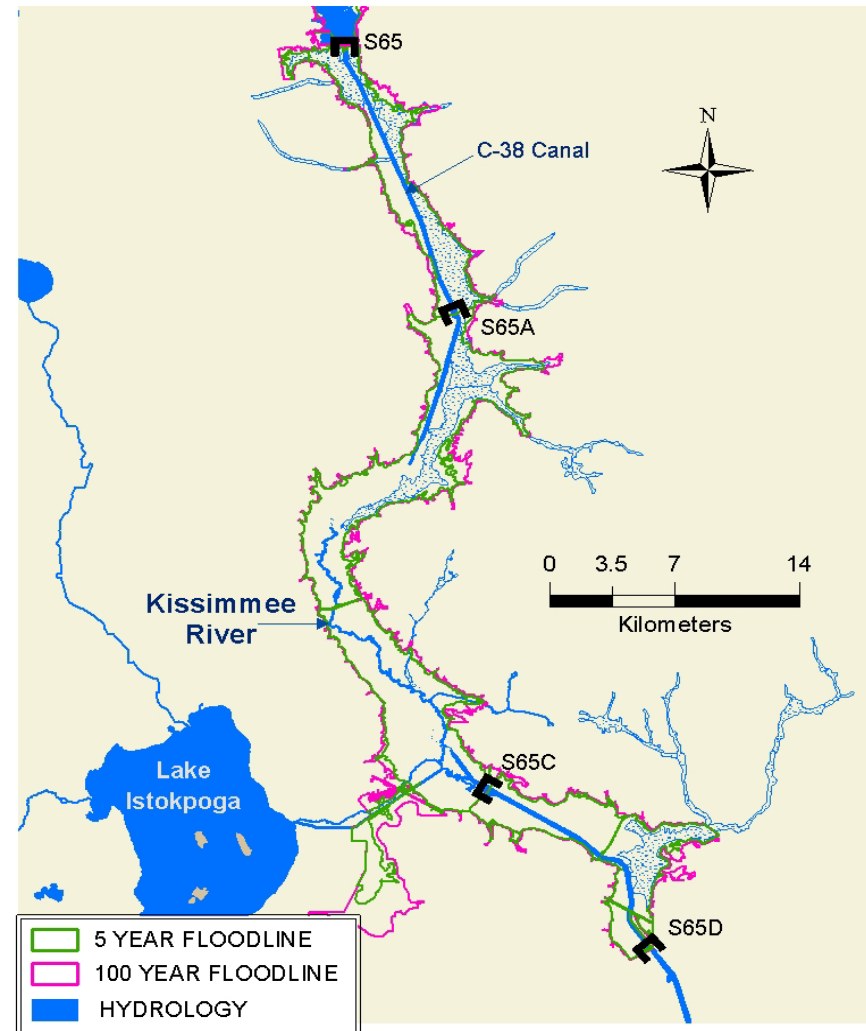
Upper Kissimmee Watershed, South Florida, USA



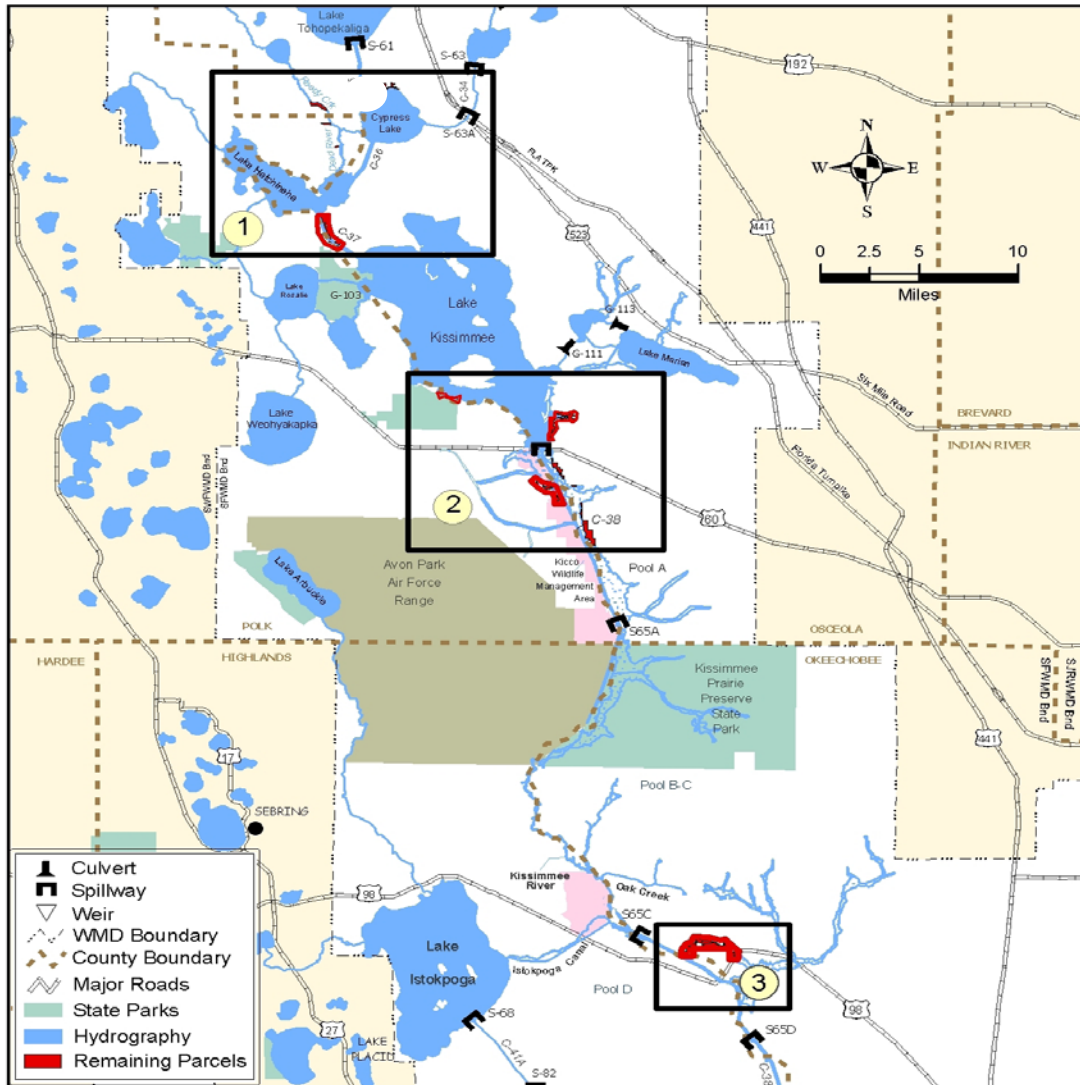
Real Estate Requirements



Lower Kissimmee Watershed, South Florida, USA



Required Lands



102,000 acres required

- 99% complete
- Total Estimated Cost ~ \$450M

Remaining interests

- Engineering Fix: 79.69 acres
- State/Non-Profit Lands: 724.7 acres
- Private Lands: 263.01
- **Total: 1067.4 acres**

Headwaters Projects



S-65 Gate Expansion



Modifications at S-65A

ALLOW SHEETFLOW



2008 Osceola County Aerial Photography

©2009 Google

Modifications at S-65A



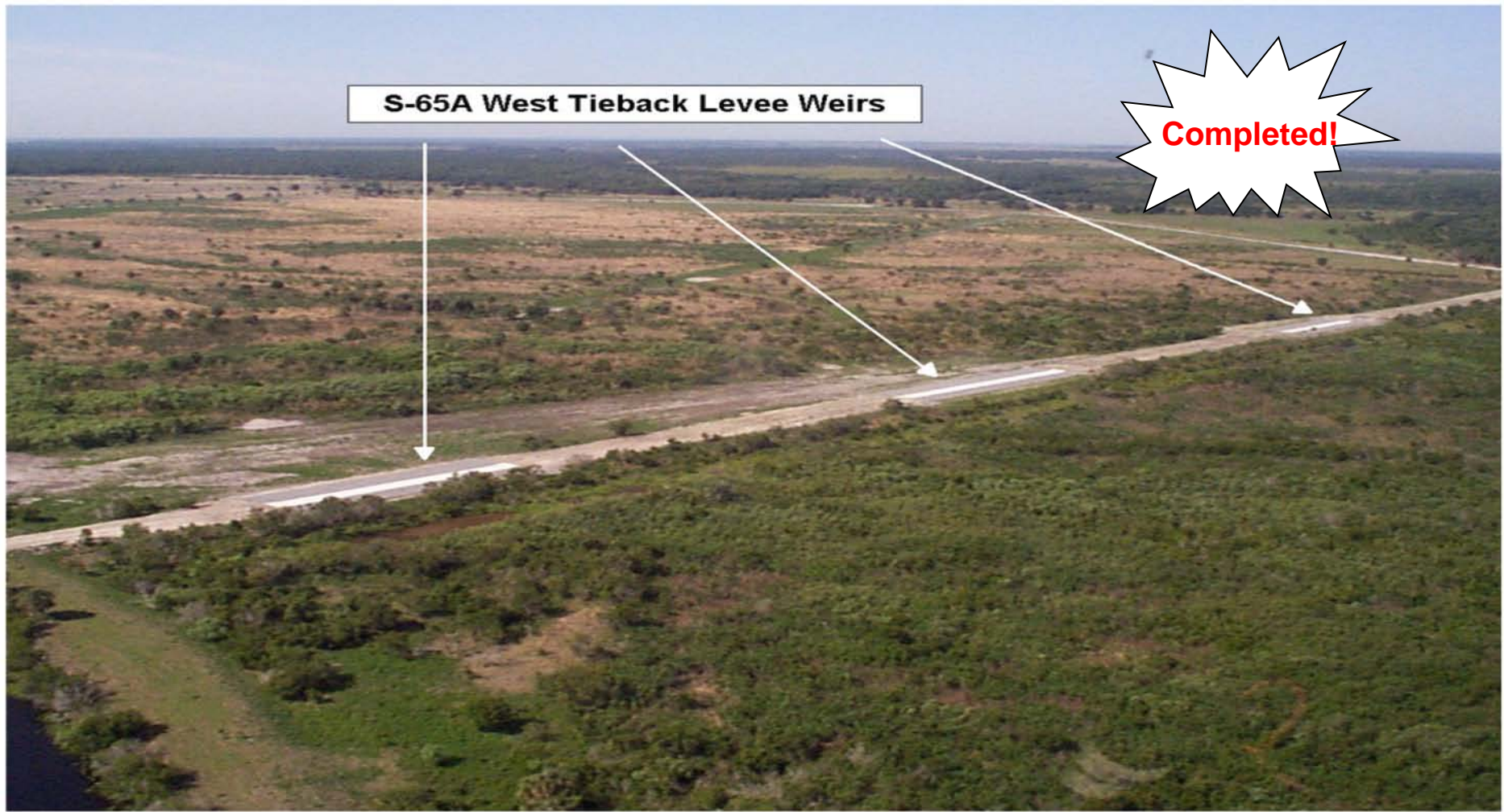
S-65A East Tieback Levee



Completed!



