

Overview of Water Supply Mission: Part II

November 10, 2011
Governing Board Meeting



Water Supply Mission: Legal Framework

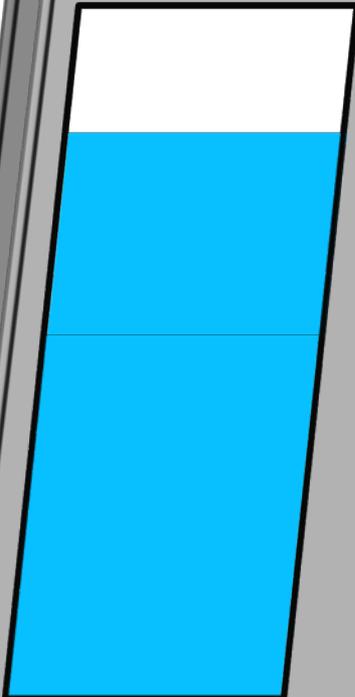
*Beth Ross, Senior Specialist Attorney
Office of Counsel*

Water Supply Mission Presentations

- **Presentation Series**
 - Complex: state and federal programs and Project operations
 - Upcoming decision areas: shortage, Corps input, regulatory, plans
- **October - Legal framework of supply mission and certainty**
- **November - Operation of C & SF Project (Lake Okeechobee)**
 - Legal framework - Beth Ross
 - Historic perspective – Tommy Strowd
 - Lake Okeechobee regulation schedule – Cal Neidrauer
 - Adaptive Protocols - Susan Gray
- **December - District's program re: withdrawals**

WATER SUPPLY CONTROL PANEL

SUPPLY



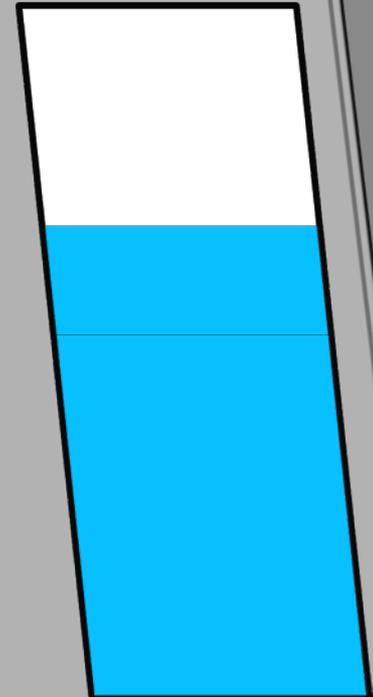
RAINFALL



EVAPO-
TRANSPIRATION



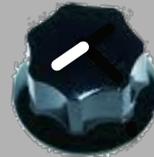
FREQUENCY



ALTERNATIVE
SUPPLY



STORAGE



OPERATIONS



WITHDRAWALS



Legal Framework for C & SF Flood Control Project - **Florida Statutes**

- **Florida Statutes authorize the District to:**
 - Act as “local sponsor” of the C & SF Project
 - Control the level of waters in all canals, lakes, ... owned, maintained or controlled by the District
 - Allocate water for use and provide for environment
 - Federal “Savings Clauses”
 - “...it is the policy of the congress to recognize the interests and rights of the States in determining the development of the watersheds within their borders and ... rights in water utilization and control,”



