Regional Storage / Treatment & Conveyance Issues

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10-County Coalition Meeting
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Regional Ecosystem Restoration Components

- Surface Water Reservoirs
- Stormwater Treatment Areas (STAs)
- Canal widening
- Aquifer Storage & Recovery (ASR) Wells

Regional Ecosystem Restoration Components

- Everglades Agricultural Area (EAA) Flowway
  - Originally suggested in 1993
  - Evaluated as an alternative in the Comprehensive Everglades Restoration Plan (CERP) and rejected
  - Recent concerns over regional water resource policy have revived the discussion of its potential utilization in restoration

Regional Concerns

- Lake & Estuary environmental impacts in wet years
  - High Lake Okeechobee stage
    - Impacts to littoral zone
    - Threat to Herbert Hoover Dike
  - High discharge to estuaries
  - High Water Conservation Area (WCA) stages
- Environmental & water supply problems in dry years
  - Lake Okeechobee low stages (Water Supply & Minimum Flows & Levels)
  - Everglades low stages & flows
  - Stormwater Treatment Area water needs
  - East & West Coast utilities
  - Estuary minimum flows & levels

Regional Concerns

- Uncertainty of ASR effectiveness
  - Floridan Aquifer storage / retrieval capacity
  - Water quality concerns
- Climatology
  - Atlantic Multi-Decadal Oscillation (AMO)
    - May result in increased wet season rainfall over an extended period

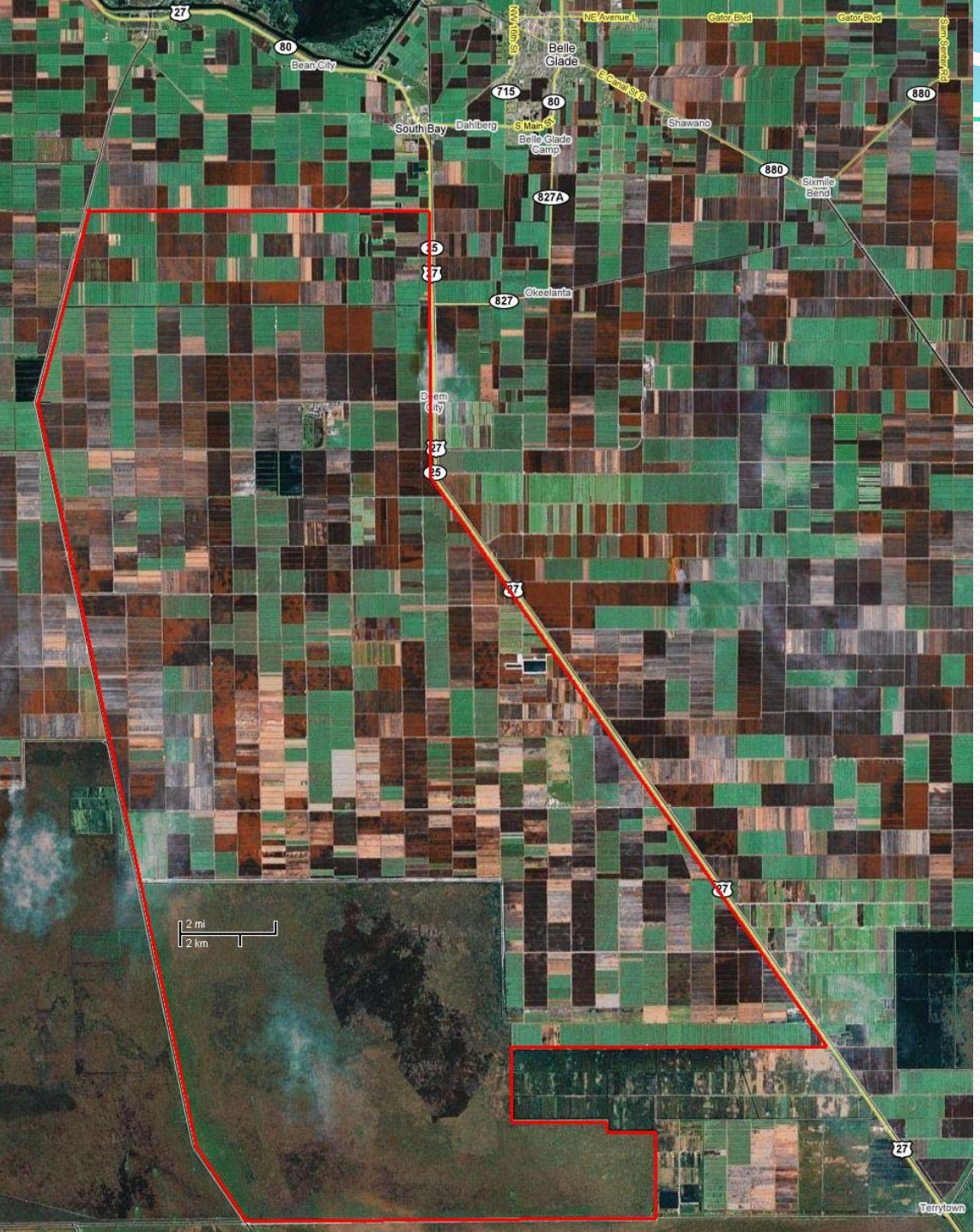
A Review of the Flowway Concept

1. Brief History of Reports
2. Flowway Evaluations

Dr. Richard Punnett

Comprehensive Review of Central and Southern Florida (C&SF) Project

- Evaluated Flowways in a Two Phase Study:
  - Reconnaissance Phase – Report in 1994
  - Feasibility Phase – Report in 1999.
    - Now known as CERP.



EAA Flowway

- Size: 117,288 acres
- 6,600 cfs inflow pump capacity
- Maximum depth: 3 feet
- Function like an STA
- Uncontrolled weir flow into the WCA-3A

Recon Report: Flowway Pro's

- The alternative plans that enhance sheet flow would result in an improvement in nutrient spreading and uptake would be expected.

- In WCA-3A, there was improvement in dry times, but less than the improvement in some other alternatives.

Recon Report: Flowway Con's

- Was not the most effective plan
- Flowway water fluctuation was not like a wetland
- Flood crests in the WCA-3A still too high
- Flows to the Everglades National Park (ENP) remained too low
- Had very low habitat suitability

1999 Feasibility Report "The Restudy"

- Evaluation of the flowway concept shows several erroneous assumptions about the flowway feasibility:
  - Soil subsidence
  - Evapotranspiration (ET)
  - Seepage management
  - Vegetation
  - Timing of flows
  - Lack of flow events are evident
- Flowways would exacerbate the already high stages in the northern parts of the WCAs.

1999 Feasibility Report, Continued

- “Summarizing, the flowway is a concept that creates a water supply burden on the system without clear hydrologic benefits.”

Flowway Management Dilemmas

- Water deliveries <u>to or from</u> a flowway will never be natural

  because Lake Okeechobee has changed

- Mutually exclusive goals:
  - spatial extent (e.g. sawgrass community or marsh)
  - natural deliveries to the WCAs and ENP?

Other Everglades Restoration Reports

- Science Sub-Group Report, 1996
- Governor's Commission for Sustainable South Florida Conceptual Plan, 1996
- Department of Interior (DOI) Science Plan, 2005

None of the reports mentioned the flowway.

All reports discussed the need for managed storage.

Why is managed storage important?

- Improve Lake Okeechobee levels
- Improve estuary flow levels
- More natural flows into WCAs and ENP

Does storage location matter?

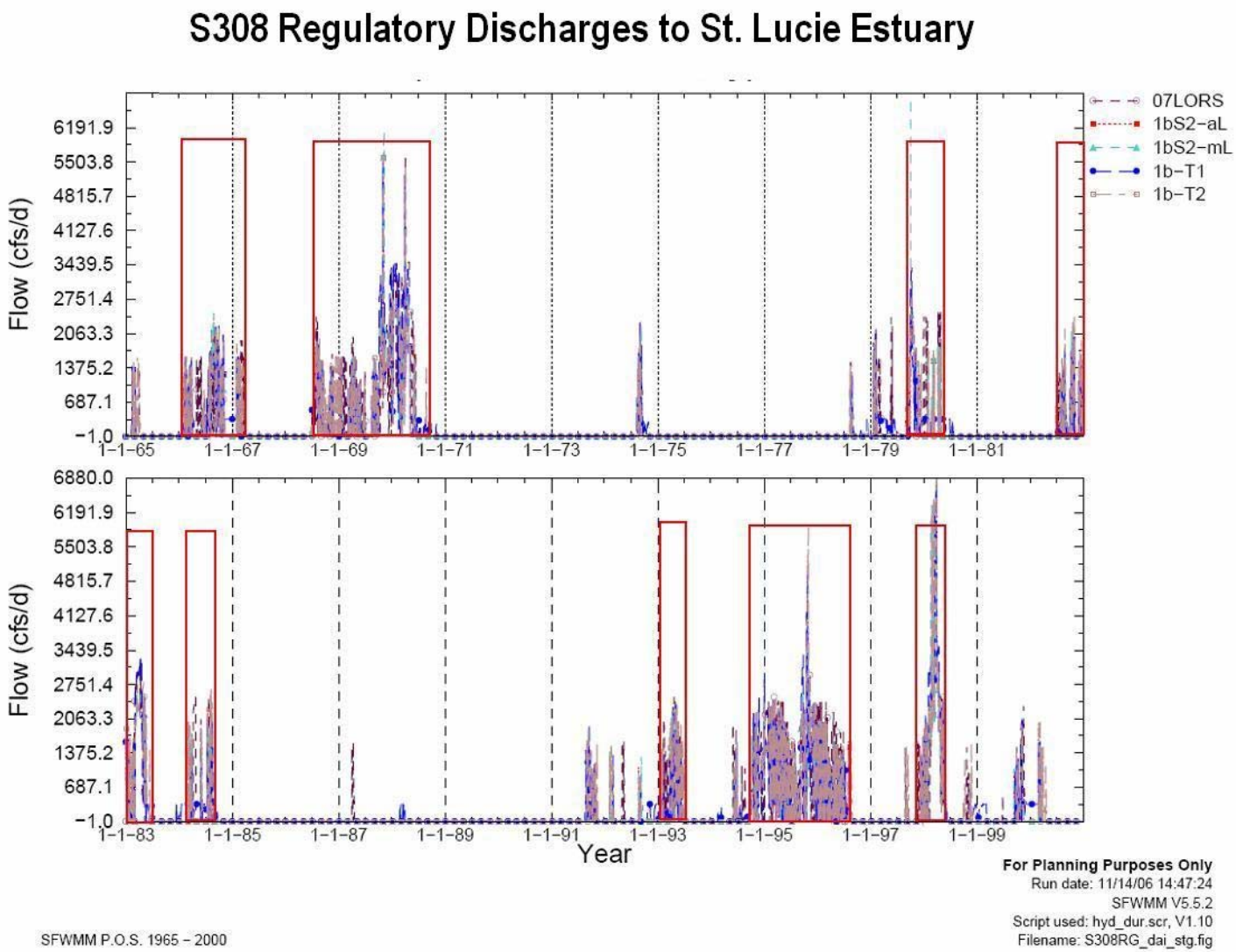
- Catch water where it is in excess
- The more upstream storage is in the system, the more downstream needs it can meet.