S-65A West Tieback Levee



Phase I Backfilling

- Completed 1999-2001
- Fill 7.5 miles C-38 canal
- Re-carved 1 mile river channel
- Removed S-65B
- Physically restored 14 miles of river channel

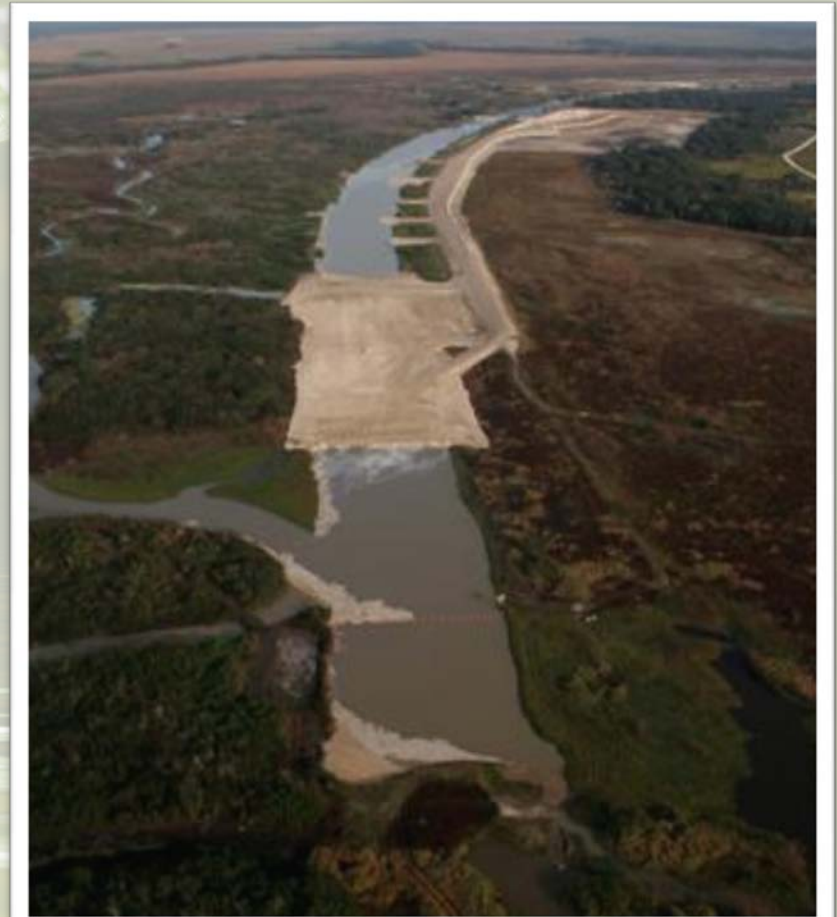
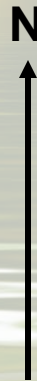




Phase IVA Construction



Pre-construction

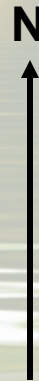


December 6, 2006

Phase IVA Construction



August 28, 2007



- June 2006 – Sept 2007
- Filled 2 miles C-38
- Re-carved 1 mile river channel
- Reestablished 4 miles river channel
- Total 18 miles of river channel

Phase IVB Construction

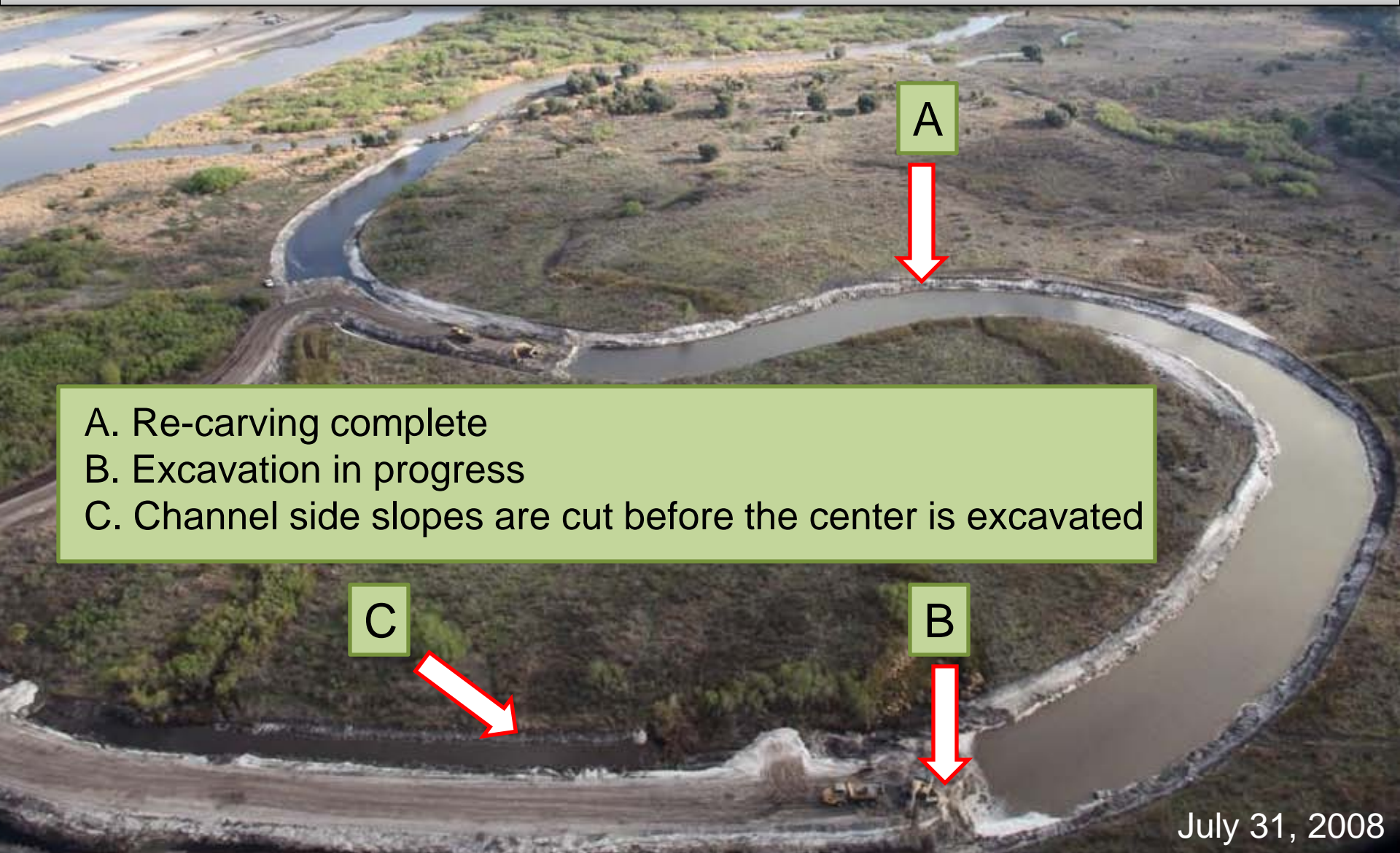


Phase IVB Construction



February 11, 2009

Re-carved River Sections



- A. Re-carving complete
- B. Excavation in progress
- C. Channel side slopes are cut before the center is excavated

July 31, 2008



Bypass flow-way

Backfilling C-38 canal

Re-carved river channel

February 11, 2009

Phase I-IVB Construction

GRAND TOTALS

- 14 miles C-38 backfilled
- 6 miles of re-carved river channel
- 24 miles of river channel
- 15,041 acres of physically restored habitat



24 miles of river
15,041 acres

2008 Highlands County Aerial Photography

2008 Lower Kissimmee River Basin Aerial Photography

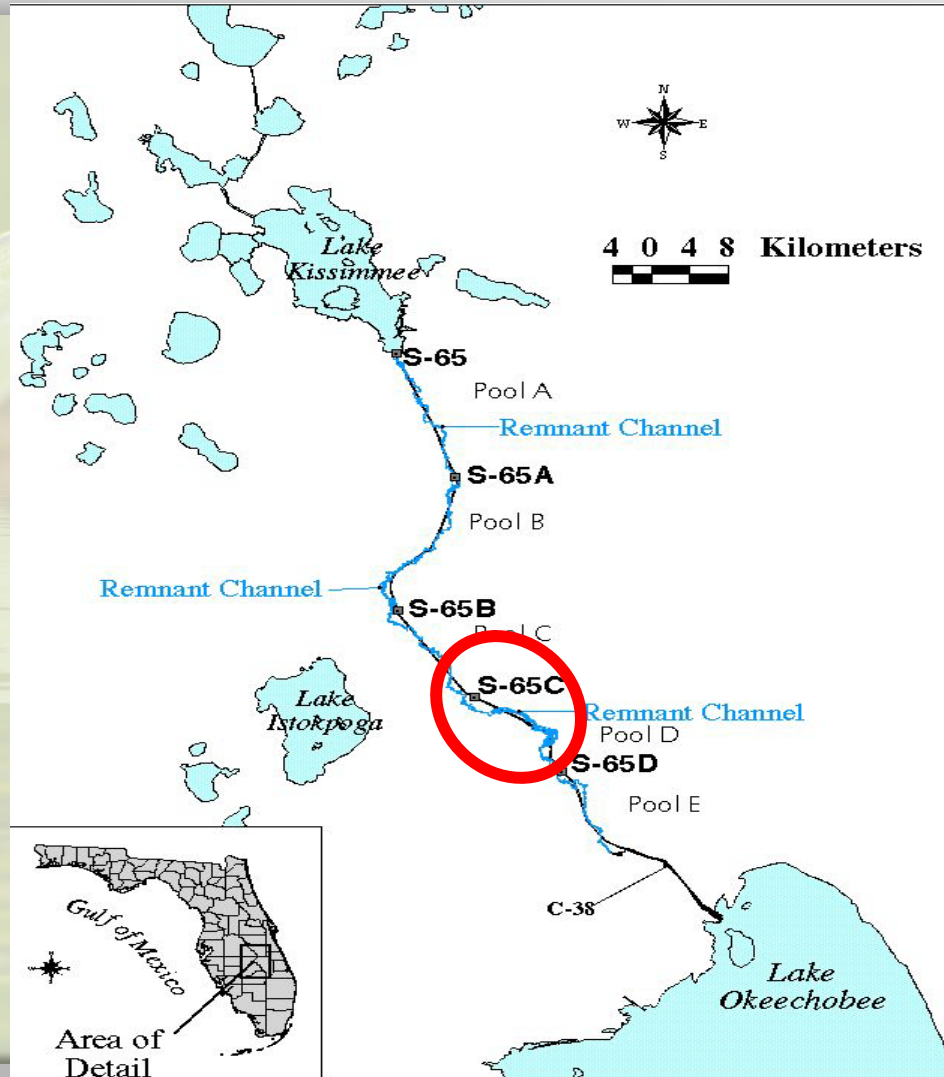
Streaming 100%

©2007 Google™

Pointer 27°29'03.48" N 81°10'39.38" W

Eye alt 52429 ft

Remaining Pool C & D Features



S-65C Structure Removal

Tieback Levee Removal

Canal Backfilling

Culvert Installation

Re-carved River Sections

U-Shaped Weir

CSX Railroad Bridge

Install Tieback Levee

River Acres Flood Reduction

2012 River Alignment
5 Year Floodline
100 Year Floodline

0 0.5 1
Miles



0 0.5 1
Kilometers

The Pool D Construction Features were provided by the U.S. Army Corps of Engineers. Imagery data provided by the South Florida Water Management District (SFWMD). Map compiled by the Kissimmee Division, Watershed Management Department, SFWMD. The SFWMD makes no representation as to the suitability or accuracy of these data for any other purpose and disclaims any liability for errors that the data may contain. Visit http://www.sfwmd.gov/CDF/PoolData/PoolC_D_ConstructionFeatures.mxd.
<http://www.sfwmd.gov/index.cfm?tid=15&id=15>

NOTE: Construction features last updated in February 2005.



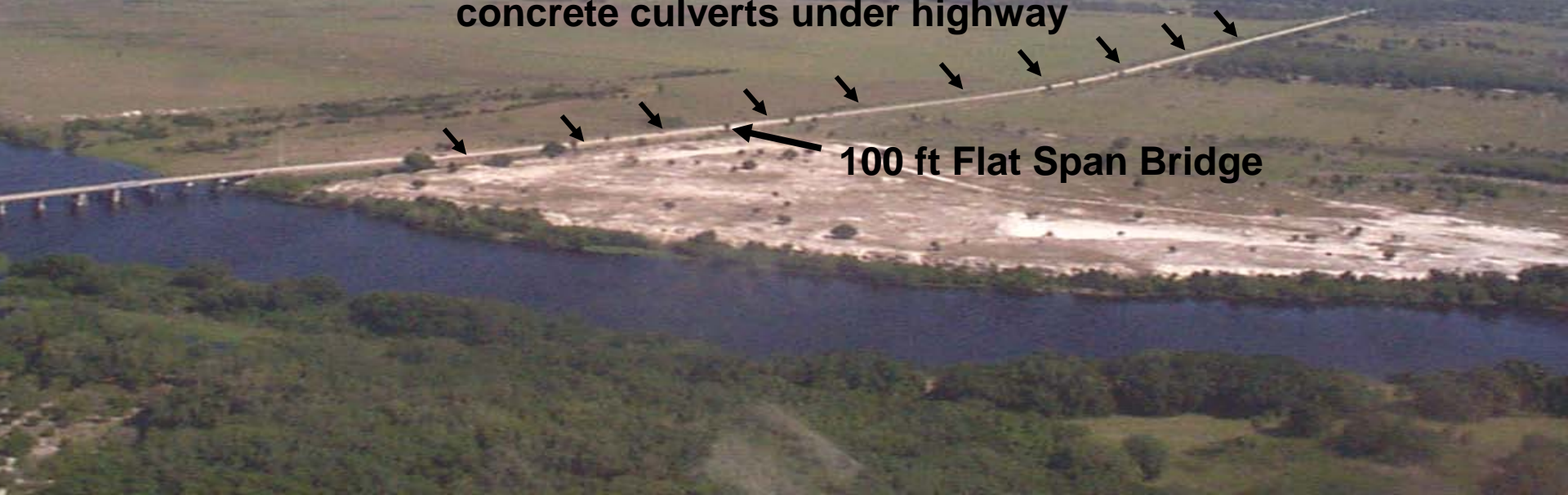
Phase II/III Features

U.S. Highway 98 Modifications

Complete!