Legal Framework for C & SF Flood Control Project - **U.S. Congress**

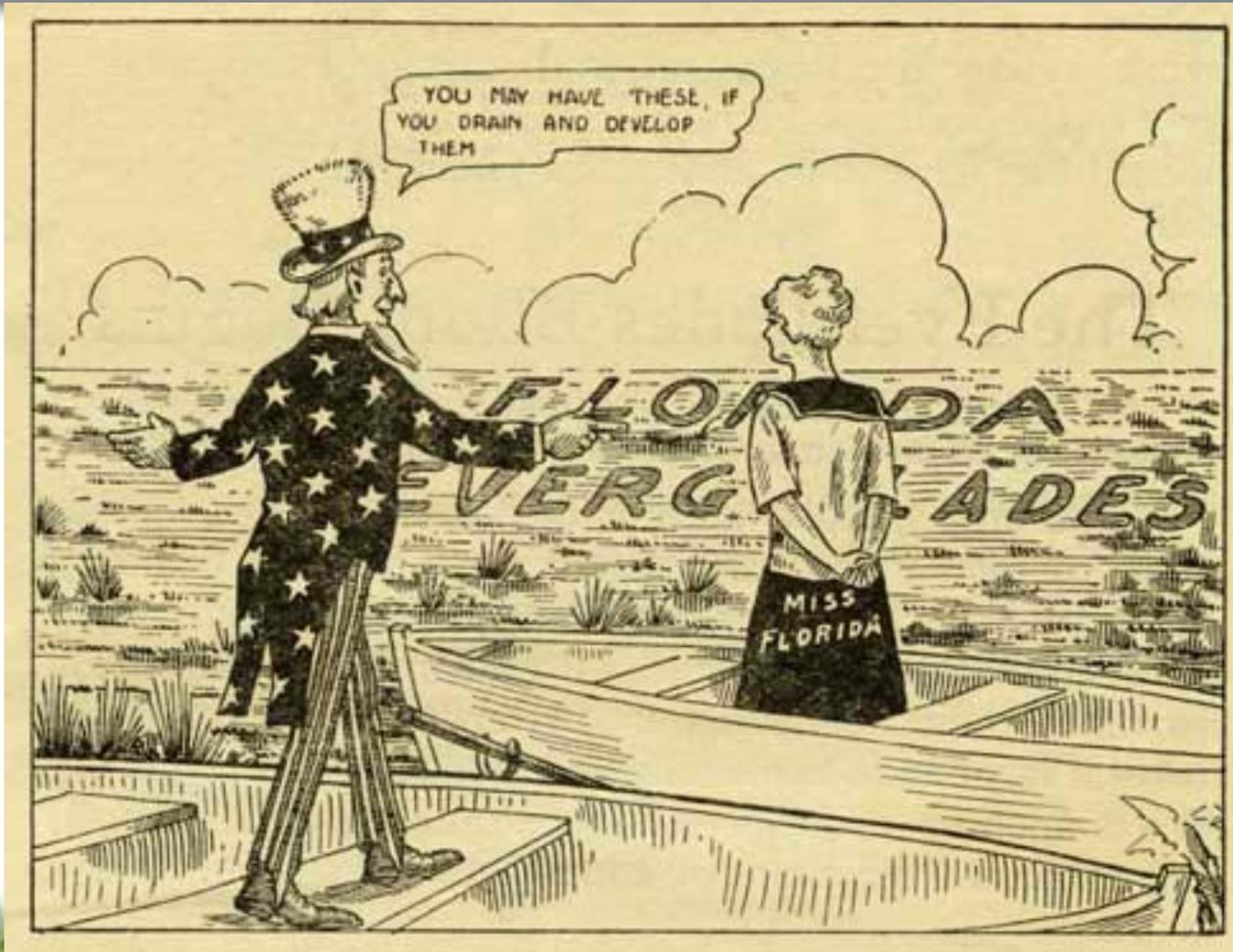
- **Local Sponsor Constraints:**
 - Agree to: "...maintain and operate all works ... in accordance with regulations prescribed by the Secretary of the Army...." (33 U.S.C. s. 701c)
- **Corps develops regulation schedules**
 - National Environmental Policy Act (NEPA)
 - U.S. Fish and Wildlife Service Coordination Act
 - Federal Administrative Procedures Act
- **Other federal laws influence operations, e.g.:**
 - Clean Water Act
 - Endangered Species Act



A Brief History of the Central & Southern Florida Project

*Tommy B. Strowd, P.E.,
Director, Operations Maintenance & Construction Division*

Reclamation! - The Swamp Act of 1850



 NEW CHANNEL CONSTRUCTION

 CHANNEL IMPROVEMENT

FIRST LARGE SCALE DRAINAGE EFFORT IN SOUTH FLORIDA



**HAMILTON DISSTON
CONSTRUCTION
1881 – 1894**

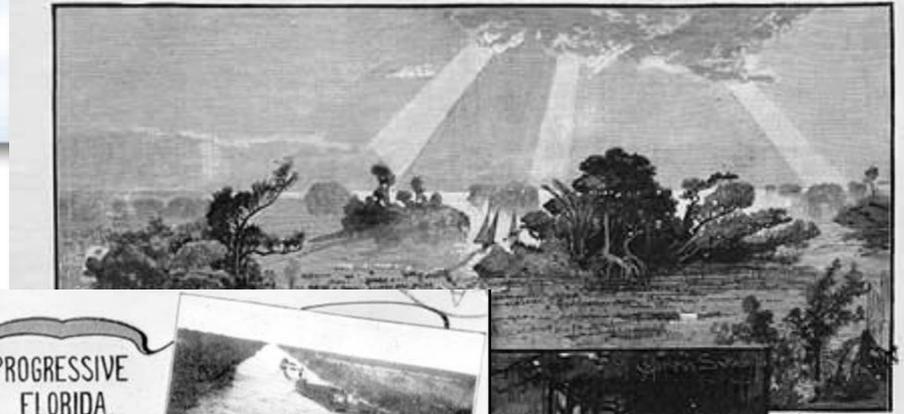
Reclamation...

ALL THERE IS

The ONLY American Tropics

POINCIANA
The coming Miami on the Gulf

142 East Flagler Street, Miami, Florida



PROGRESSIVE FLORIDA.

RECLAIMING THE

GREAT EVERGLADES

CALOOSAHATCHEE RIVER DISTRICT, NEAR FORT MYERS, FLA.