Water Availability Issues

- Both high water and low flow issues were identified in both the Recon and Feasibility Reports as problems for the flowway concept.

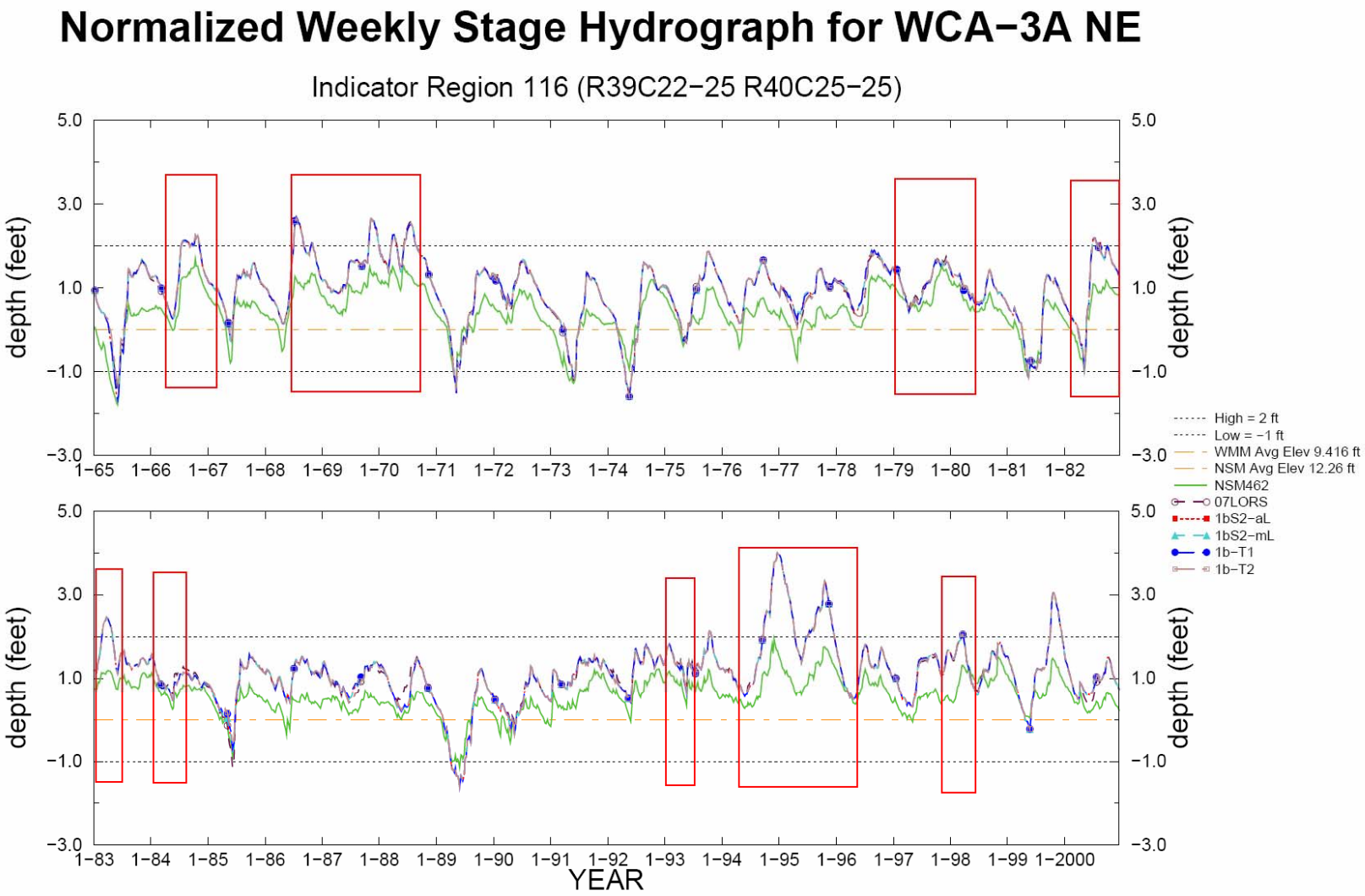
- Would a newer, lower lake schedule, such as the Lake Okeechobee Regulation Schedule Study (LORSS):
  - Fix the high regulatory discharges issues?
  - Make more water available for the flowway?

Flood Discharges from Lake Okeechobee For LORSS



LORSS Regulatory Flows to St Lucie Estuary only occur during very wet periods

High stages in Lake Okeechobee <--> high stages in WCA-3A For LORSS



Restudy concluded that a flowway would exacerbate high stages in northern parts of WCAs.

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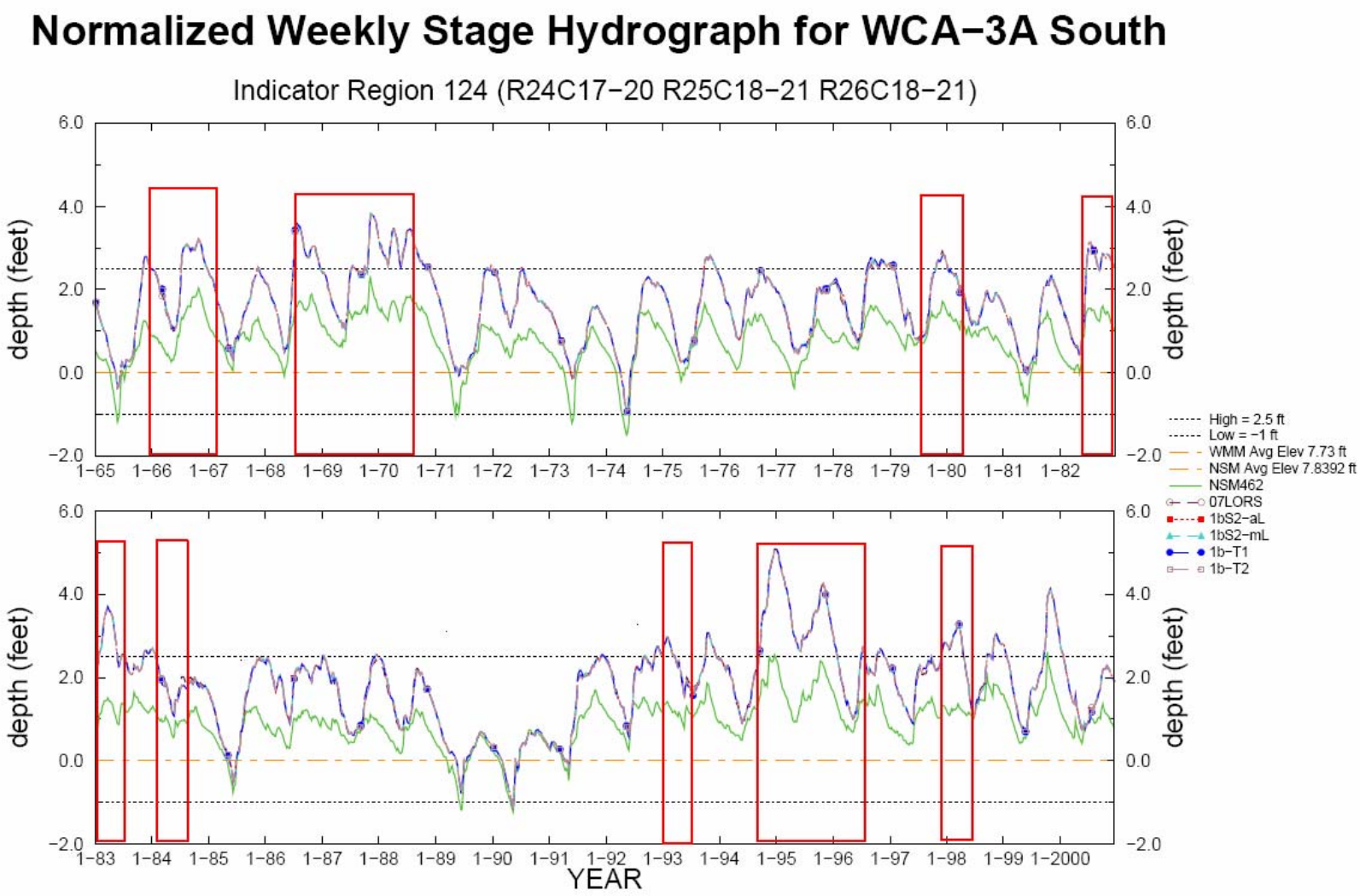
For Planning Purposes Only
SFWMM V5.5.2

High stages in Lake Okeechobee <--> high stages in WCA-3A For LORSS



Restudy concluded that a flowway would exacerbate high stages in northern parts of WCAs.