A series of 10 - 2m x 3m x30m
concrete culverts under highway

100 ft Flat Span Bridge



Phase II/III Features

New CSX Railroad Bridge

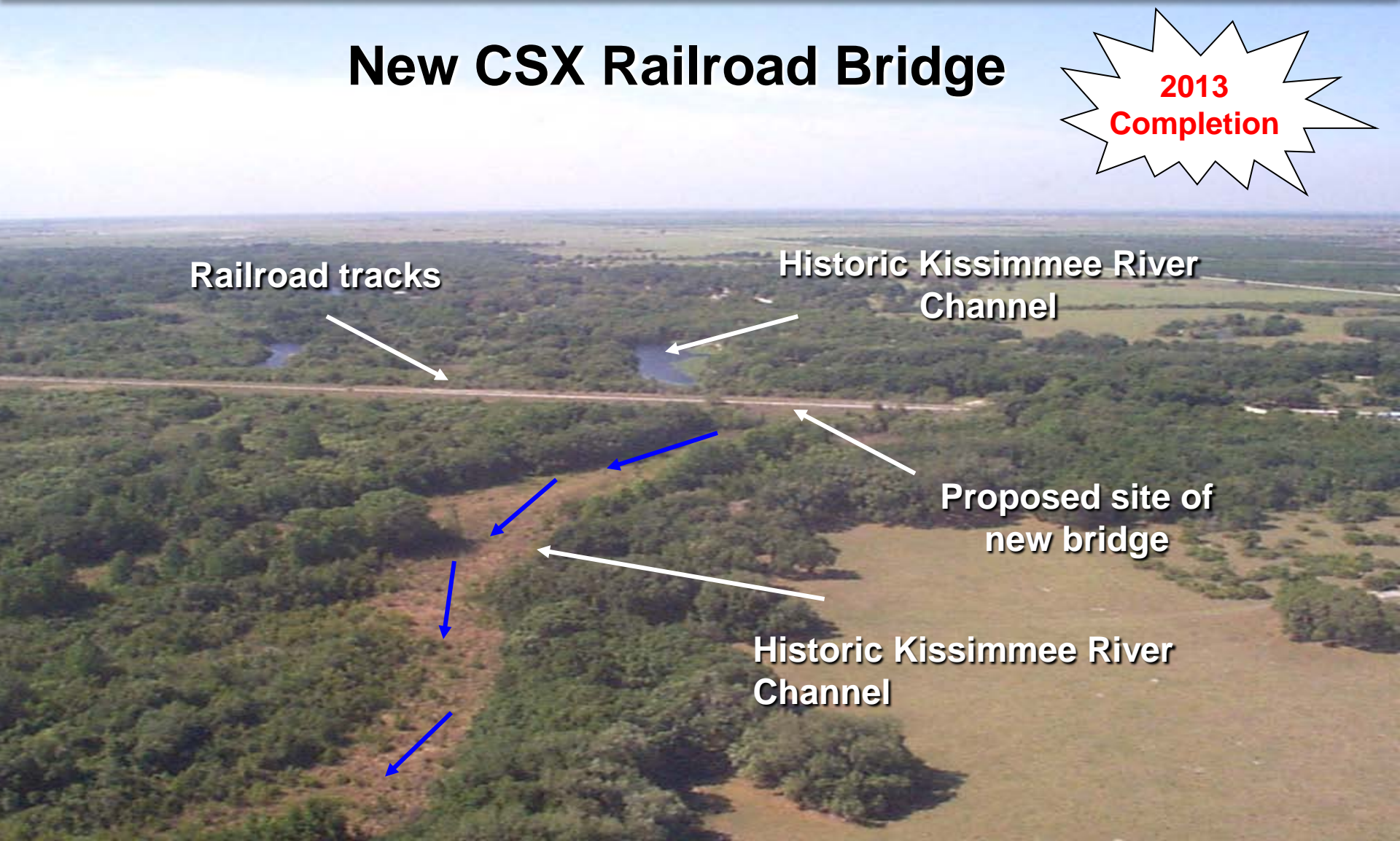
**2013
Completion**

Railroad tracks

Historic Kissimmee River
Channel

Proposed site of
new bridge

Historic Kissimmee River
Channel

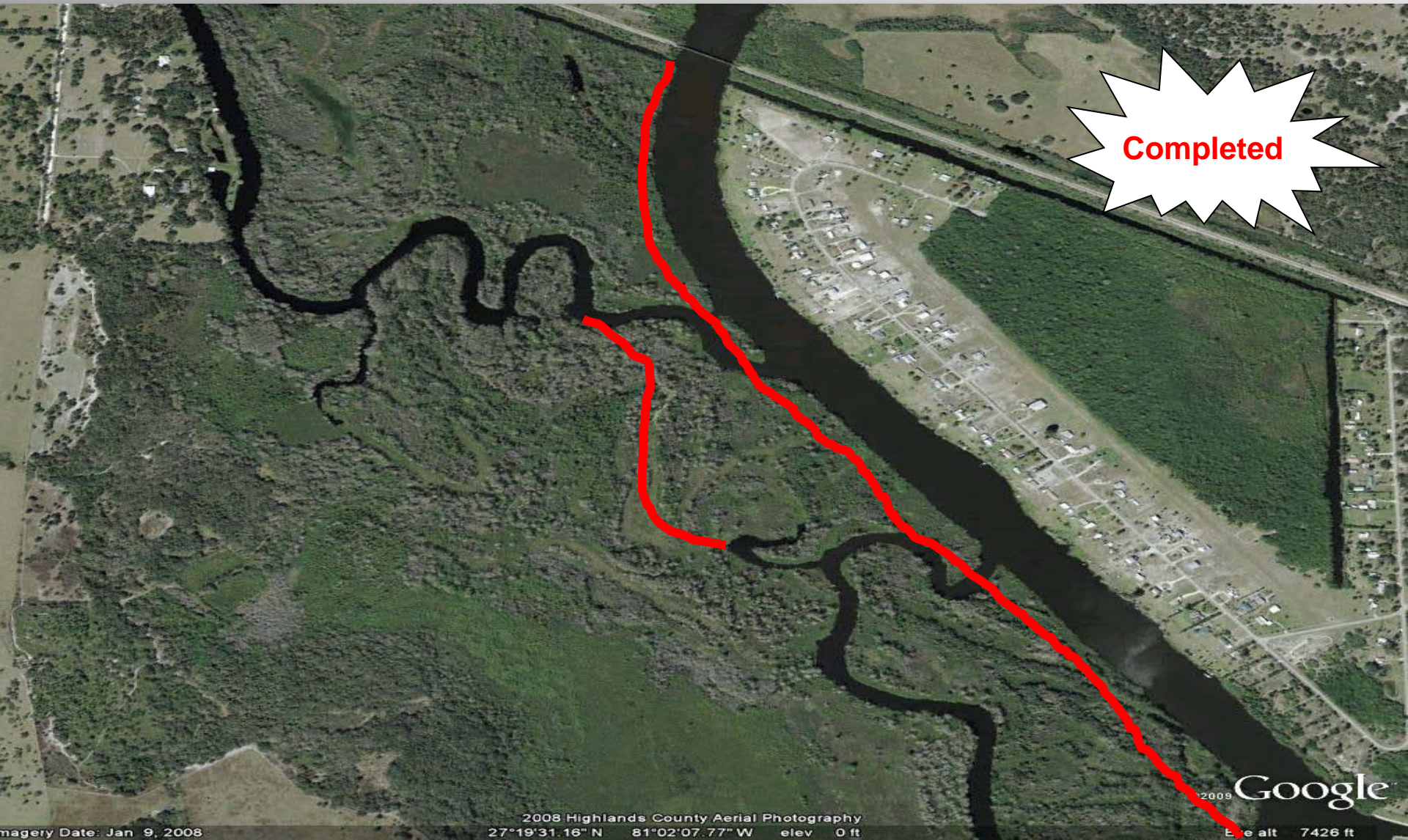


Phase II/III Re-carved Section



Completed

Phase II/III Tie Back Levee



Completed

River Acres Flood Reduction



2008 Highlands County Aerial Photography

©2009 Google

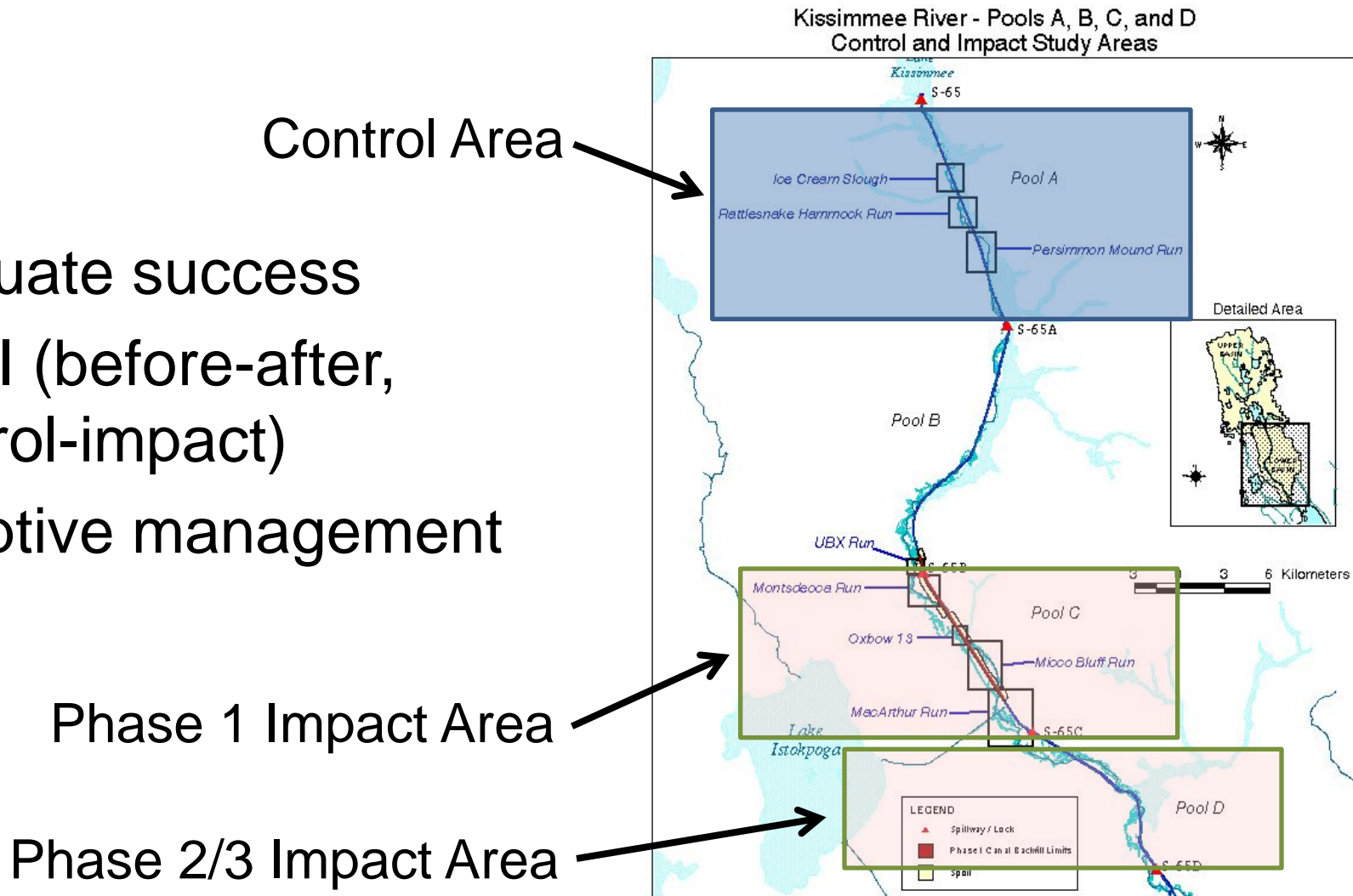
Comprehensive Restoration Evaluation Program

- Hydrology
- Geomorphology
- Dissolved Oxygen & Water Quality
- Plant Communities
- Invertebrate Communities
- Reptile and Amphibian Communities
- Fish Communities
- Avian Communities
- Threatened and Endangered Species



KRR Evaluation Program Design

- Evaluate success
- BACI (before-after, control-impact)
- Adaptive management



Kissimmee River Restoration Studies Compendia

- Results of Baseline Studies 1995-1999
- 25 Performance Measures “Restoration Expectations”
- Executive Summary