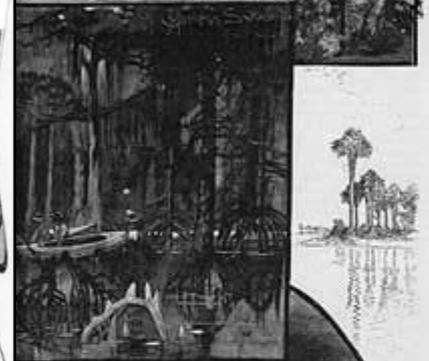
DEEPER, DEEPENING CANAL

STEAM BOAT ENTERING CANAL FROM CANAL

SOIL DRAINER CANAL DEPLETED

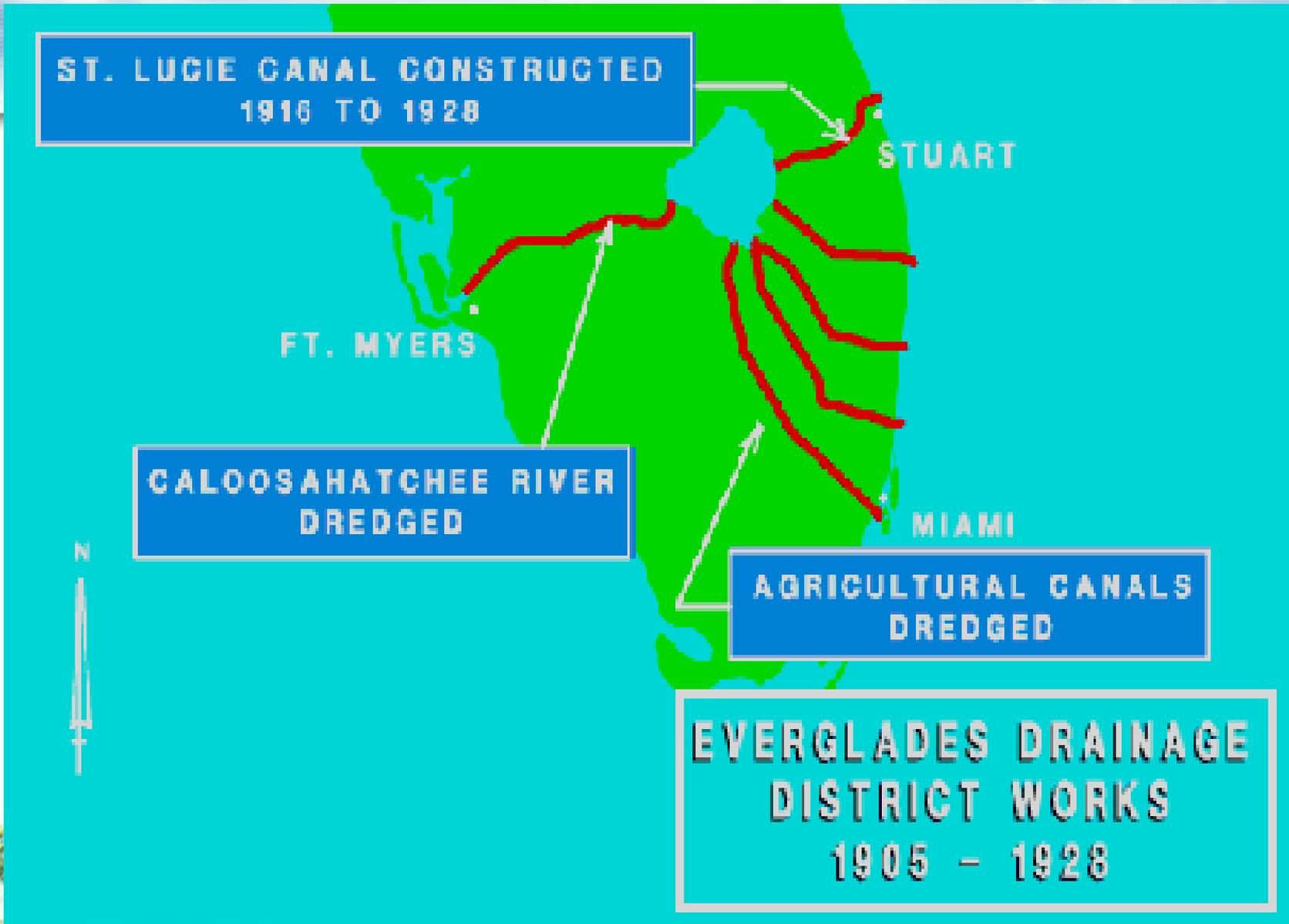
TRUCKS SUPPLIED BY CANAL

DRAINED SOIL READY FOR PLANTING



LANDS NOW BEING RECLAIMED
RICHEST SOIL IN THE WORLD.
DEEP MUCK, BIG CROPS, YEAR AROUND SEASON
BUY NOW AT GROUND FLOOR PRICES.
REALTY SECURITIES CORPORATION, Miami.