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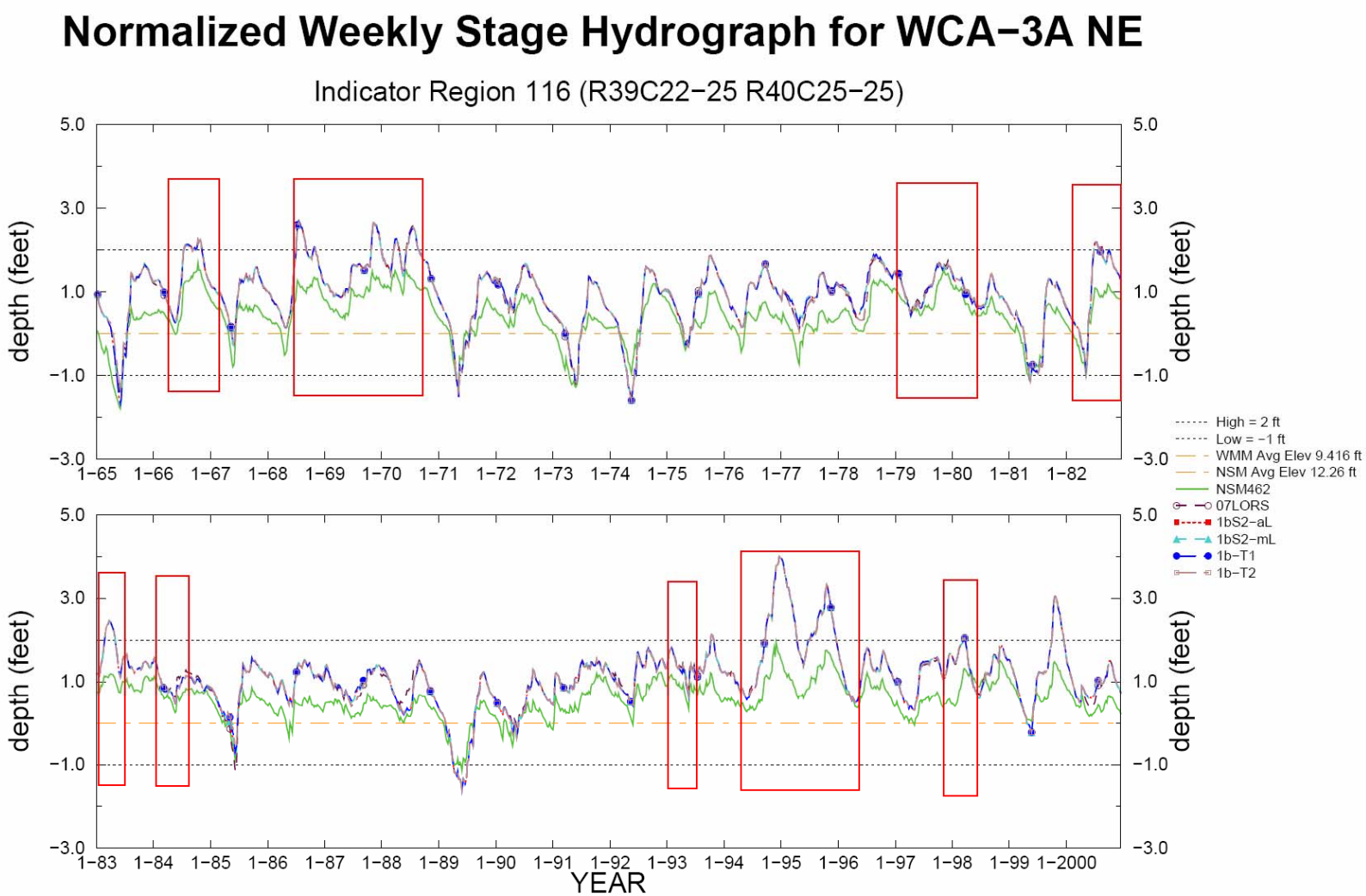
High stages in Lake Okeechobee <--> high stages in WCA-3A For CSOP



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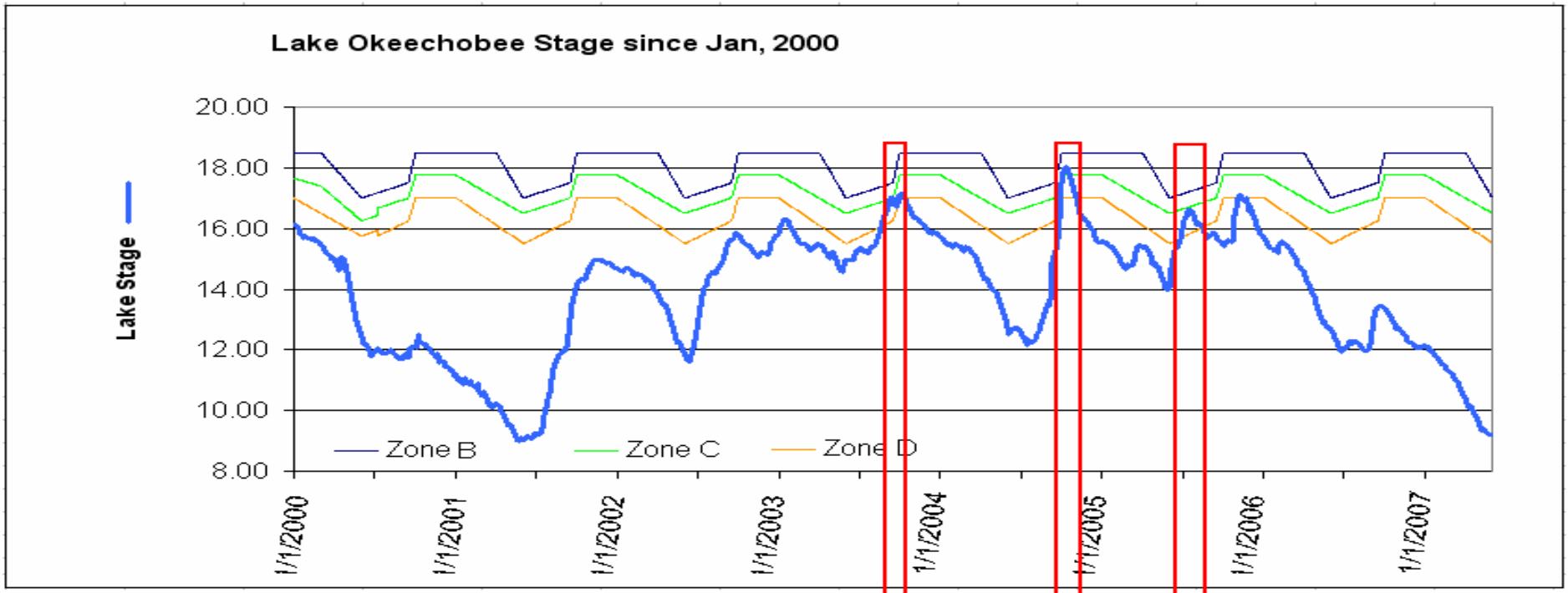
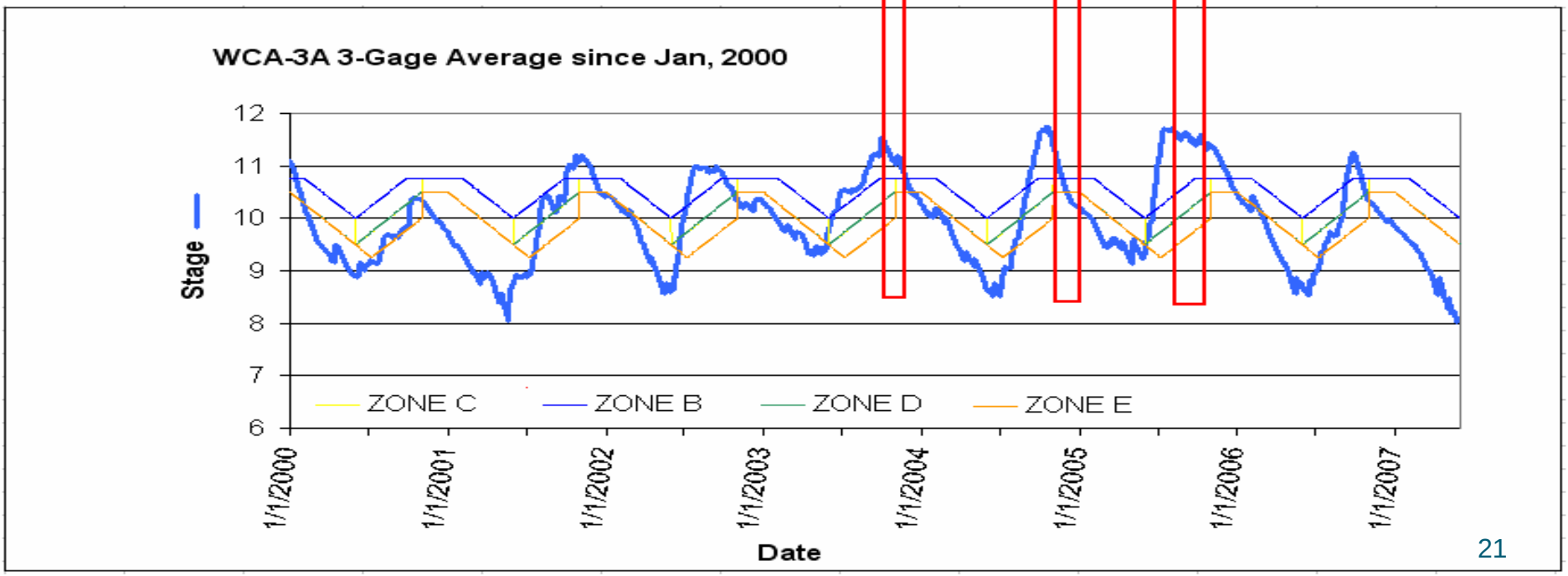

Lake Okeechobee Stage since Jan, 2000
Lake Stage
20.00
18.00
16.00
14.00
12.00
10.00
8.00
Zone B
Zone C
Zone D
1/1/2000
1/1/2001
1/1/2002
1/1/2003
1/1/2004
1/1/2005
1/1/2006
1/1/2007