Degraded
Spoil
Area

Backfilled
C-38

Remnant
River
Channel

Physical Template

New River
Connection

Remnant
River
Channel

Phase I Environmental Response





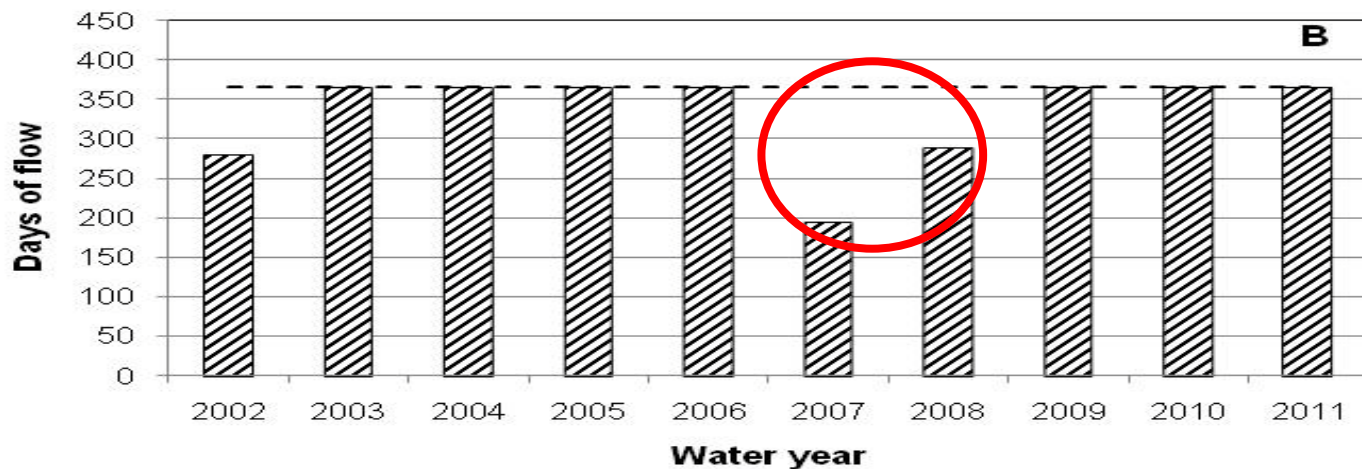
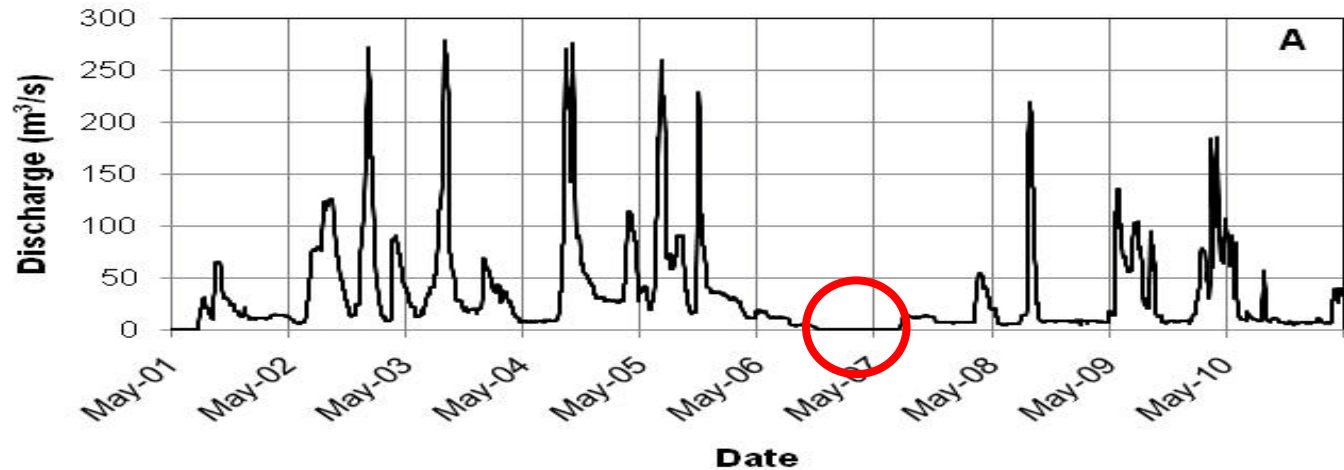
June 3, 2008

River stage fluctuation reestablished

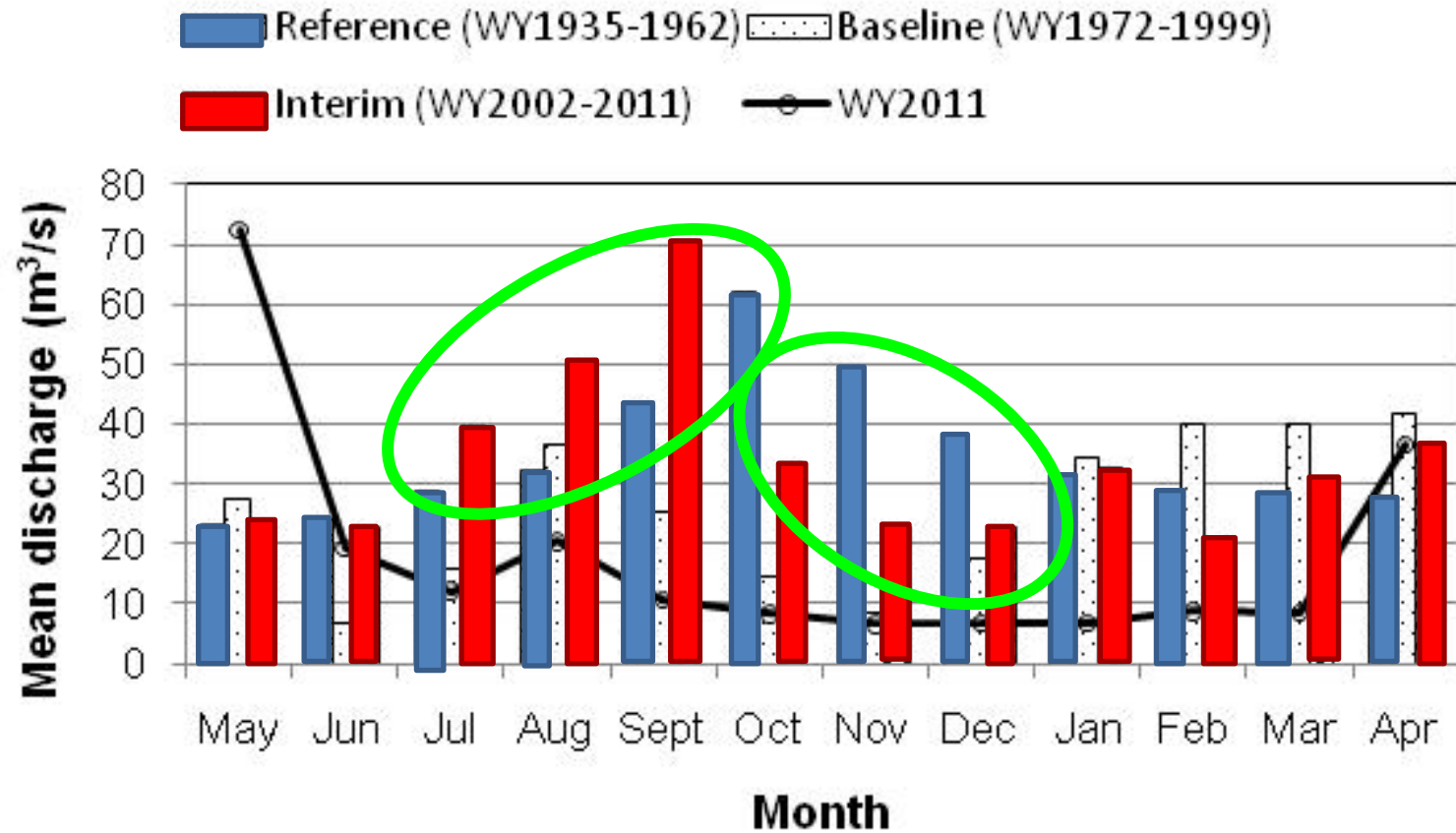


July 31, 2008

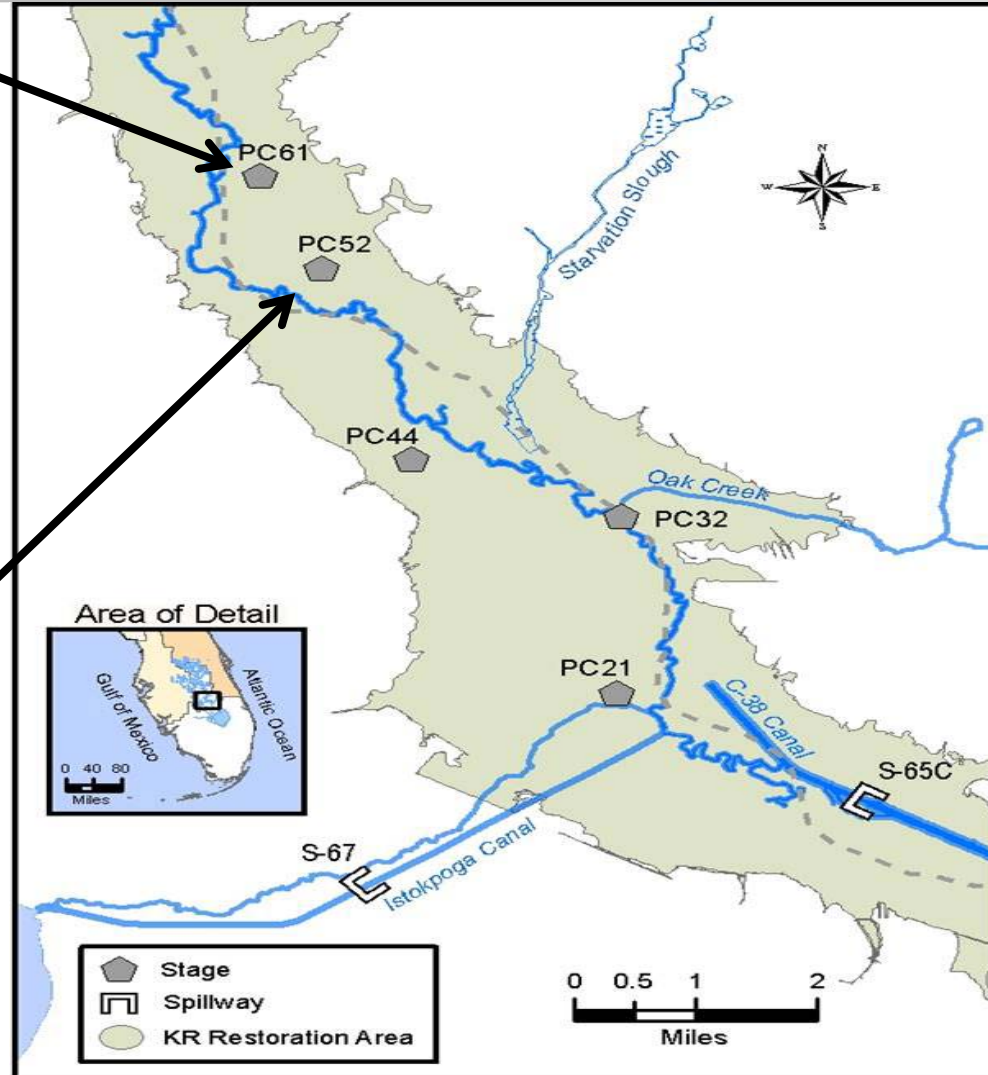
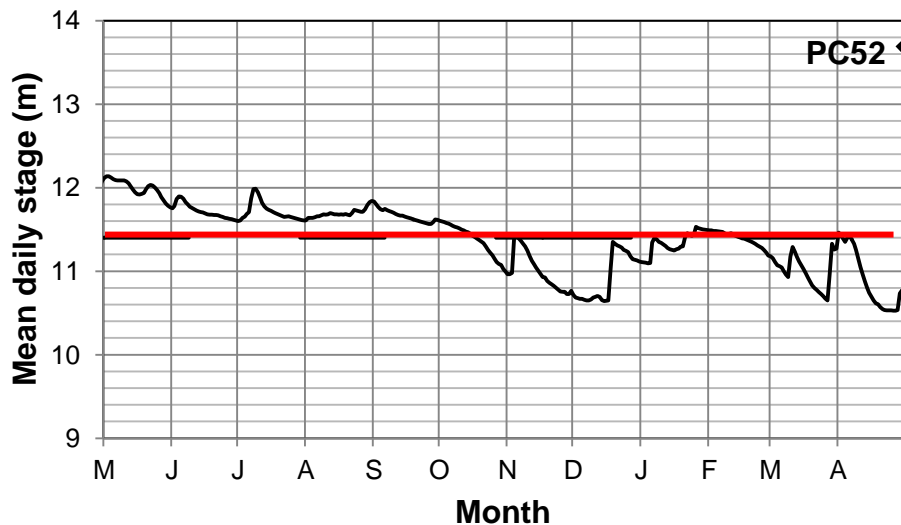
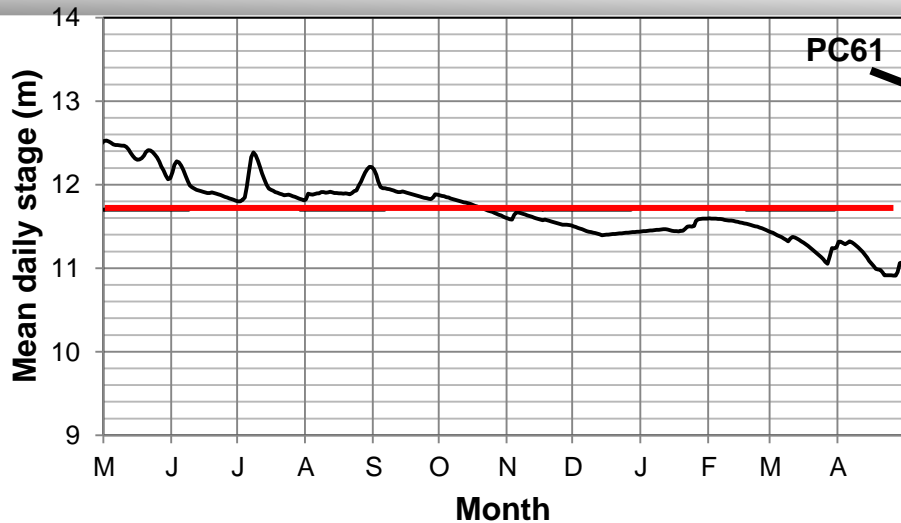
Continuous Flow