ST. LUCIE CANAL CONSTRUCTED
1916 TO 1928

STUART

FT. MYERS

CALOOSAATCHEE RIVER
DREDGED

MIAMI

AGRICULTURAL CANALS
DREDGED

EVERGLADES DRAINAGE
DISTRICT WORKS
1905 - 1928





Early dredging of the Okeechobee Drainage System



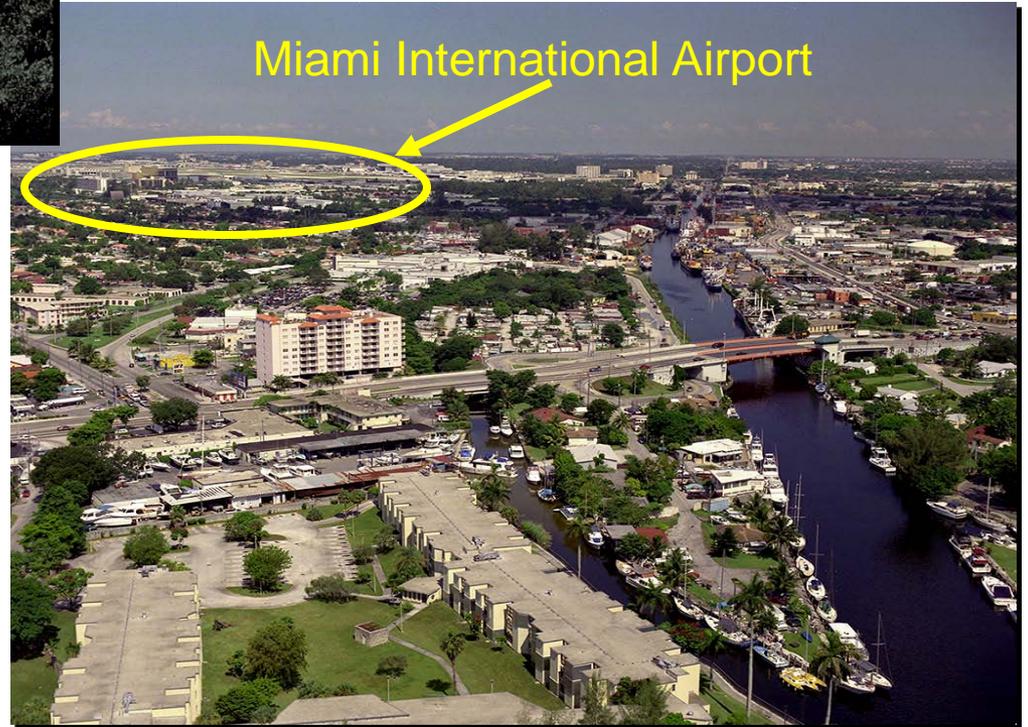


RAPIDS AT HEAD OF MIAMI RIVER BEFORE DRAINAGE
OPERATIONS COMMENCED.