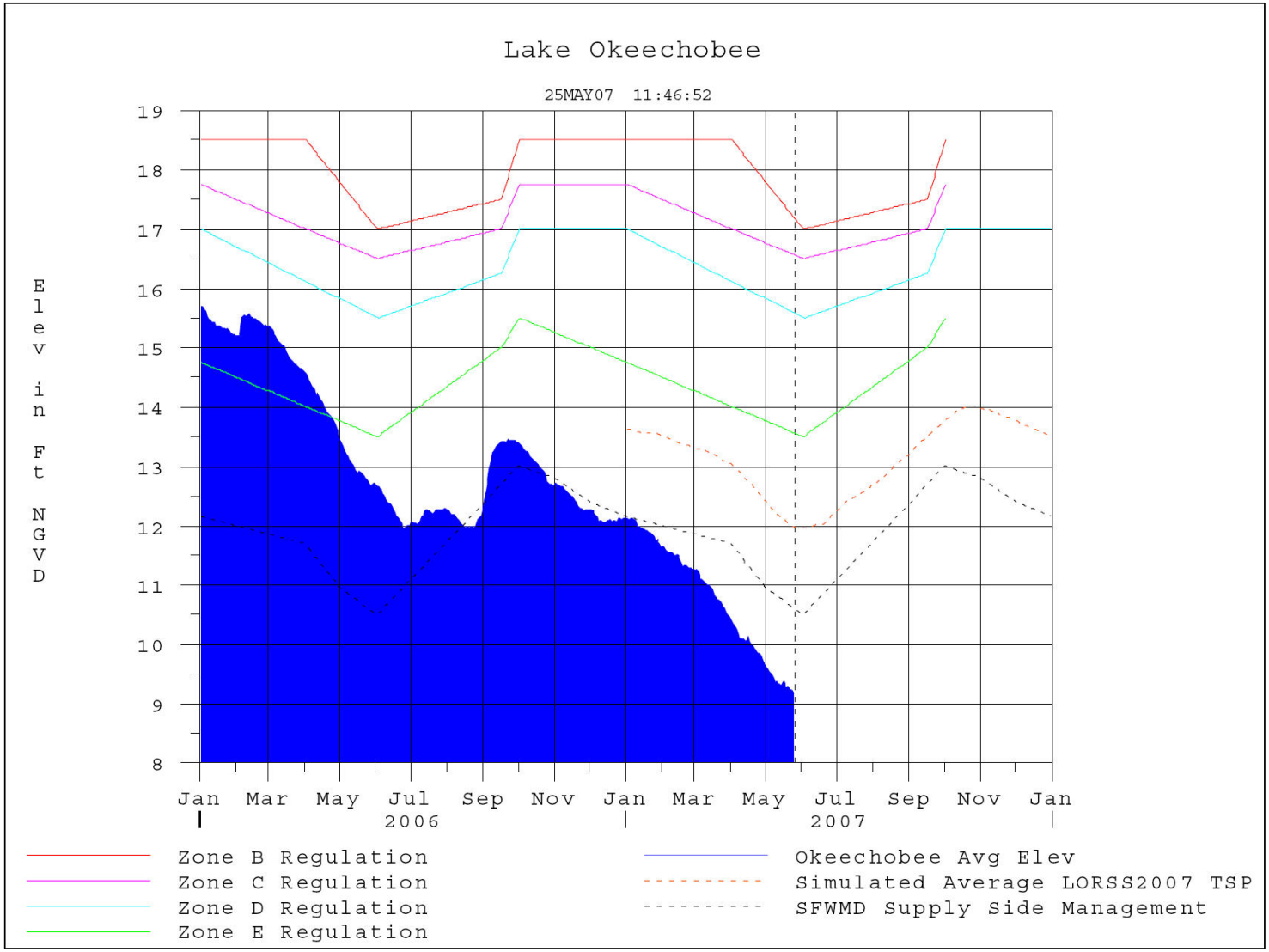

WCA-3A 3-Gage Average since Jan, 2000
Stage
12
11
10
9
8
7
6
ZONE C
ZONE B
ZONE D
ZONE E
1/1/2000
1/1/2001
1/1/2002
1/1/2003
1/1/2004
1/1/2005
1/1/2006
1/1/2007
Date

Current Modeling:

- Lake Okeechobee Regulation Schedule Study (LORSS)
  - Reduced Lake Okeechobee releases to WCAs.
  - Stage in WCA-3A too high during wet times.

- Modified Water Deliveries (CSOP)
  - Limits Lake Okeechobee deliveries to the WCAs.
  - Stage in WCA-3A too high during wet times.

“Wetter than Normal” Predictions…



If a flowway was in place, how much lower would Lake Okeechobee be?

If “wetter than normal” predictions are accurate:

A flowway would worsen high water stages in the WCA-3A and cause greater endangered species issues with snail kites, wood storks, and Cape Sable Seaside Sparrows.

Review Summary

- New information has not improved the issues associated previously identified with a flowway.

- There is a clear need for managed storage to improve the conditions of the Lake, Estuaries, and WCAs. But, where…?

Flowway Issues

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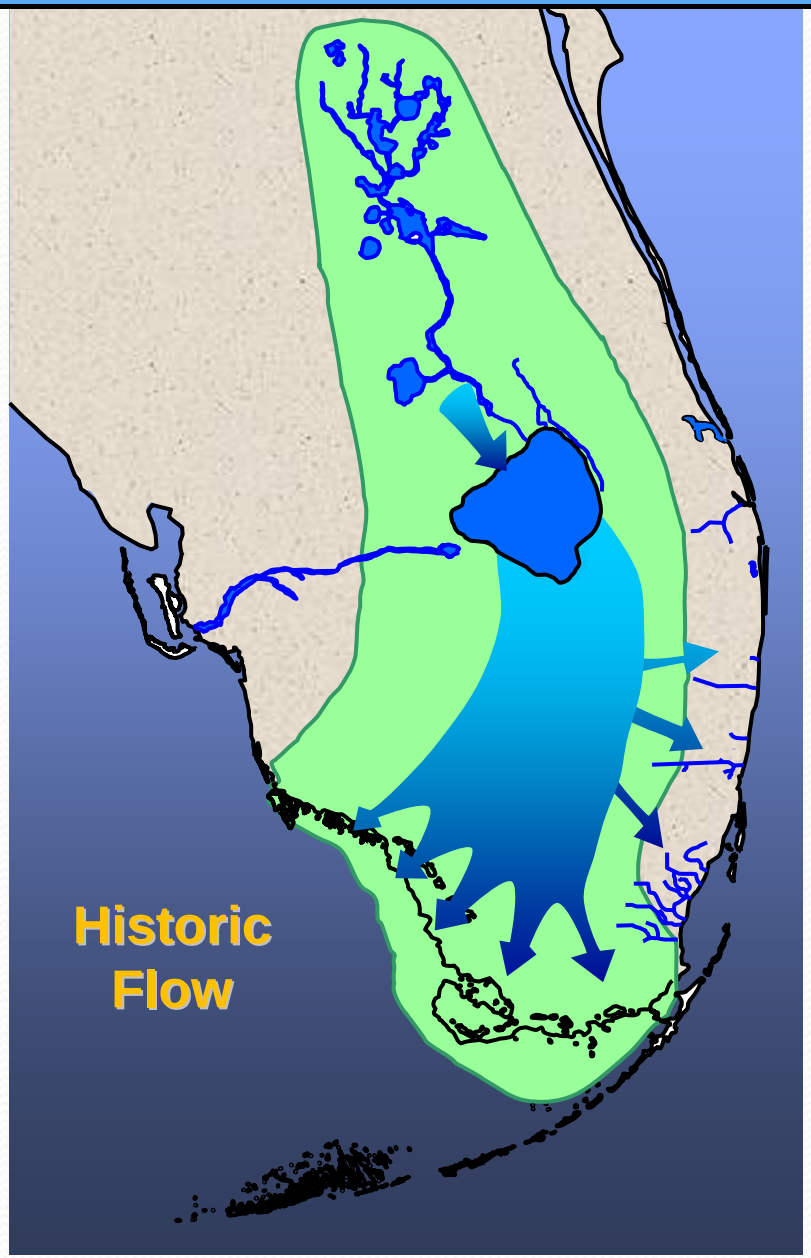
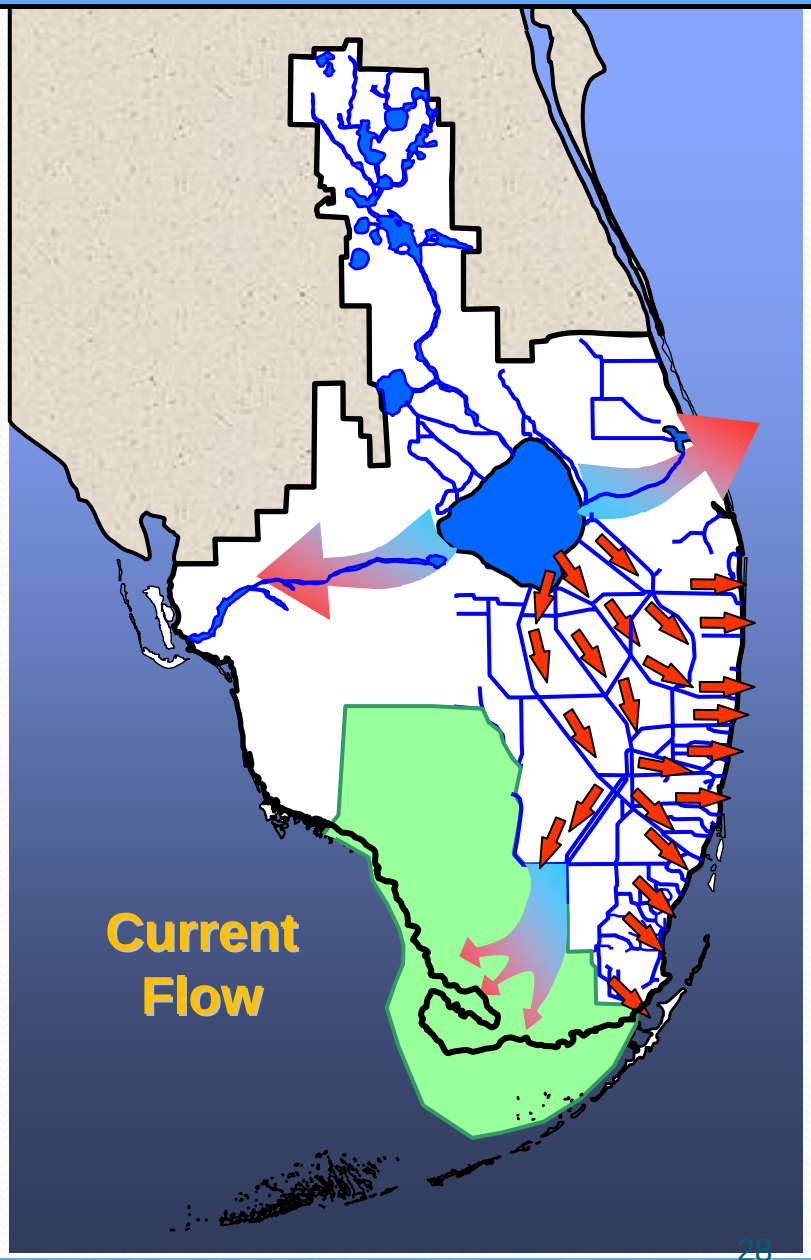
Assistant Deputy Executive Director,
Everglades Restoration Resource Area

Regional System Changes

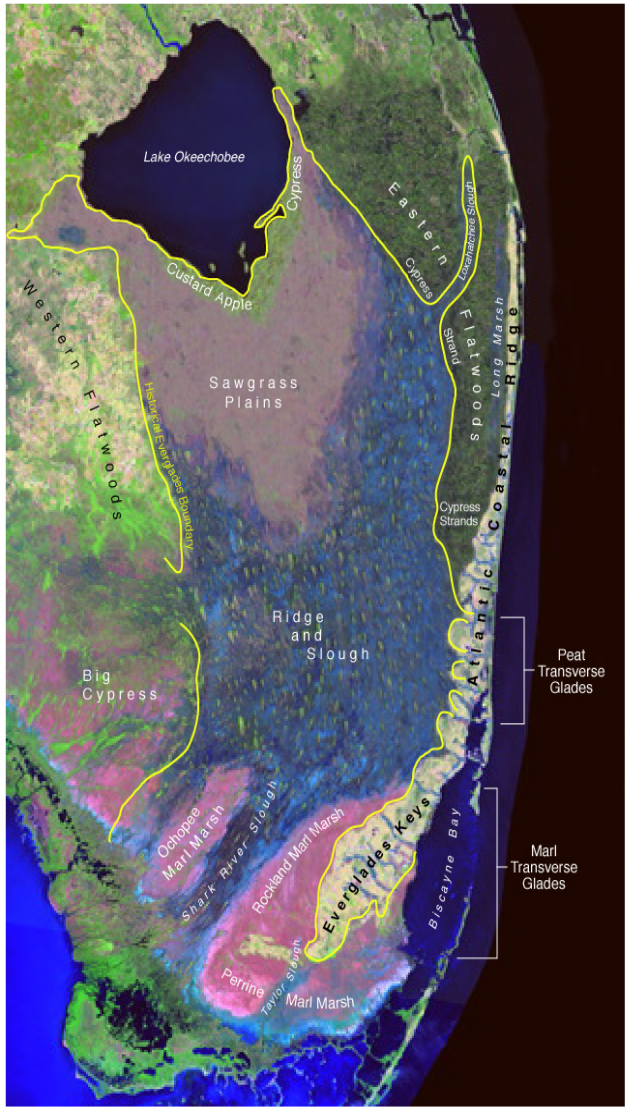
- Major changes in regional storage and conveyance over the past 100 years
- Changes in Kissimmee basin removed significant regional storage upstream of Lake Okeechobee
- Regional drainage improvements significantly reduced overall lake surface area and lowered storage depth
  - Estimated ~3 million acre feet of storage lost
- Construction of the protective levee system in the Everglades reduced overall natural area by one-half and constrained flow south from Lake Okeechobee