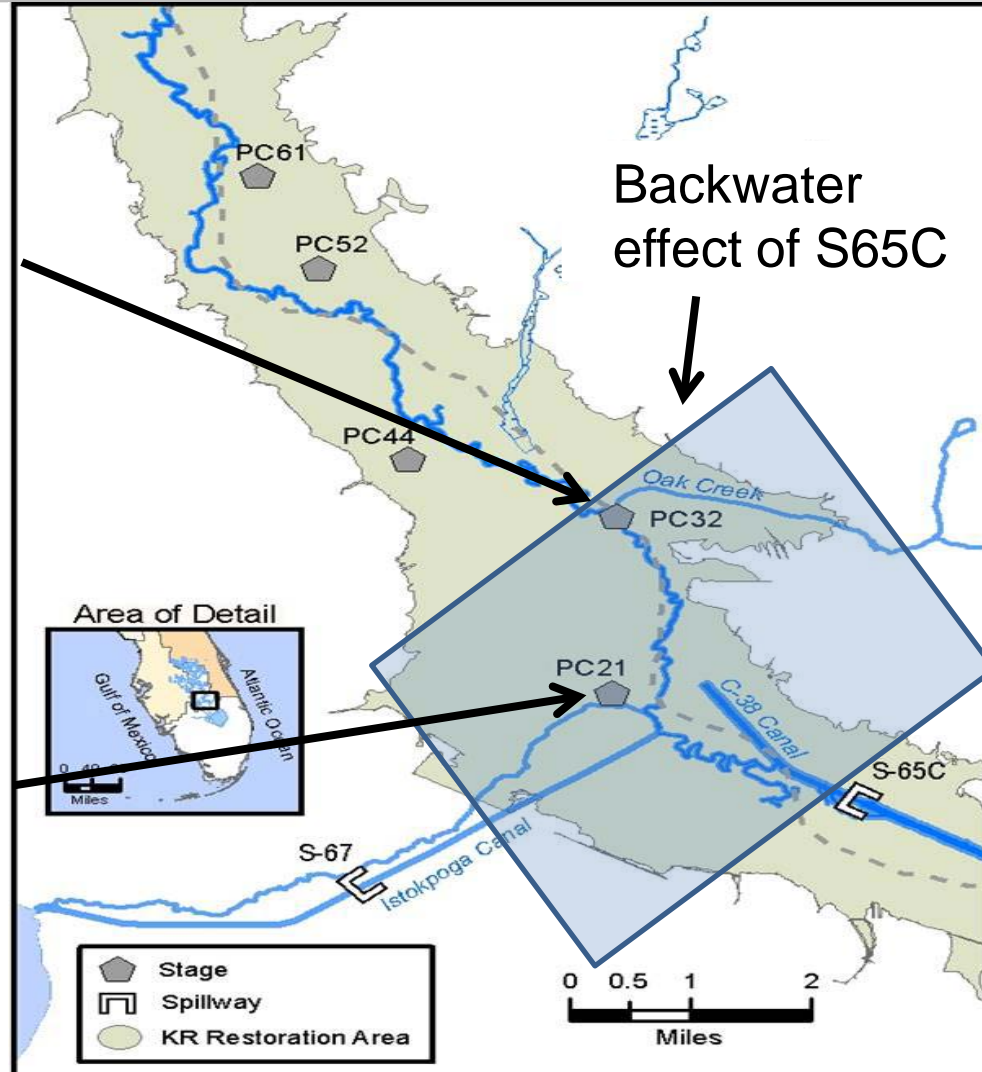
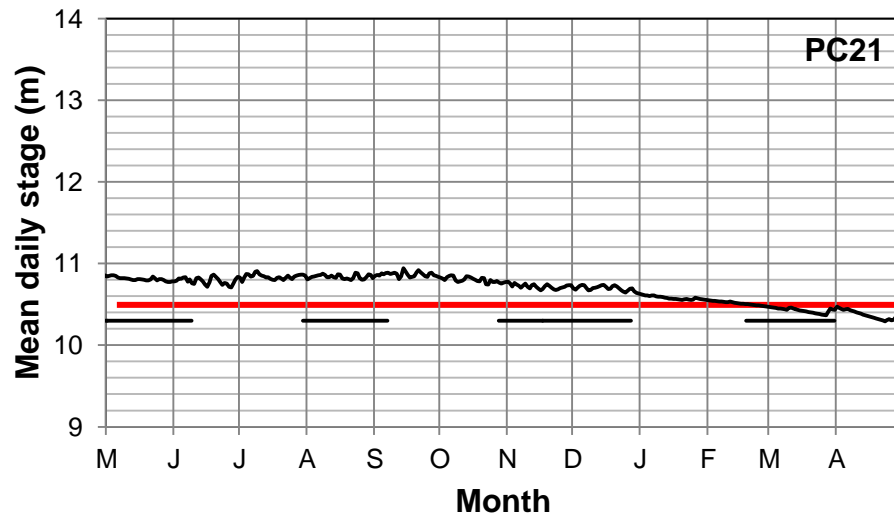
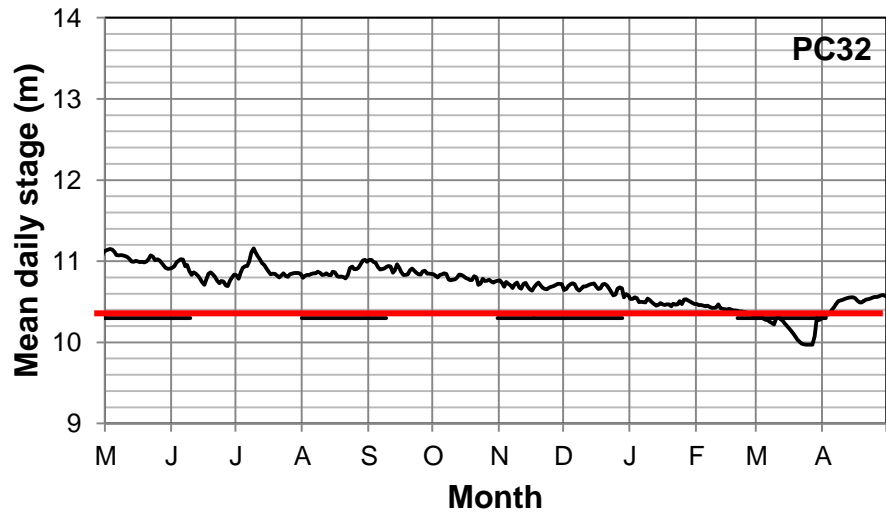
Hydrologic Variability



Floodplain Inundation



Floodplain Inundation



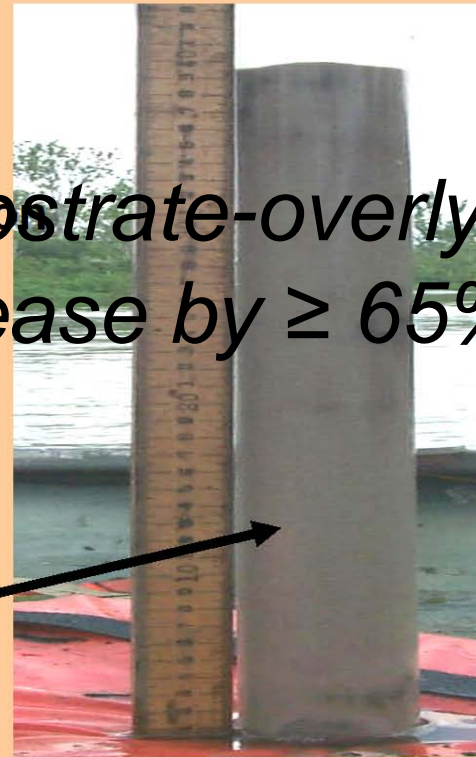
River Channel Bed Deposits

Remnant Channel

Restored Channel

Expectation #6

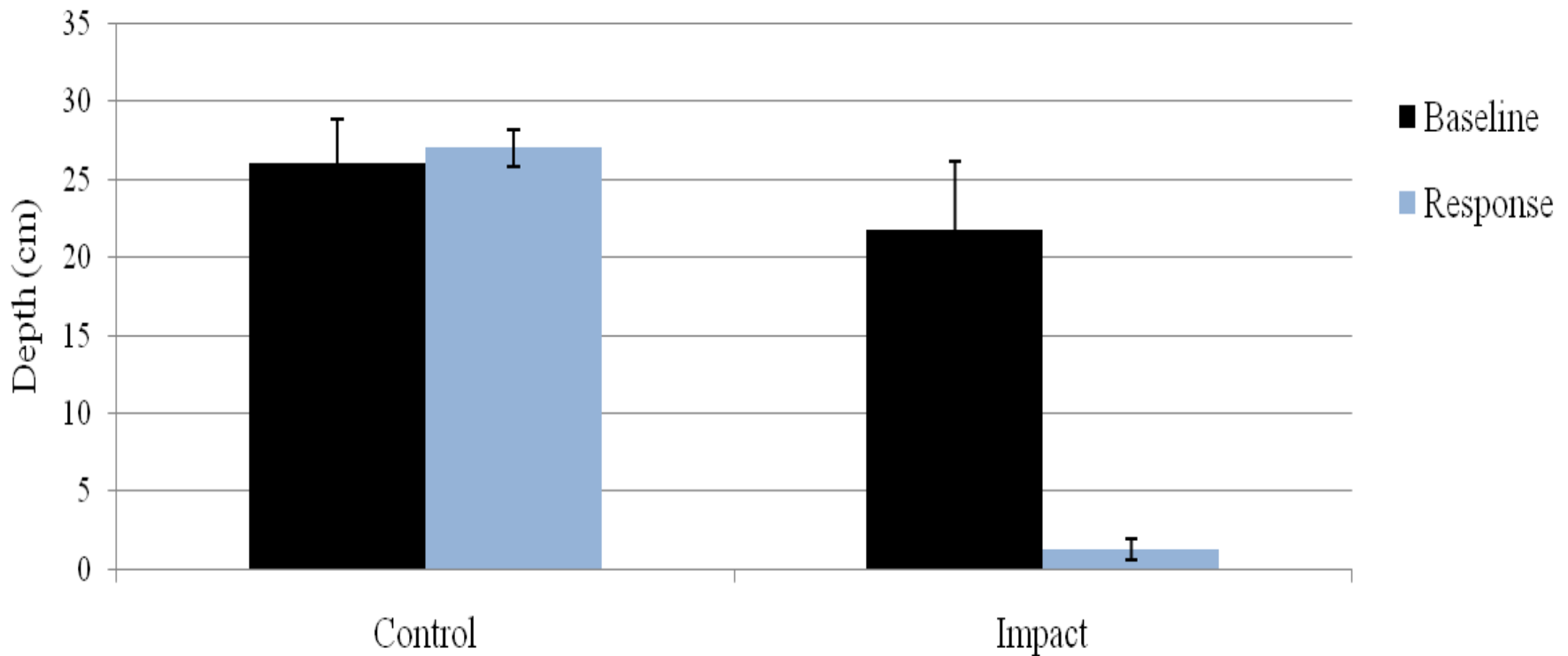
Mean thickness of substrate-overlying deposits will decrease by $\geq 65\%$