Miami River and Miami Canal in 1912

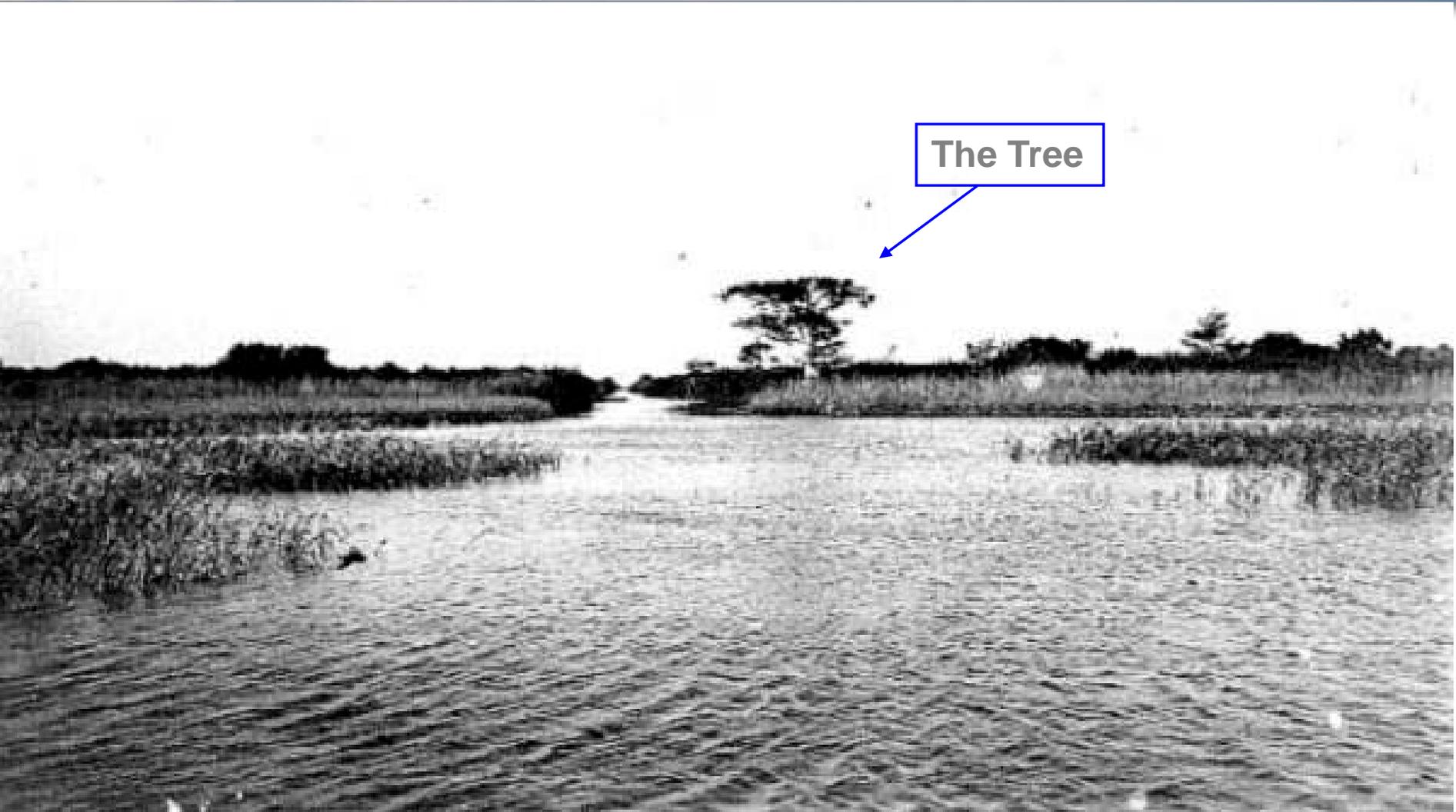
Miami International Airport



Contemporary photo of the same area



Lake Okeechobee Entrance to 3-mile Canal ~ 1908 Excavated by Hamilton Disston in 1882