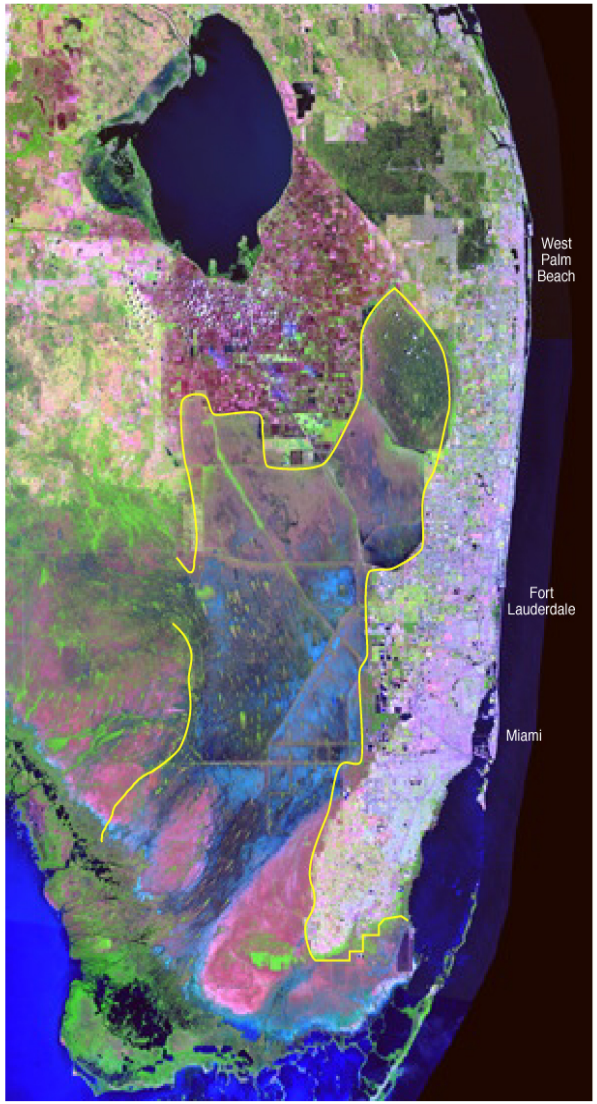
System Modifications





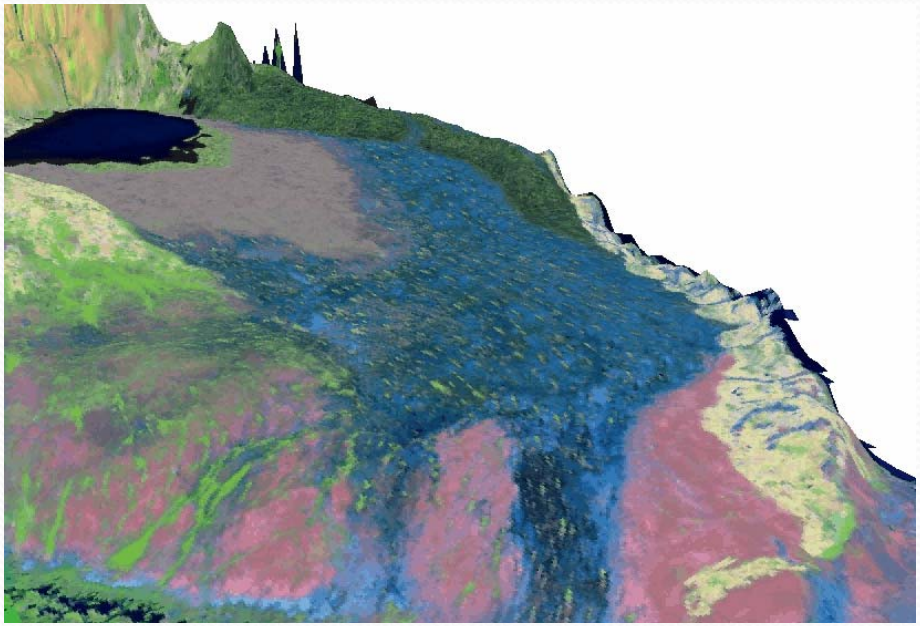
Regional System Changes



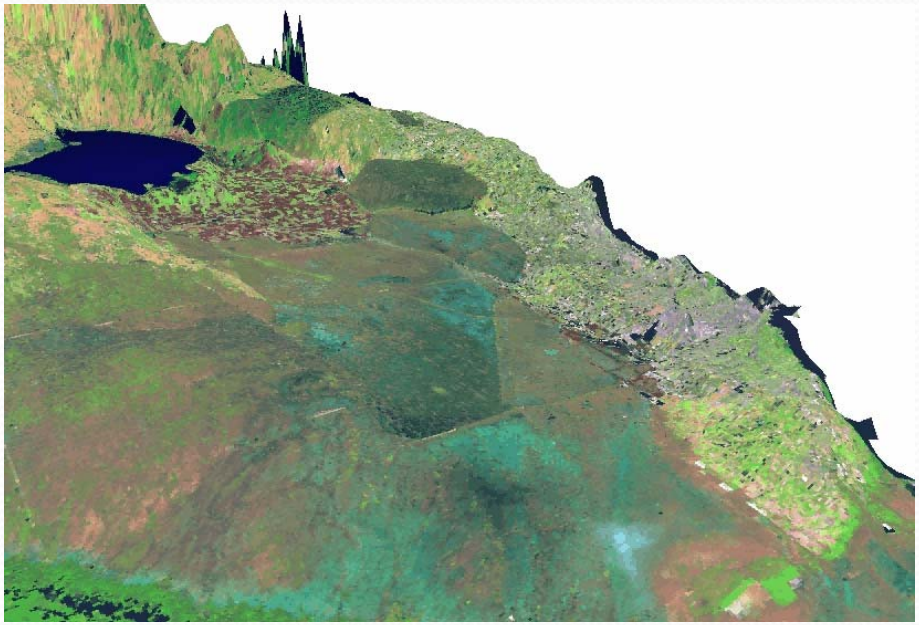


Over half the Everglades lost to urban and agricultural development

Changes in Topography

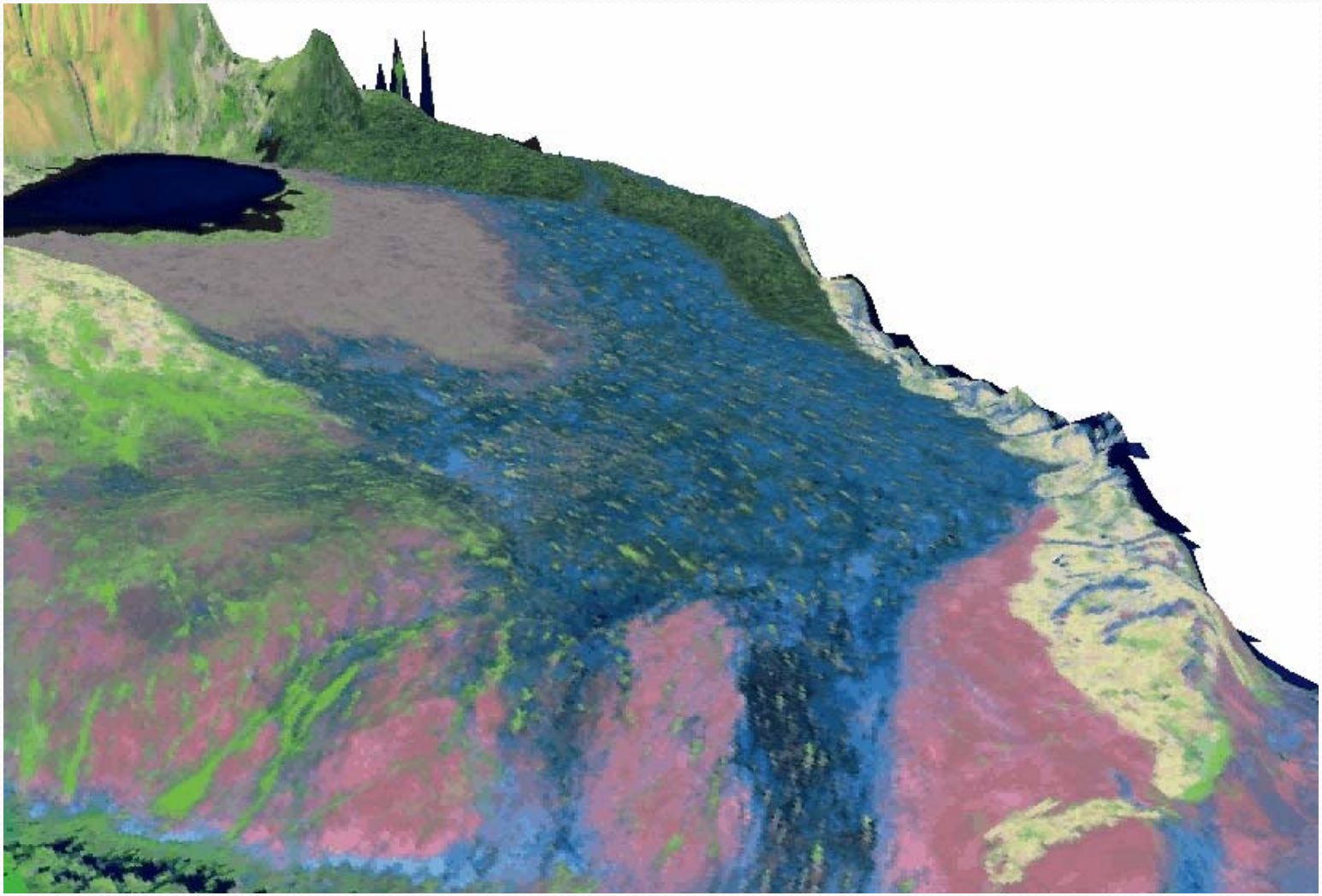


Pre-Drainage Topography

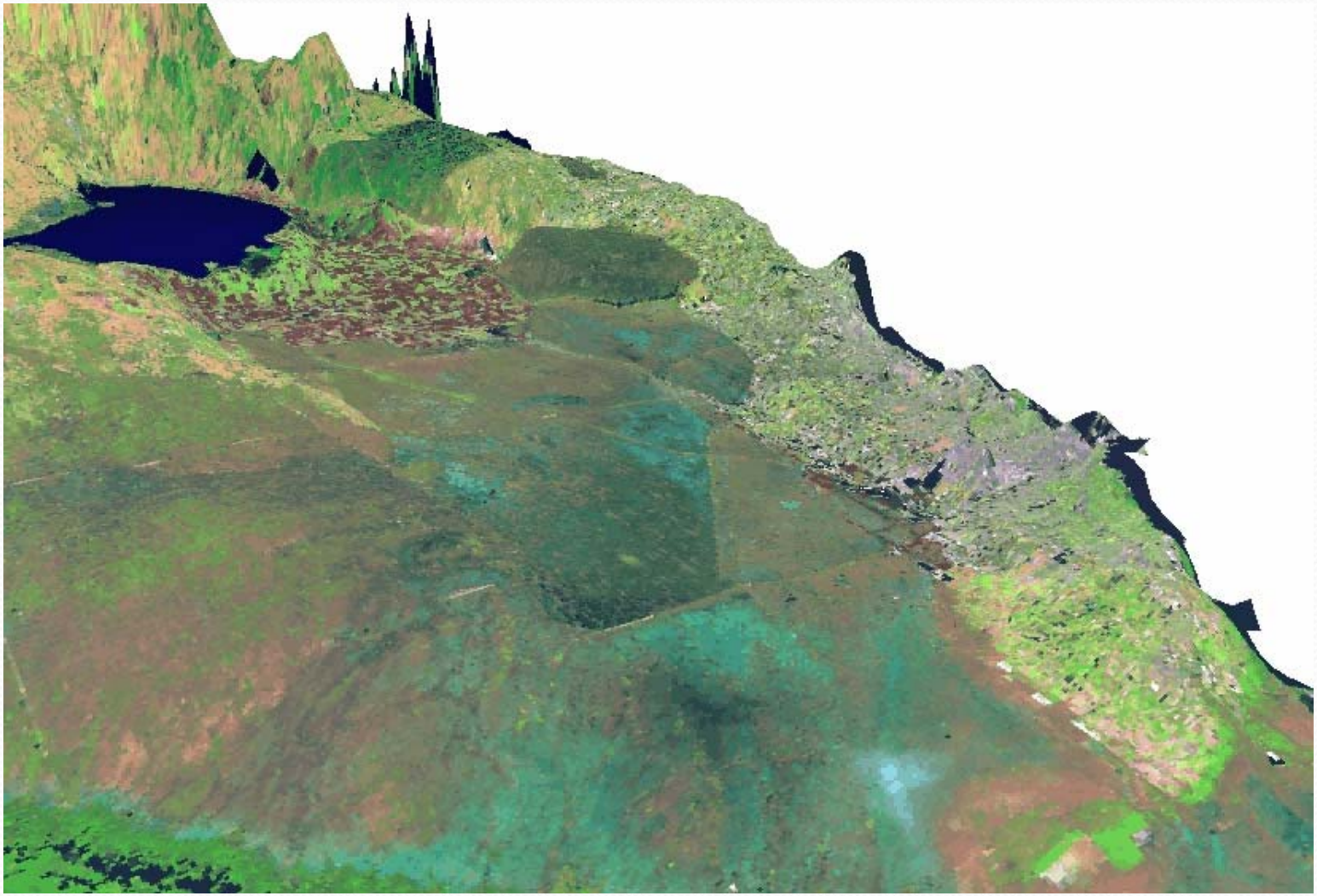


Post-Drainage Topography

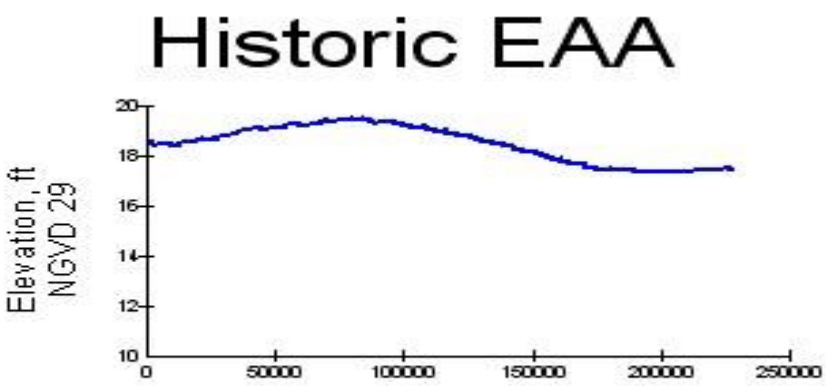
Pre-Drainage Topography