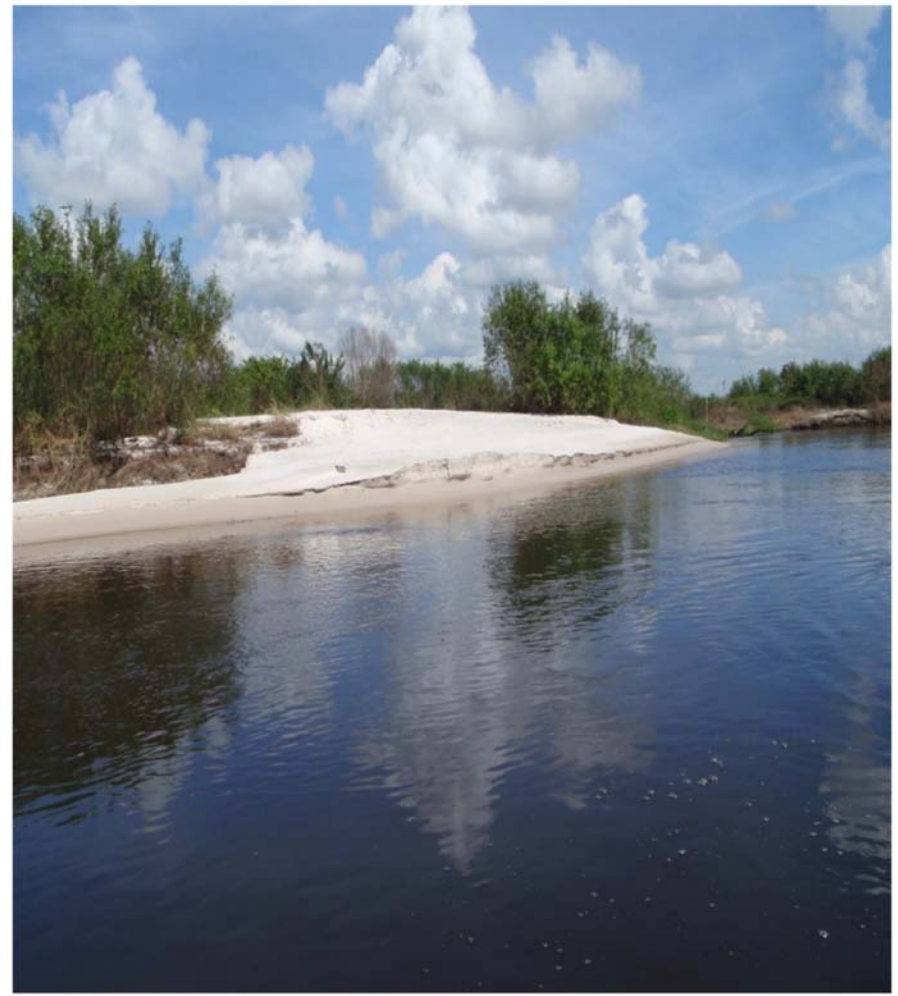
Sand

River Channel Bed Deposits

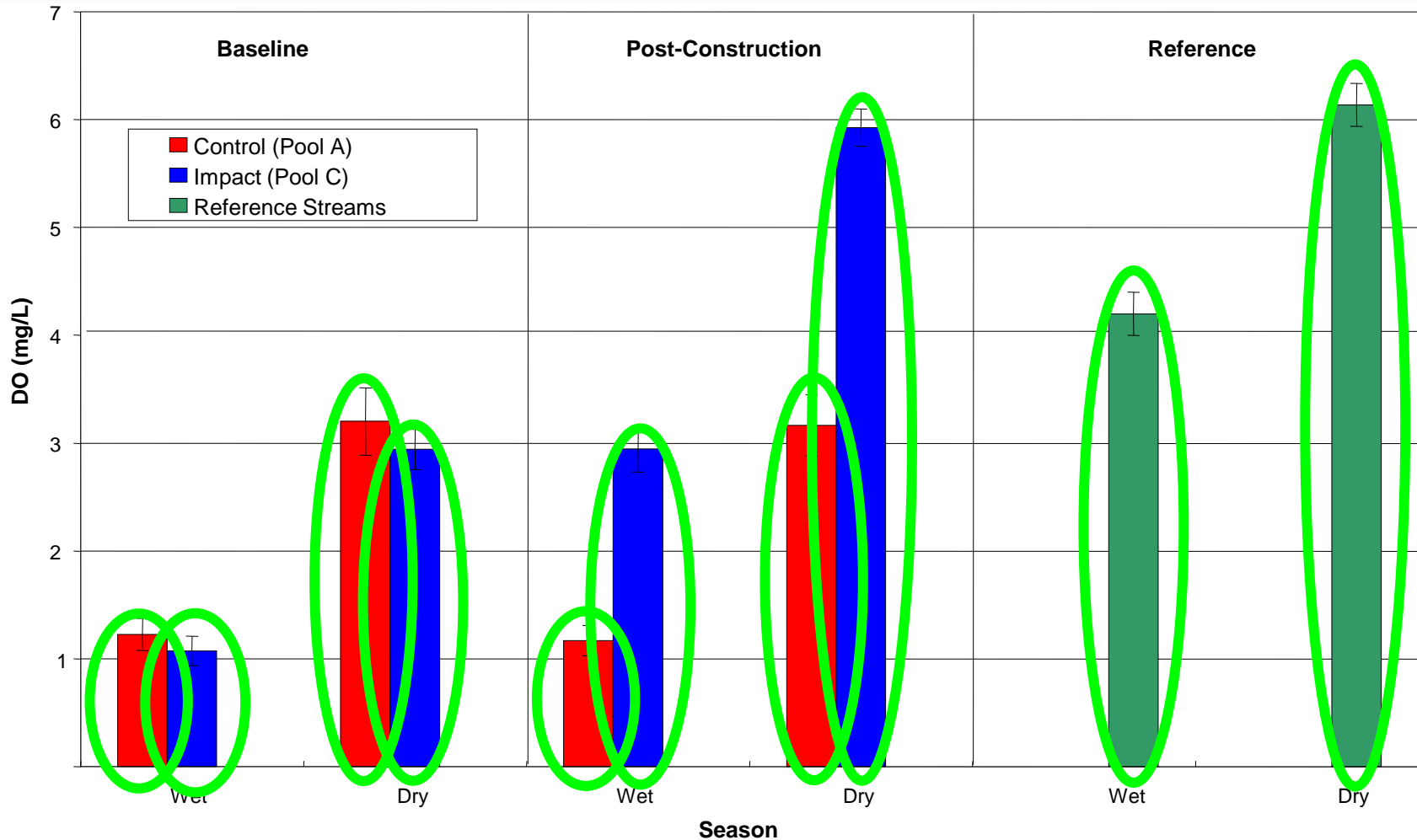
Benthic Organic Matter Depth



Sandbar Formation



Shifts in Dissolved Oxygen

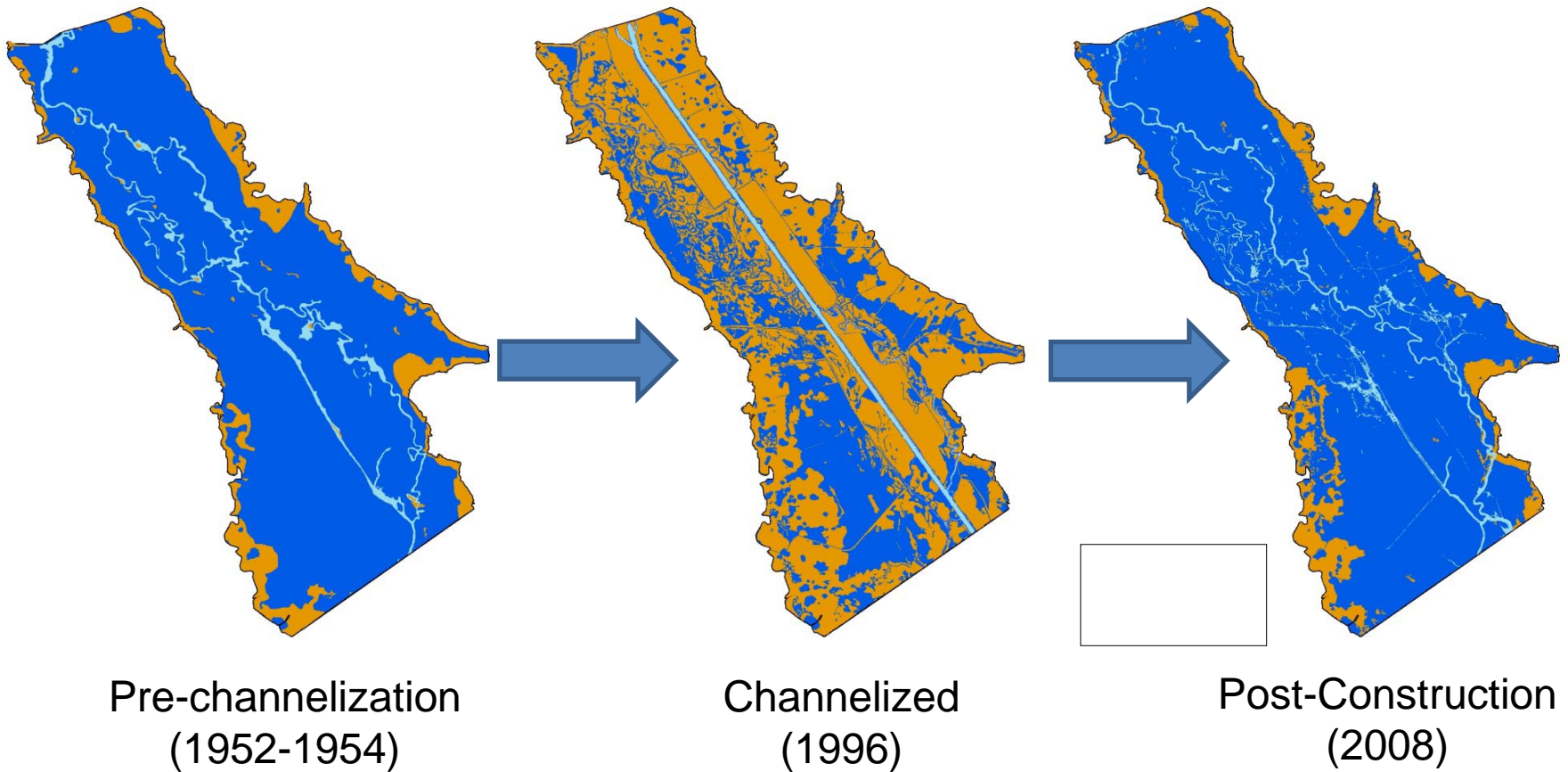


Floodplain Vegetation Response



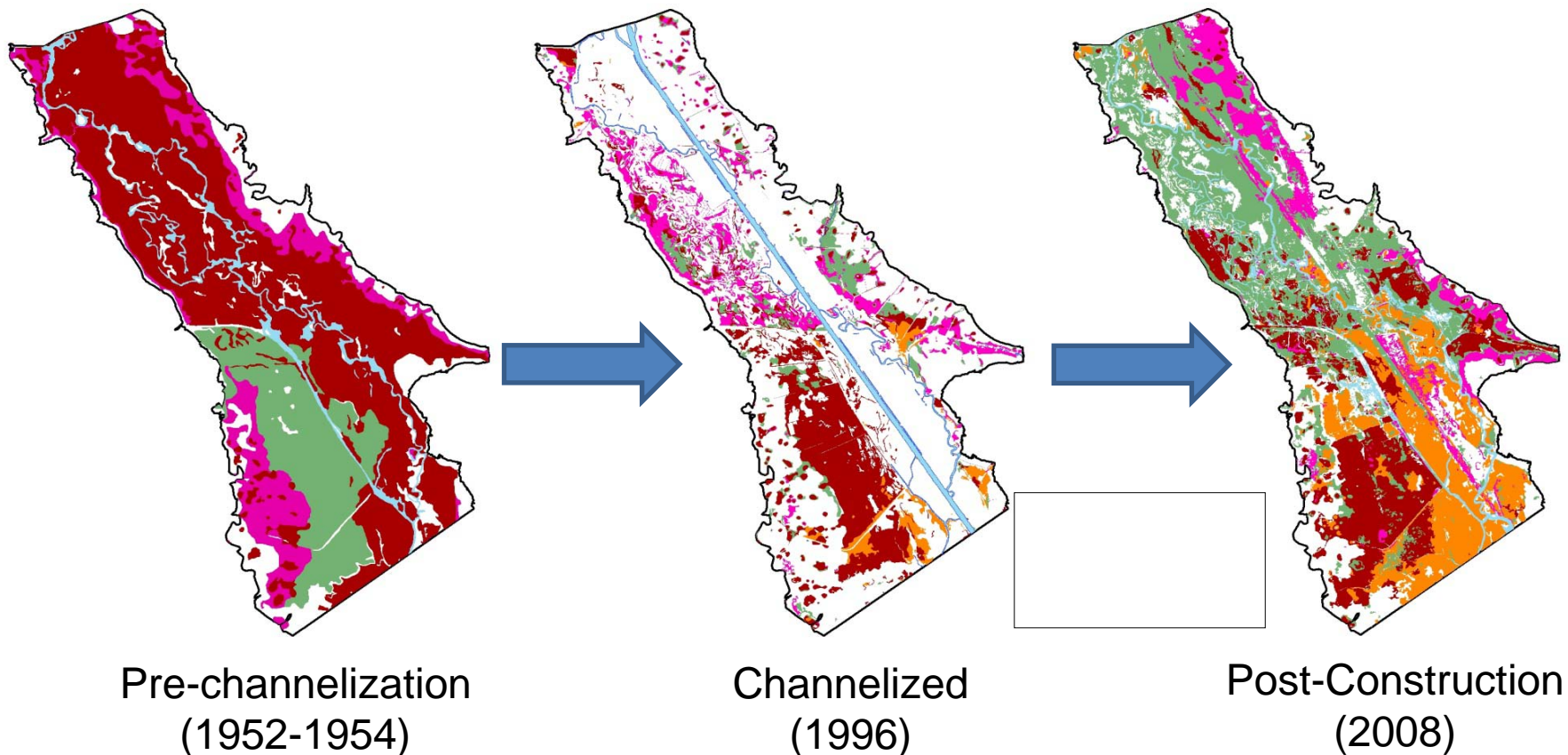
Floodplain Vegetation Response

Wetland vs. Upland



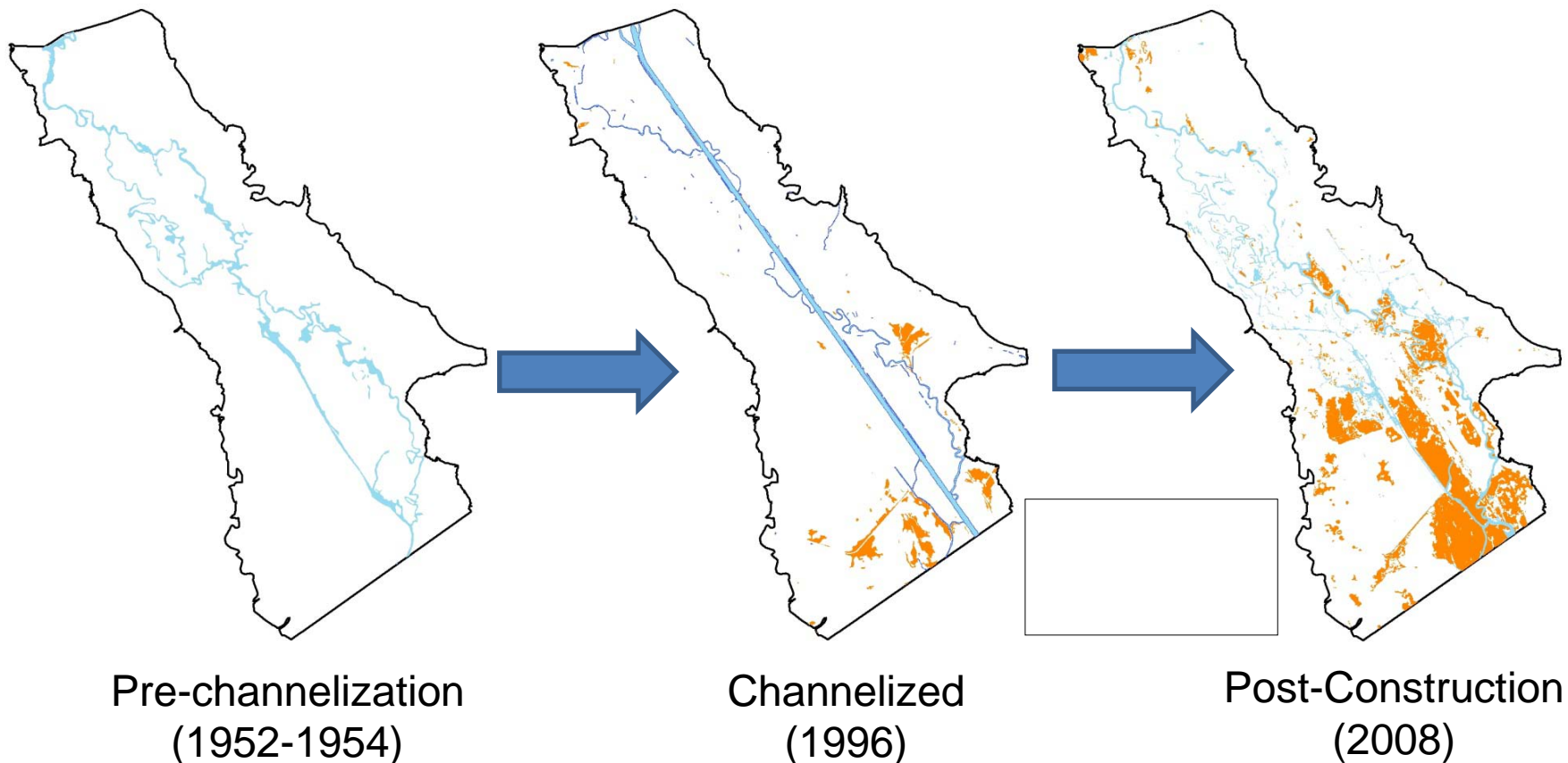
Floodplain Vegetation Response

Relative Abundances of Wetland Community Types



Floodplain Vegetation Response

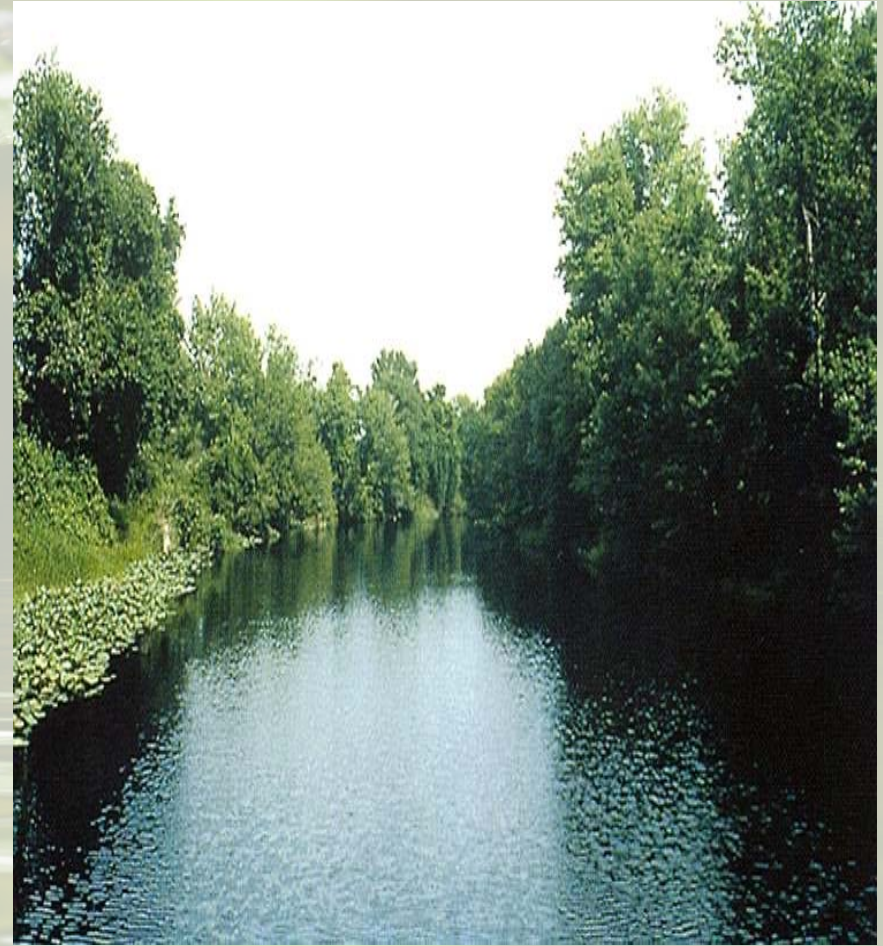