The Tree

West Coast Interests promote development in 1912



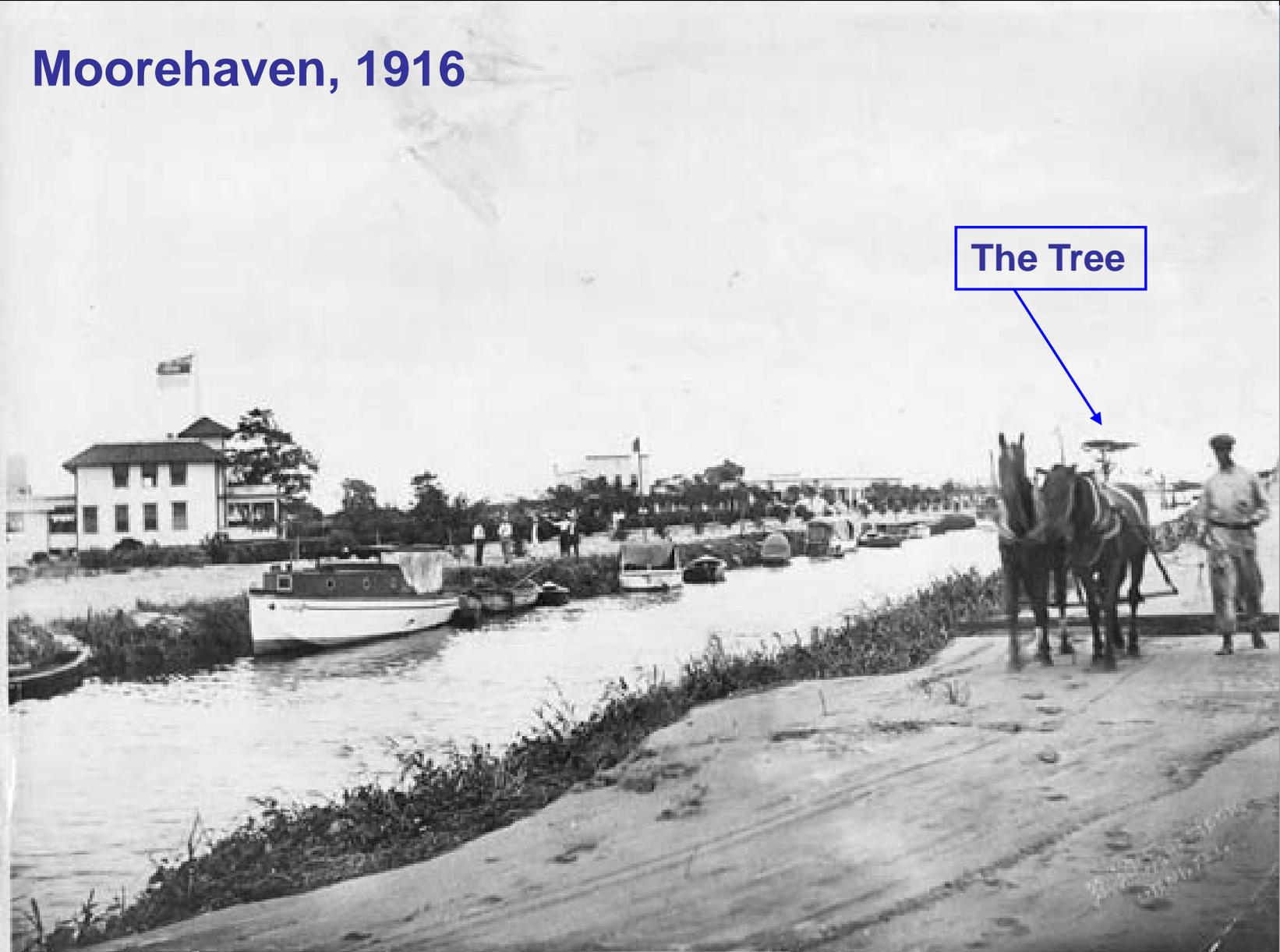
View from 3-Mile Canal in 1913



The Tree

3 mile Canal
Lake Okechobee
1913