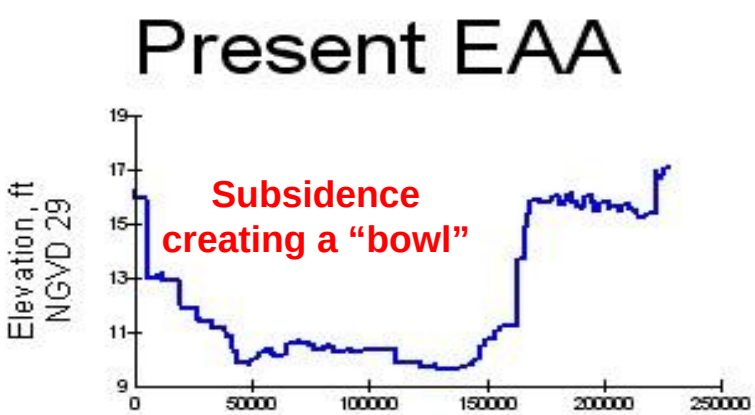


Post-Drainage Topography



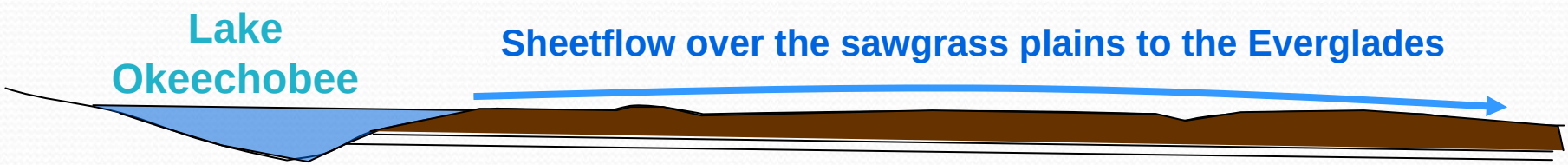
Profile Line through the Historic System and in the Current System



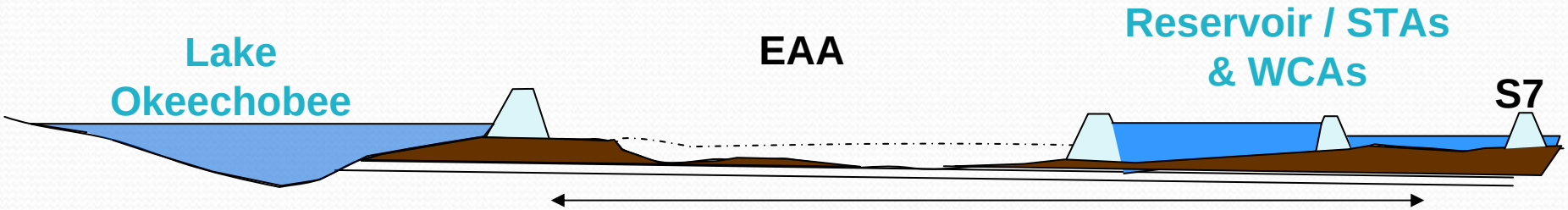


Soil Subsidence

HISTORICAL



PRESENT



Loss of muck in the EAA through subsidence, compaction, and oxidation

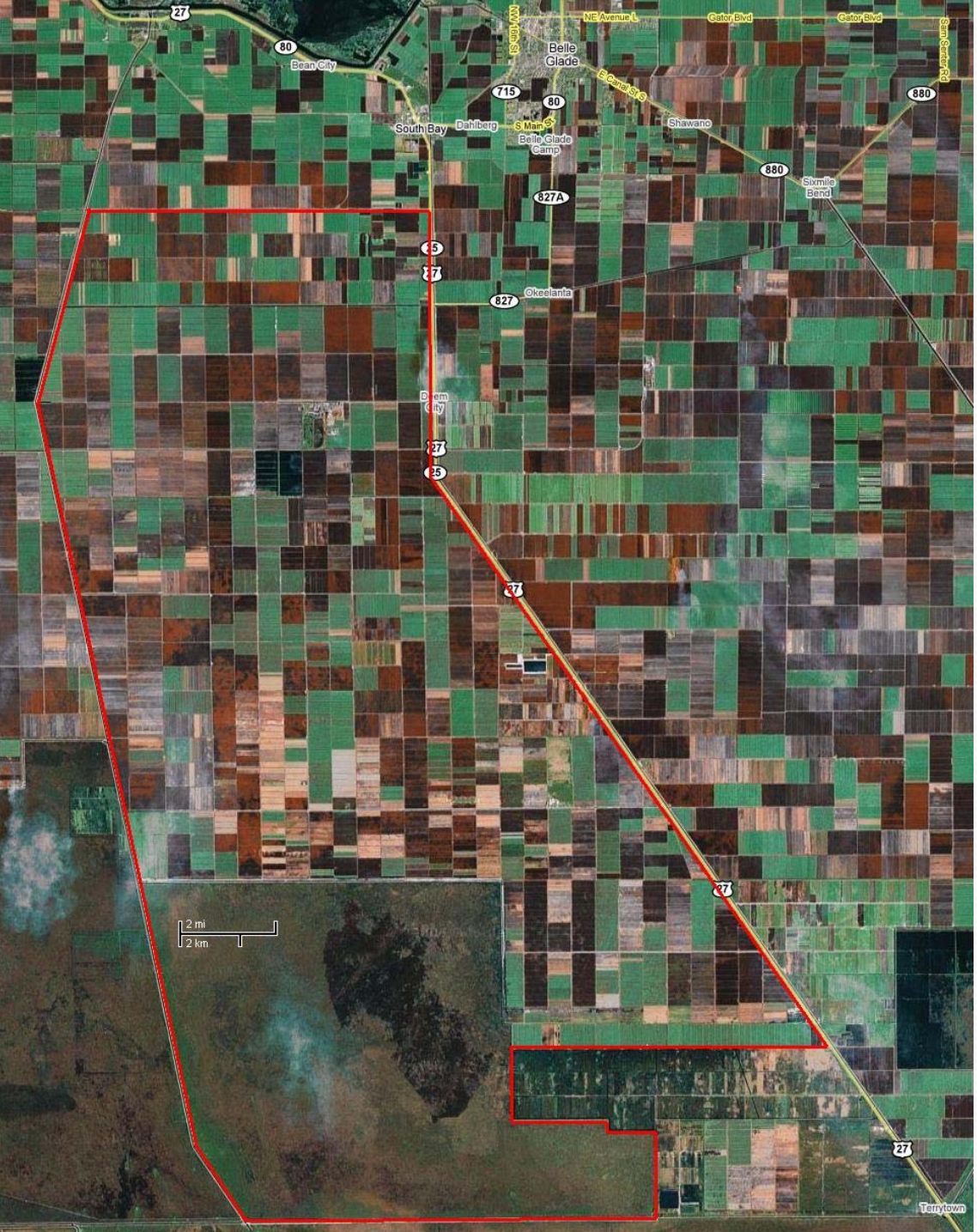
Water will not <u>naturally</u> flow from a shallow flowway to the WCA-3A.