Increased Invasive Shrub Community Type



River Channel Vegetation Response



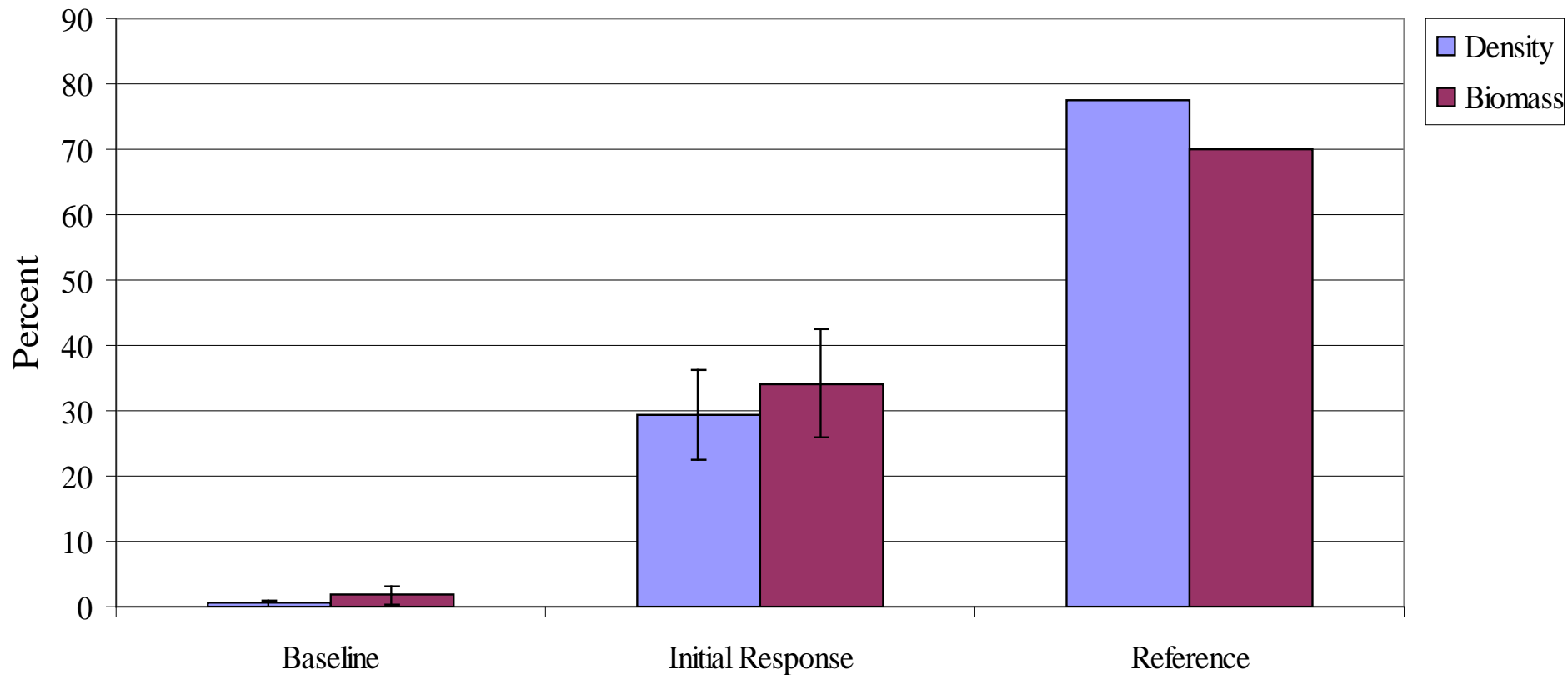
Pre-restoration



Post-restoration

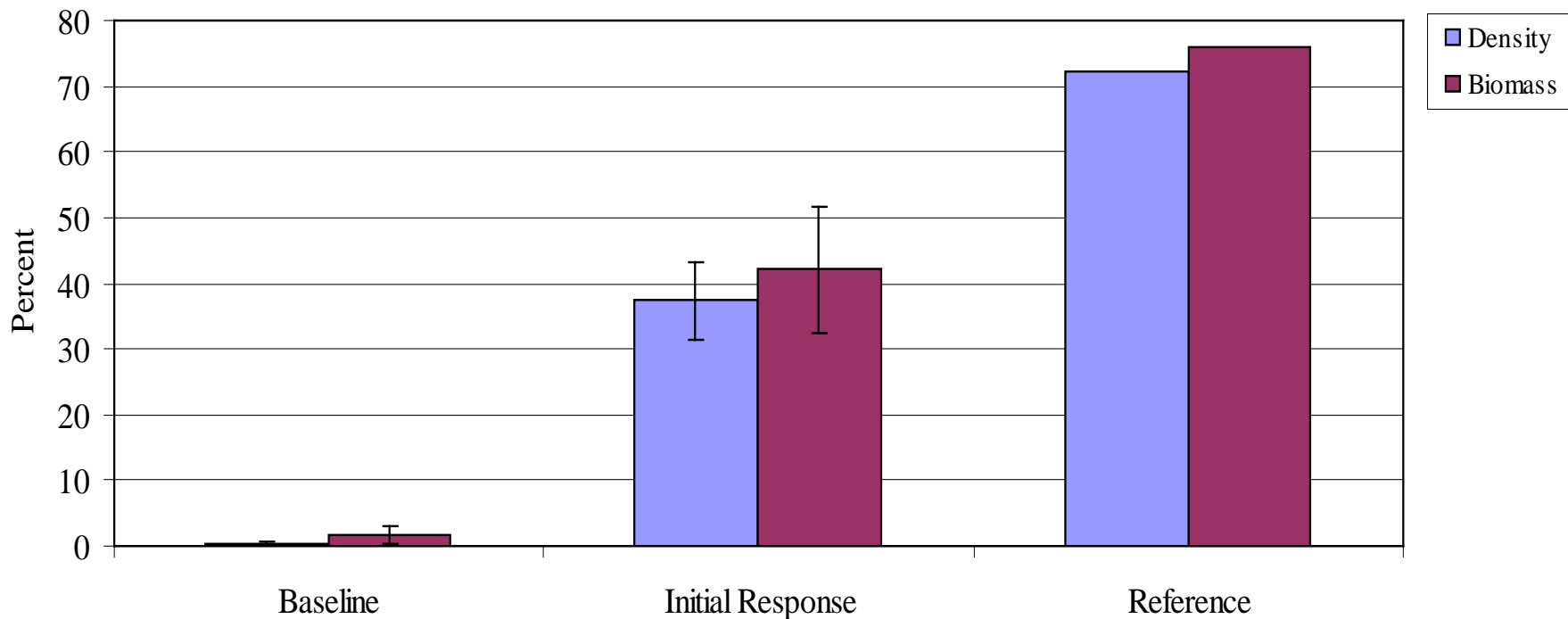
Invertebrate Response

Filtering-collector Invertebrates



Invertebrate Response

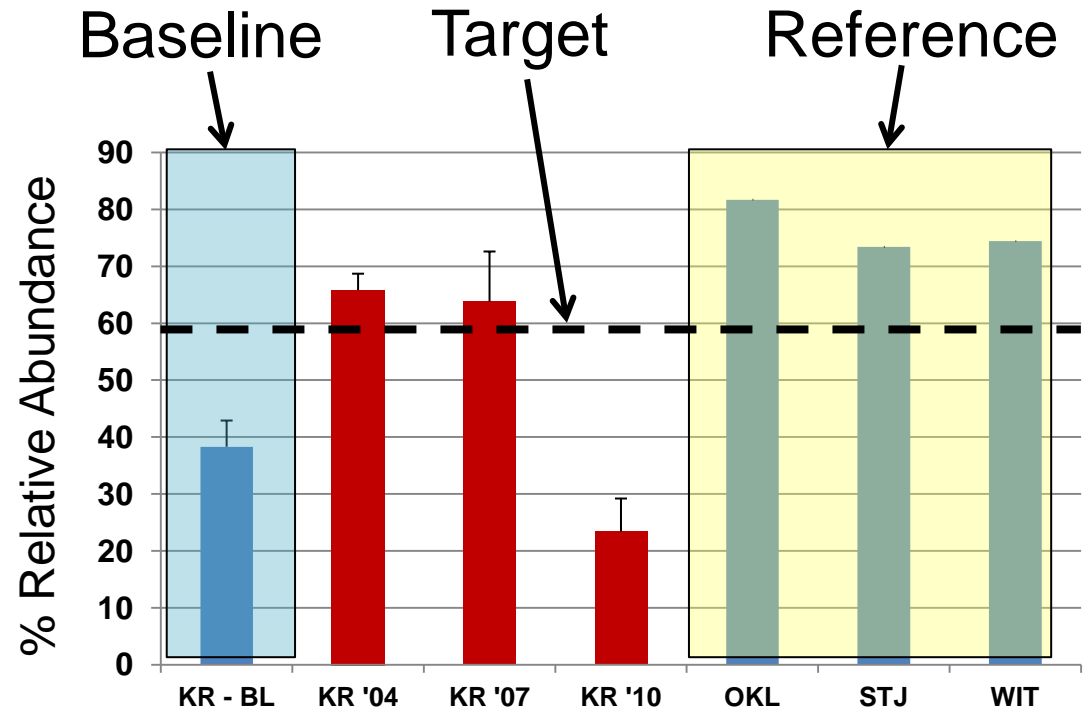
**Density and Biomass of Indicator Taxa on Woody Debris
(Indicates Restoration of Food Base)**



Fish Response



Centrarchids - Bass and Sunfish

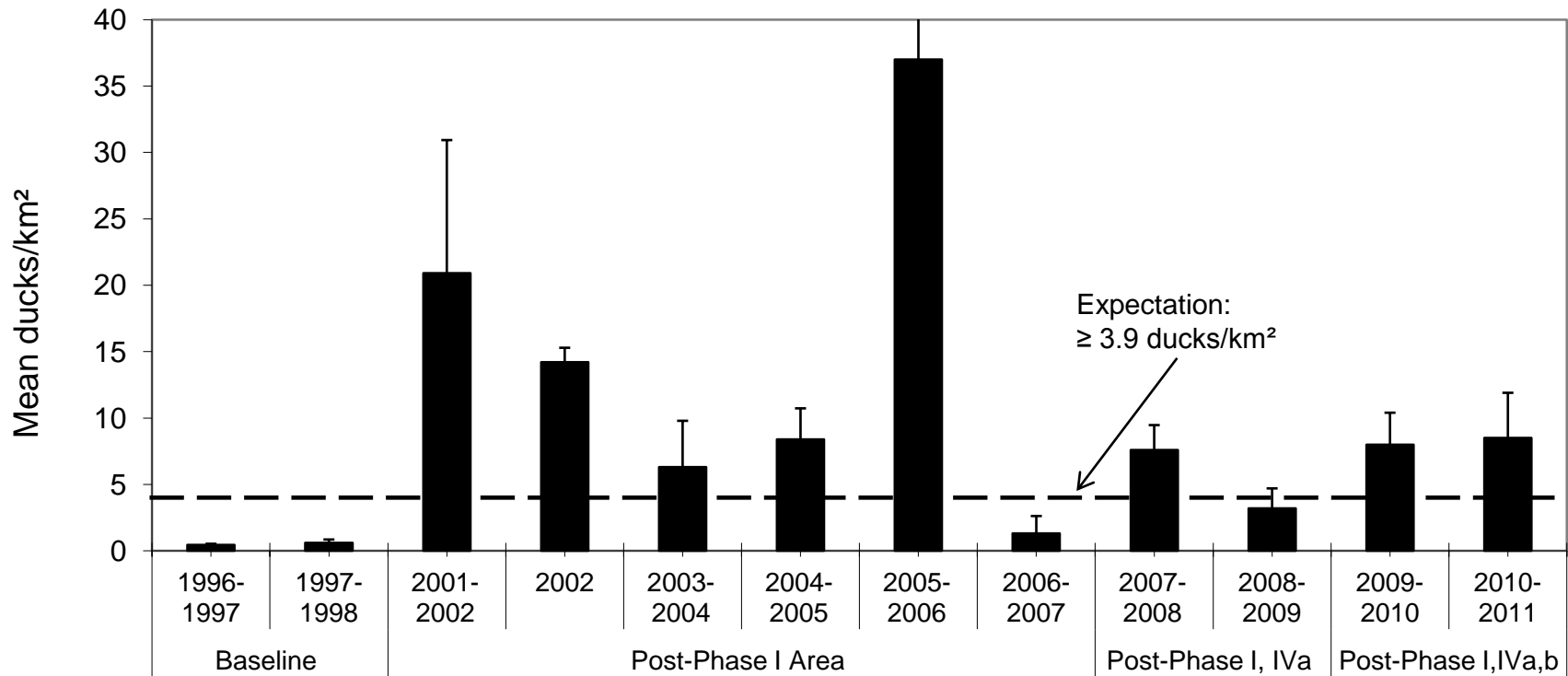


Waterfowl Response

- 9 species return
Species richness ≥ 13
- Winter (Nov-Mar)