Moorehaven, 1916



The Tree

Moorehaven, Today

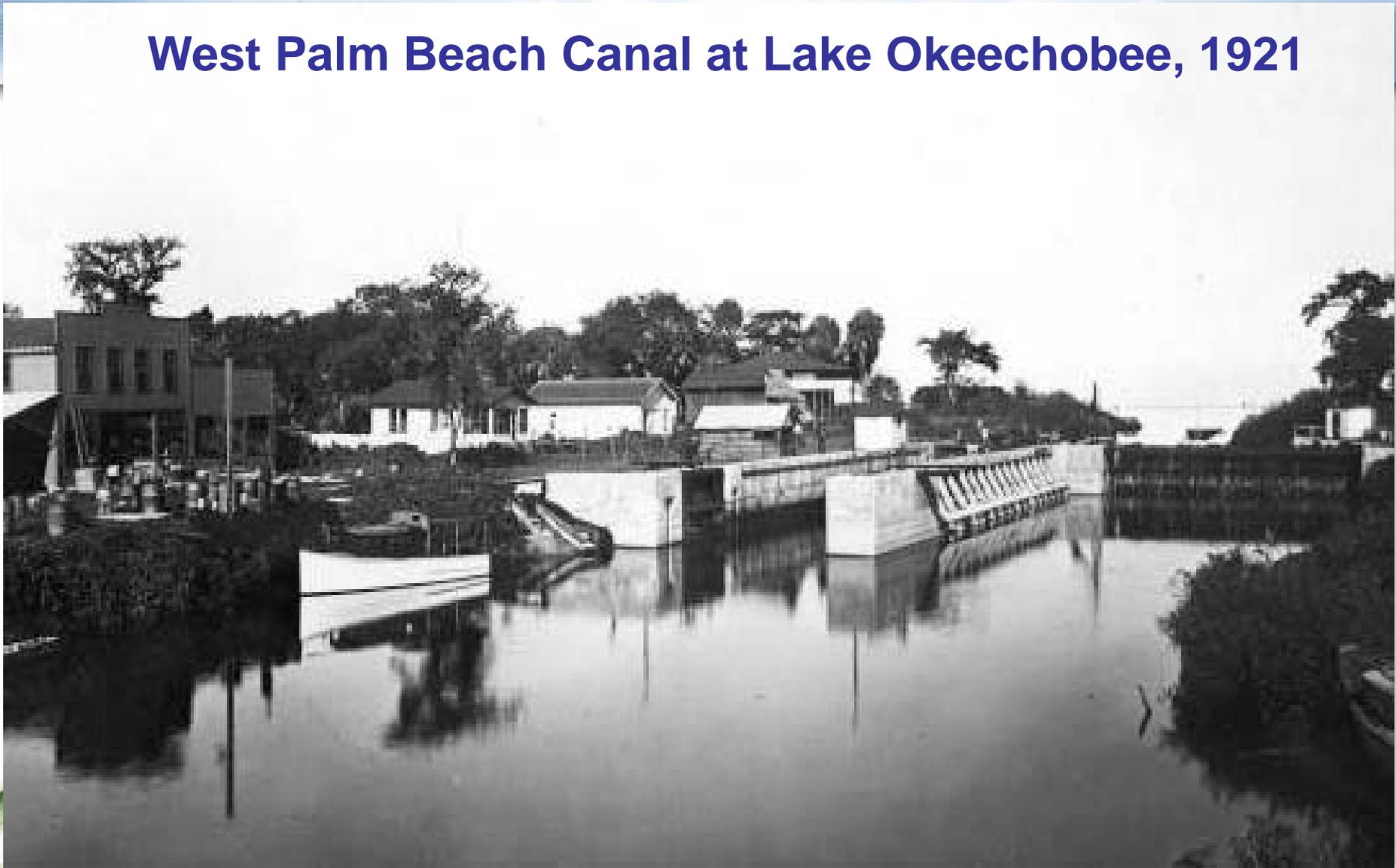
The Tree



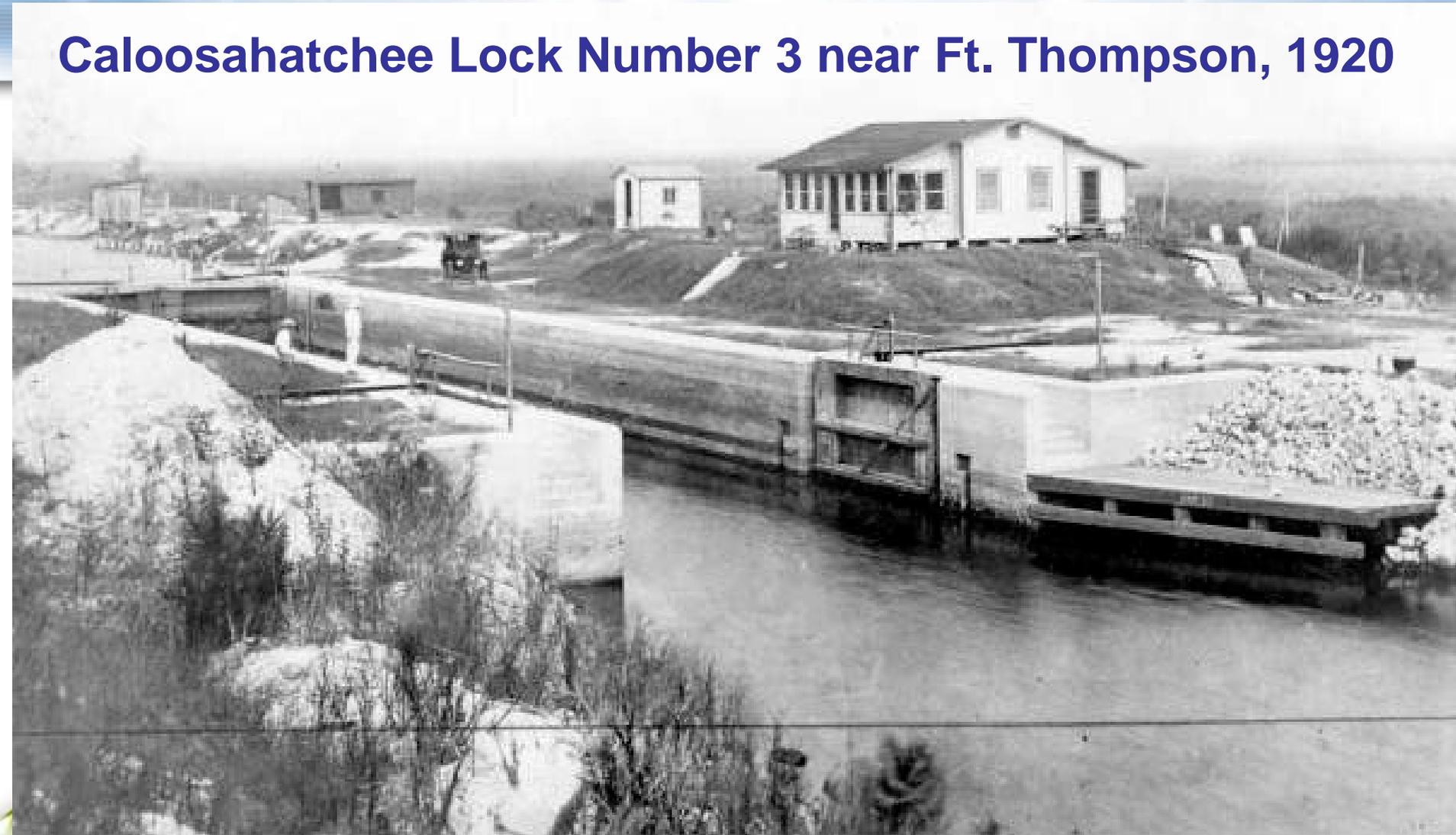
West Palm Beach Canal at Lake Okeechobee, 1917