Subsidence Effect on Flowway Concept

- Without significant land leveling or cell construction in 117,000+ acres of EAA land, the flowway:
  - would have significantly varying depths
  - will not have STA-like benefits due to constant wetting and drying of large areas
- Inflows and outflows will have to be pumped

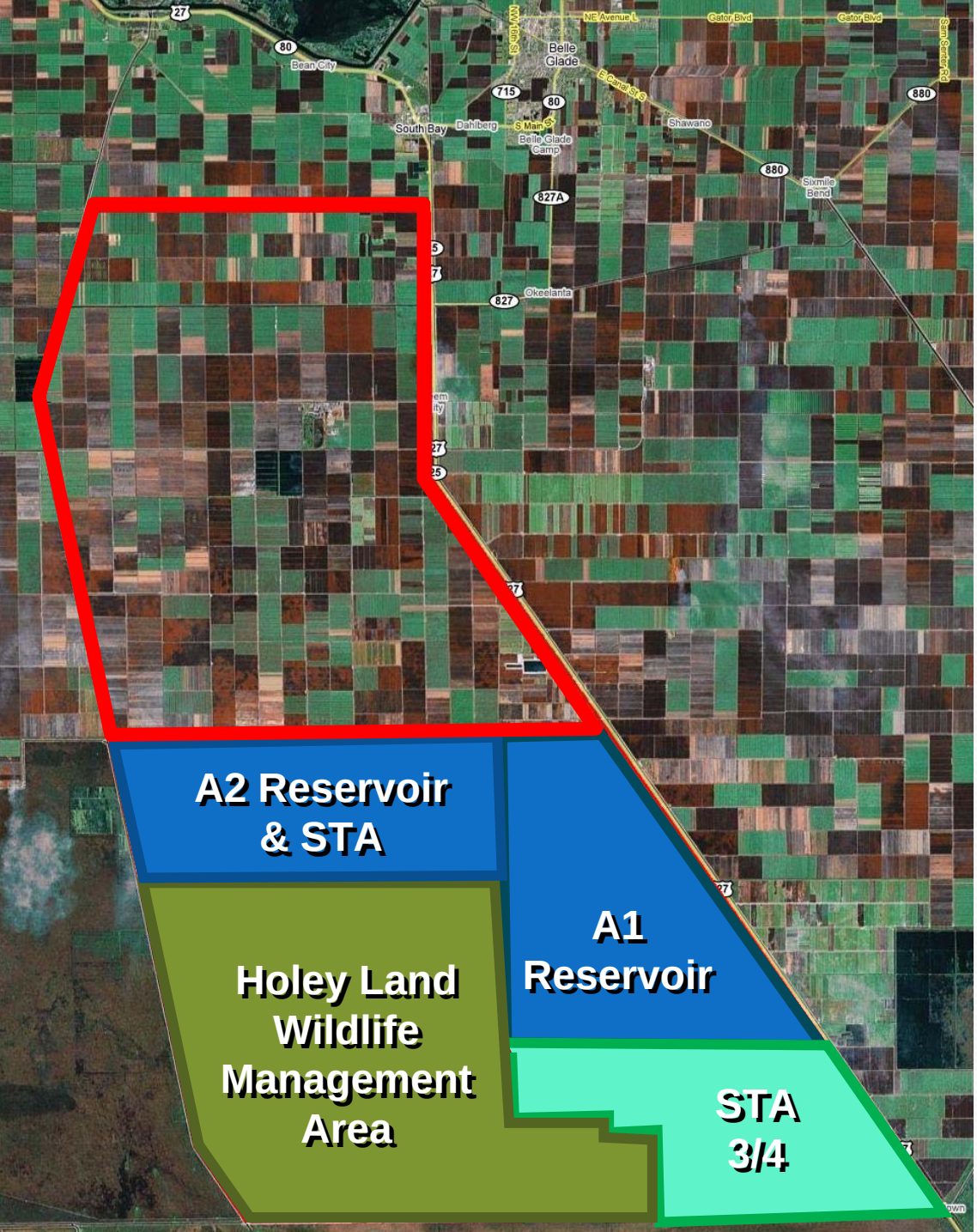
Increased Evapotranspiration Effect on Flowway Concept

- Greater water loss than EAA crops because water is held higher
  - flowway must be covered with water during dry times to maintain wetland vegetation for water quality treatment purposes
- Results in less water available for the WCAs, Everglades National Park, Estuaries, Lake Service Area, and Lower East Coast in dry times



Plan 6

EAA flowway
117,288 acres



Remaining opportunity for EAA flowway

60,000 acres

Existing Infrastructure

Processing/Distribution Plant

- Raw Sugar Mill
- Refinery
- Packaging
- Distribution
- Power Co-Gen

Infrastructure Issues

- Land acquisition
- Business value
- Purchase of processing & distribution plant
- Construction of new bridges
- Relocation of railroad facilities
- Removal of all interior agricultural levees
- Construction of new perimeter embankments (Safety Stds)
- Greater seepage management costs (O&M pumping)
- Modifications to existing & future restoration projects
- Modifications to existing & future water quality projects required to comply with federal court settlement

- **Land and infrastructure requirements for a flowway result in a multi-billion dollar water resource project**

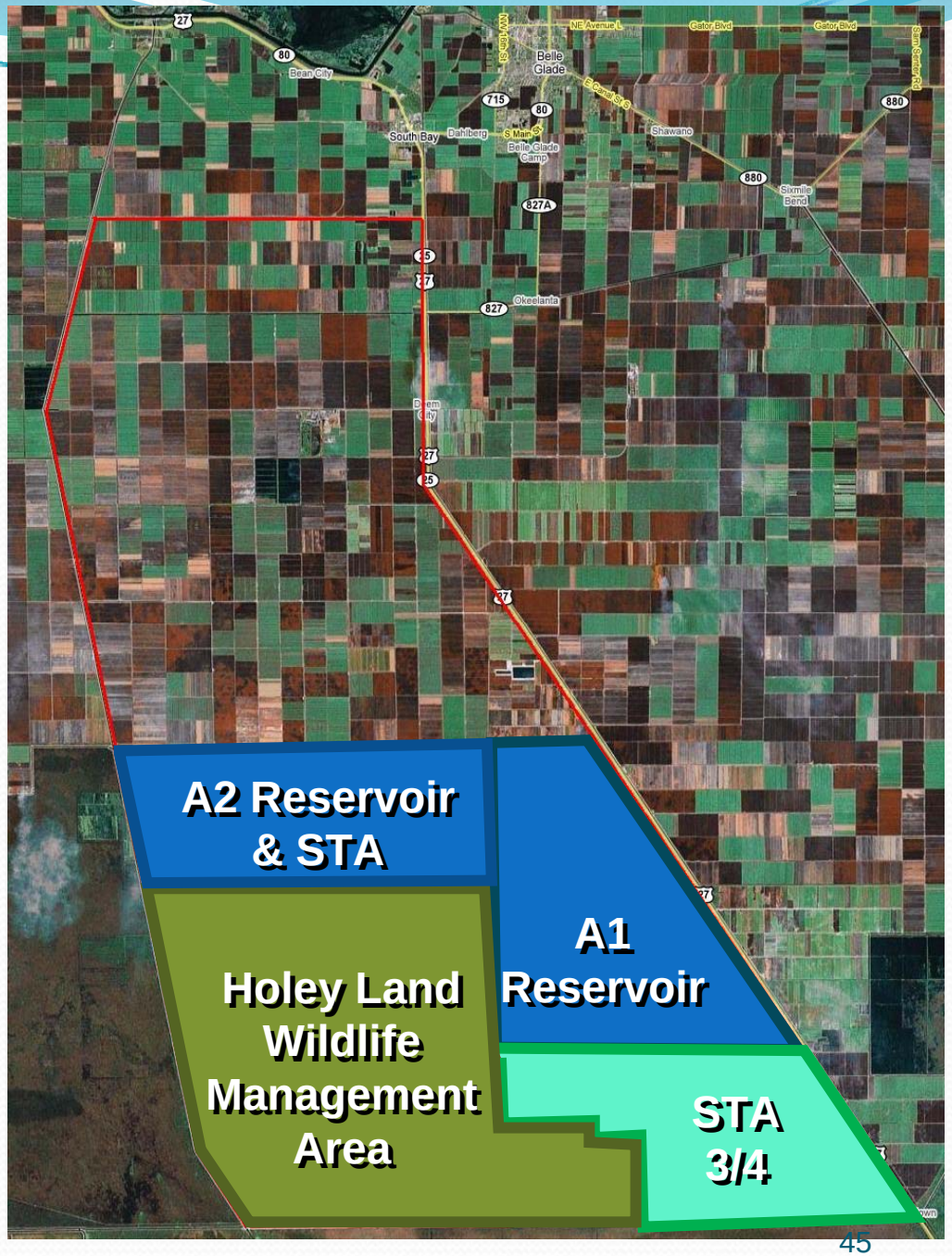
Current Restoration Plan

- CERP proposes Surface Storage Reservoirs, improved canal conveyance and Stormwater Treatment Areas to meet Everglades water needs
  - A1 Reservoir – 17,000 acres, 12 feet deep (190,000 ac-ft)
  - A2 Reservoir – 14,000 acres, 12 feet deep (170,000 ac-ft)

    TOTAL 31,000 acres, 12 feet deep (360,000 ac-ft)
  - STA 3 / 4 (Existing) - 16,500 acres
  - New A2 STA – 7,000 acres to 17,500 acres
- A1 Reservoir will meet most Everglades' water needs considering MODWATERS flow improvements
- A2 / A1 Reservoirs will meet most of the Everglades' water needs considering WCA-3A Decompartmentalization

Current Restoration Plan

- The proposed plan of deep reservoirs associated with Stormwater Treatment Areas is more cost effective than Flowway alternatives
- Shallow STA-like facilities are about 2 times the cost of a deep water reservoir of the same volume.