waterfowl densities ≥ 3.9
ducks/km²



Waterfowl Response



Wading Bird Response

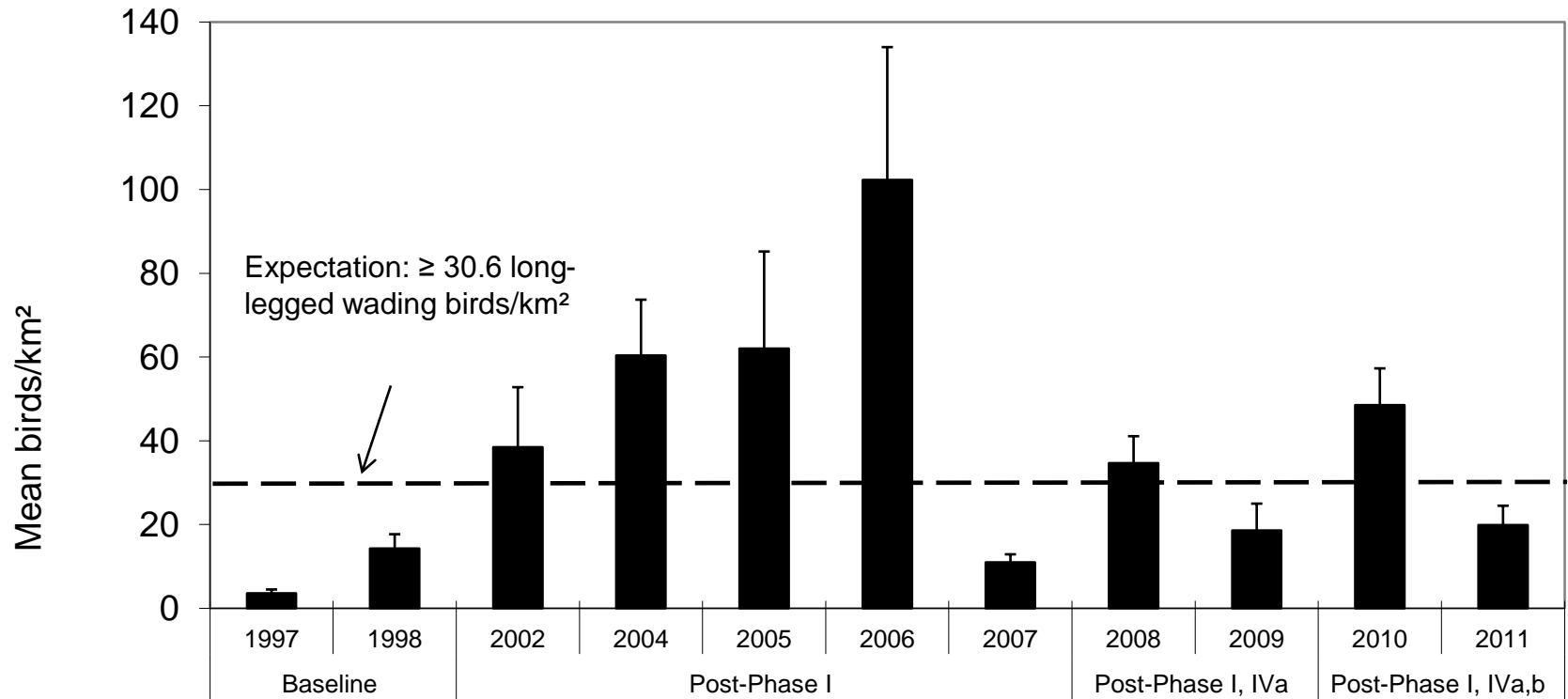
Expectation #24

“Mean annual dry season density of long-legged wading birds (excluding cattle egrets) on the restored floodplain will be ≥ 30.6 birds/km²”

Wading Bird Response



Wading Bird Response



Conclusions

- Restoration is incomplete
- Response by many ecosystem components on trajectory to target values
- Bulk of environmental benefits expected following construction completion and implementation of new Headwaters Schedule in 2015





QUESTIONS?