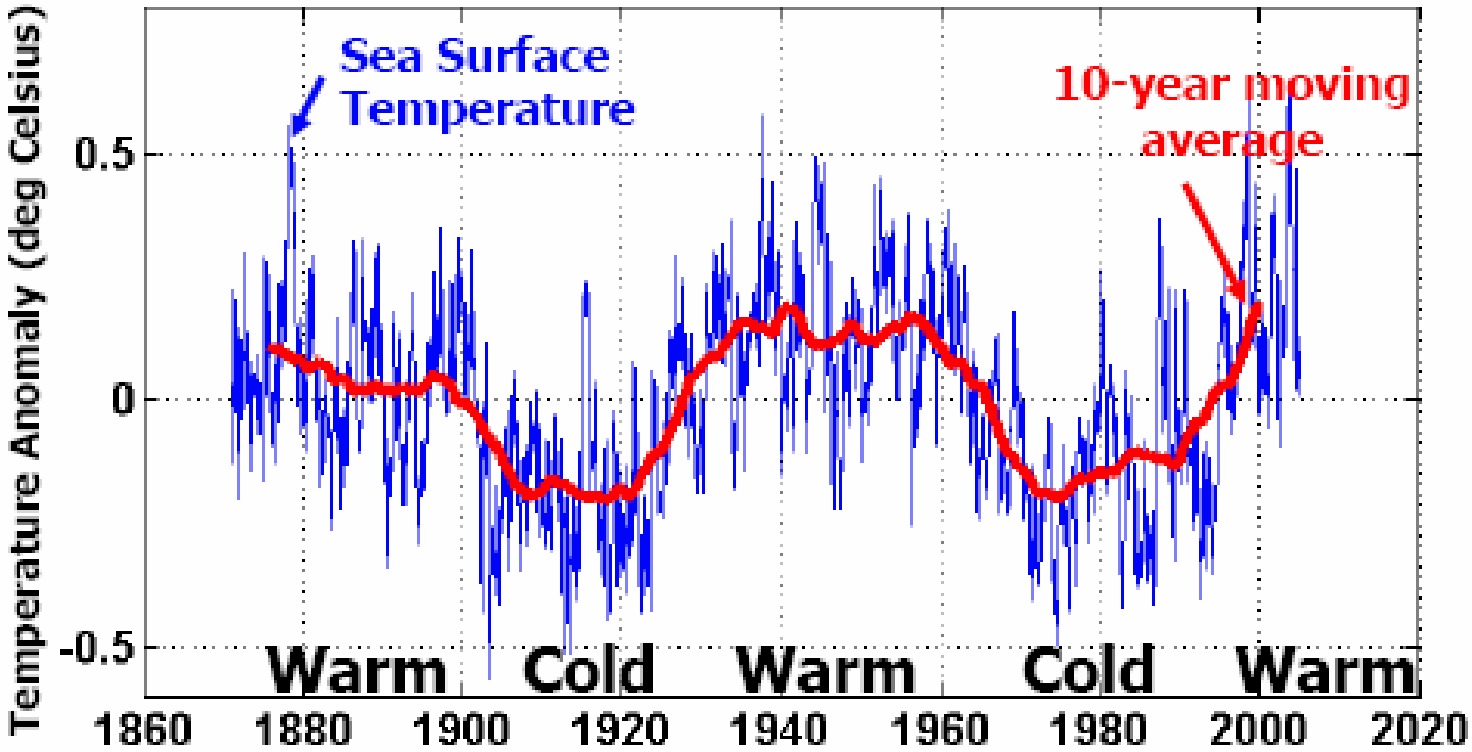
Aquifer Storage & Recovery

- Several ASR pilot projects are currently under construction
  - C-43 ASR Pilot
    - Initial results indicate this area is not suitable for ASR
  - Lake Okeechobee ASR Pilot
    - Looking at ‘groups’ of ASR wells
  - Hillsboro ASR Pilot
- ASR Regional Study
  - Interim Report, Fall 2007
- ASR Contingency Plan due in December 2007
- These efforts will help assess the efficiency of ASR in CERP

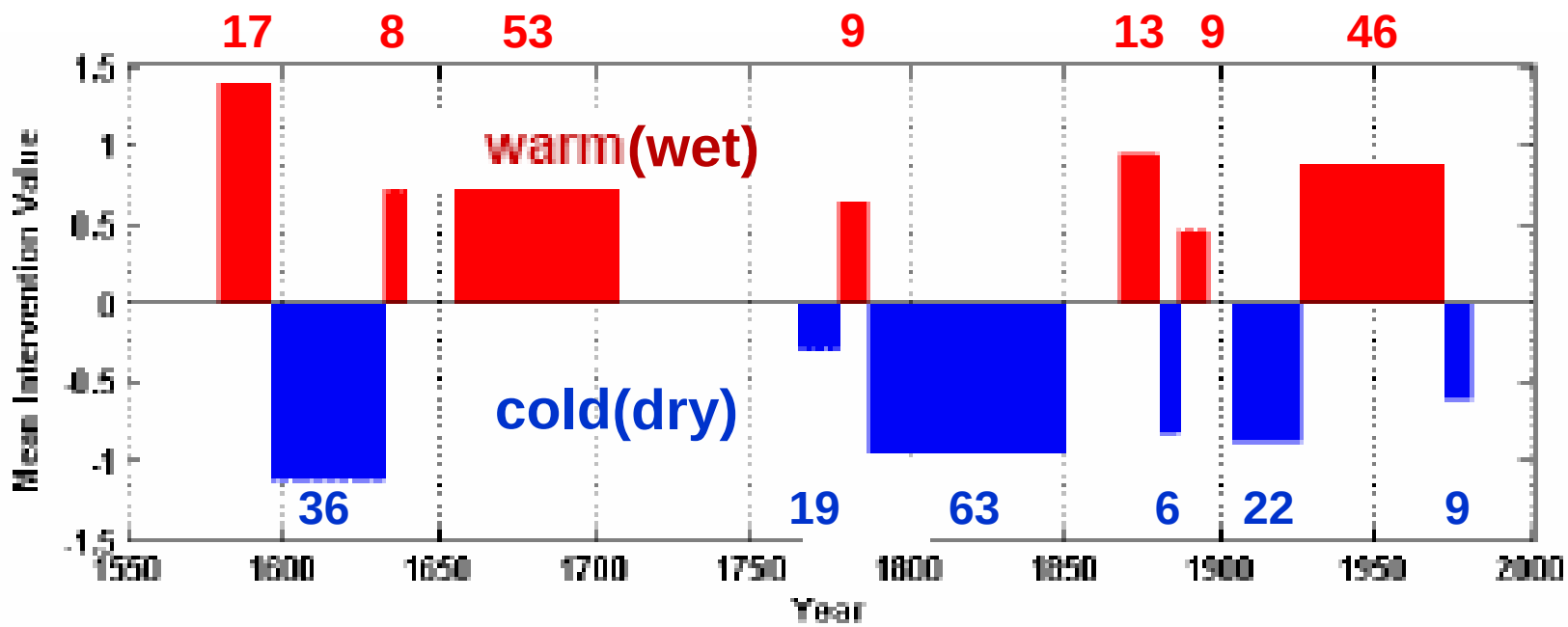
Climatology

- Atlantic Multi-decadal Oscillation
  - Temporal Variability
  - Other Climate Factors
  - Water Resource Engineering Design

AMO Short Term View



AMO Long Term View



Durations of significant warm (red) and cool periods. Reconstructed values of North Atlantic Sea Surface Temperature (SST) anomalies using tree-ring technology

Other Climate Cycles & Events

- Atlantic Multi-decadal Oscillation
- Pacific Multi-decadal Oscillation
- El Nino / La Nina (Pacific Ocean)
- Solar Activity (Sunspots)
- Volcanic Activity
- Global Warming?

- All of these have some effect on rainfall in Florida
- Interactions of these events make long range forecasts extremely uncertain

Climate Based Design

- Extreme uncertainty with climate based rainfall projections
  - The best climate / rainfall correlations (El Nino / La Nina) have often proven poor predictors of regional rainfall
    - 2006 / 2007 El Nino Event
      - Wetter than normal dry season projected
    - 2006 / 2007 Record Drought
- Expanding CERP water resource facilities based on the uncertain effects of the AMO risks billions of taxpayer dollars
  - By the time these large facilities are constructed, the current AMO cycle could shift back to the dry phase

Summary

- The regional drainage improvements reduced the storage in Lake Okeechobee by approximately 3 million acre feet (Equivalent Lake Depth : ~6 ft.)
  - There has been no significant reduction in inflow compared to the natural system condition
- The remaining Everglades is only ½ of its original size and cannot tolerate more water in wet periods
  - During wet periods, when the Lake is most likely to require discharges to manage high stages, water levels in the Water Conservation Areas are typically too deep to accept the additional inflow without environmental damage
  - Climate indications of wetter future conditions will only exacerbate this problem

Summary

- During dry to normal periods, excess water from Lake Okeechobee would often not be available to maintain the wetland plant communities necessary to meet the environmental or water quality objectives of a flowway
  - May export nutrients upon re-wetting
- Ecosystem constraints in the Everglades may preclude sending flood discharges from Lake Okeechobee south
  - Cape Sable Seaside Sparrow
  - Snail Kites
  - Tree Islands

Summary

- Based on extensive experience in the construction of Stormwater Treatment Areas and Reservoirs in the EAA, it is evident that a flowway would be an extremely expensive, multi-billion dollar project
  - Extensive perimeter impoundment
  - Large pumping stations
  - Land terracing or cell construction
  - Considerations for existing infrastructure
    - Removal of roads, railroads, ditches, etc.
    - Removal of processing, packing, distribution and power facilities
    - Site remediation
  - Land and business acquisition

Summary

- Every agency study has recommended that storage, conveyance and treatment are needed to restore the regional ecosystem
- No agency study has recommended the EAA flowway as a component of CERP
- Given the flow limitations south combined with the limited storage capability in a shallow flowway, the actual benefits to Lake Okeechobee and the estuaries are uncertain
  - The potential for impacts to the Everglades is significant

Solutions

- The problems associated with Lake Okeechobee and the estuaries are best addressed upstream of the Lake, at the source
- *The Northern Everglades and Estuaries Protection Program* , established by the Florida Legislature, affords the best opportunity to accomplish this
- *The Northern Everglades and Estuaries Protection Program* is planned to complement the ongoing state and federal activities including CERP, Acceler8, and the Everglades Construction Project that are working to address storage, treatment, and conveyance solutions north of the Lake, the St. Lucie and Caloosahatchee Rivers, and the Everglades.

Recommendation

- Dedicate resources to development and implementation of the of the Northern Everglades and Estuaries Protection Program and the ongoing Everglades restoration efforts including the Everglades Construction Project and CERP
- Commitment of additional resources to further investigate a southern flowway are not warranted at this point in time
- Cost effective opportunities for additional storage, treatment and conveyance will continue to be evaluated in the implementation of the Everglades restoration components

Questions