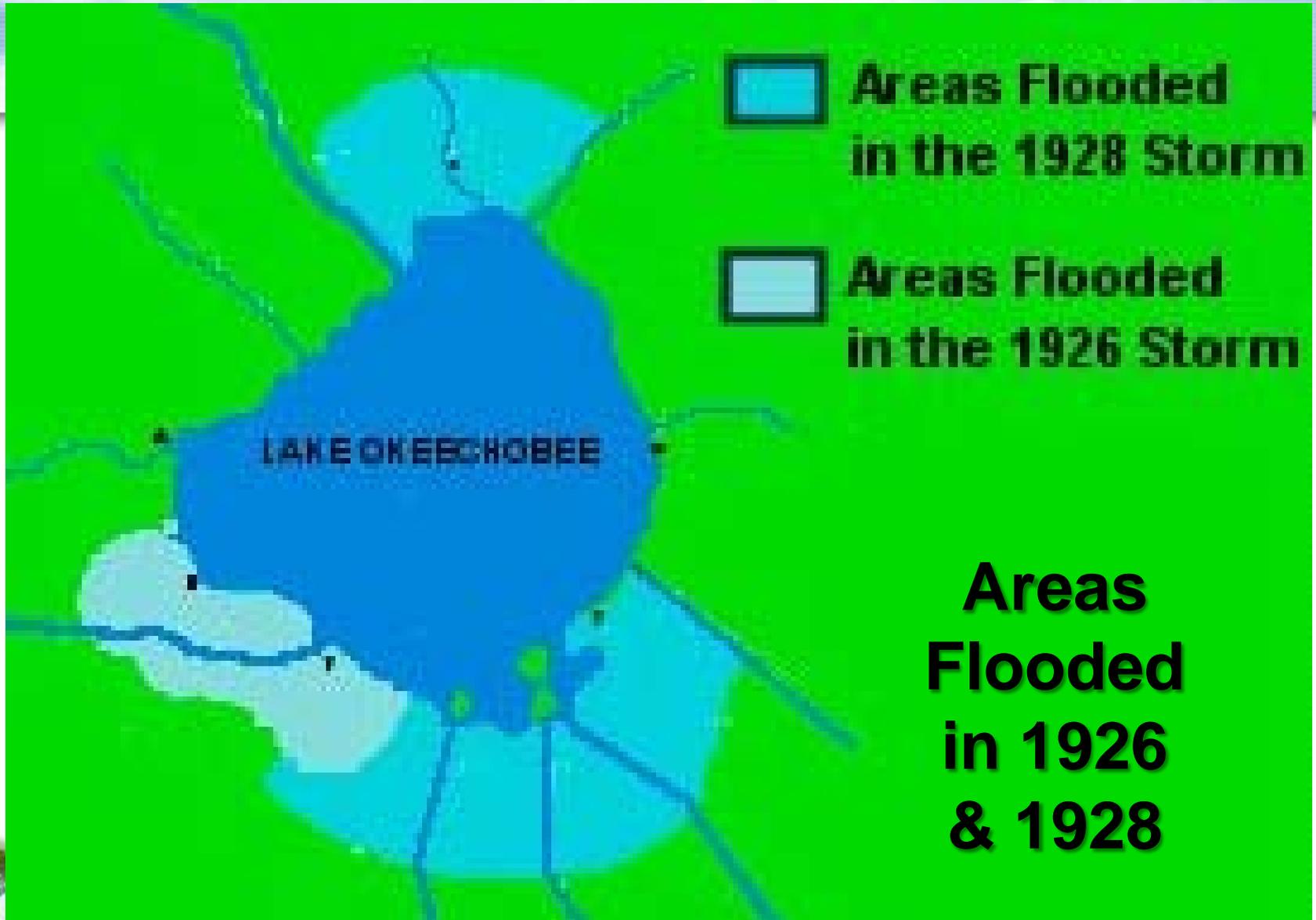


West Palm Beach Canal at Lake Okeechobee, 1921



Caloosahatchee Lock Number 3 near Ft. Thompson, 1920





Caloosahatchee Lock Number 3 near Ft. Thompson, 1926





One of Moore Haven's Few Standing Homes.



After the 1926 Hurricane in Moore Haven



Governor John W. Martin (in white shirt) Entering Moore Haven on Inspection Trip After Disaster.



Hurricane Damage in Belle Glade, 1928



Hurricane Damage in Okeechobee, 1928



**Loaded Bodies to be Hauled to
West Palm Beach for Mass Burial**



Rivers & Harbors Act of 1930

- **First Federal effort at flood control in Florida**
 - **Authorized projects**
 - Miami River
 - Caloosahatchee River / Lake Okeechobee Drainage Areas
 - **U.S. Army Chief of Engineers recommended that a project for the combined purposes of navigation and flood control be constructed**
 - Herbert Hoover Dike on the southern rim of Lake Okeechobee
 - Caloosahatchee channel dimensions: 6 ft. Deep and at least 80 ft. wide



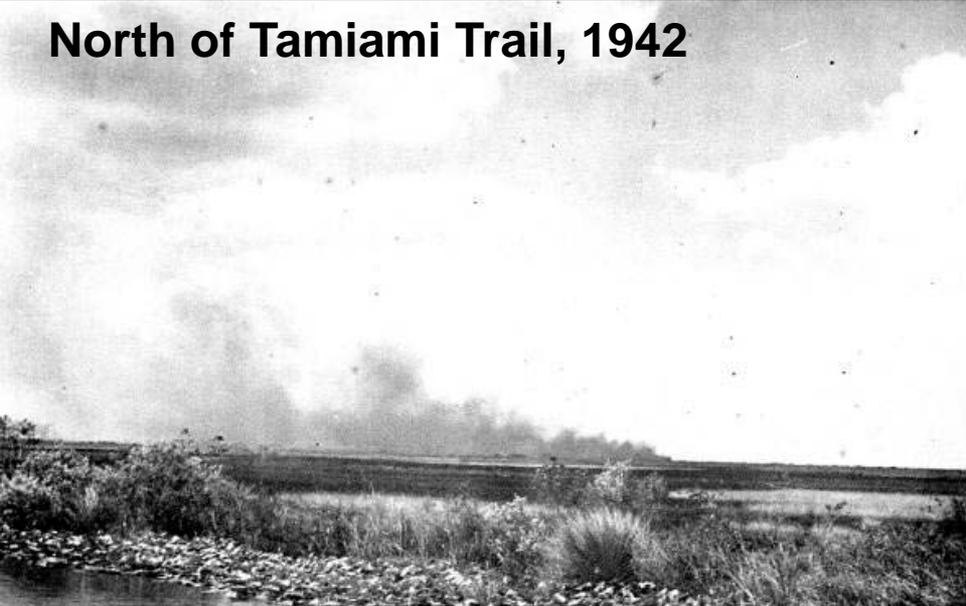
Herbert Hoover Dike Construction, 1932



Herbert Hoover Dike Construction, 1932



North of Tamiami Trail, 1942



Everglades Fires in the Early 1940s

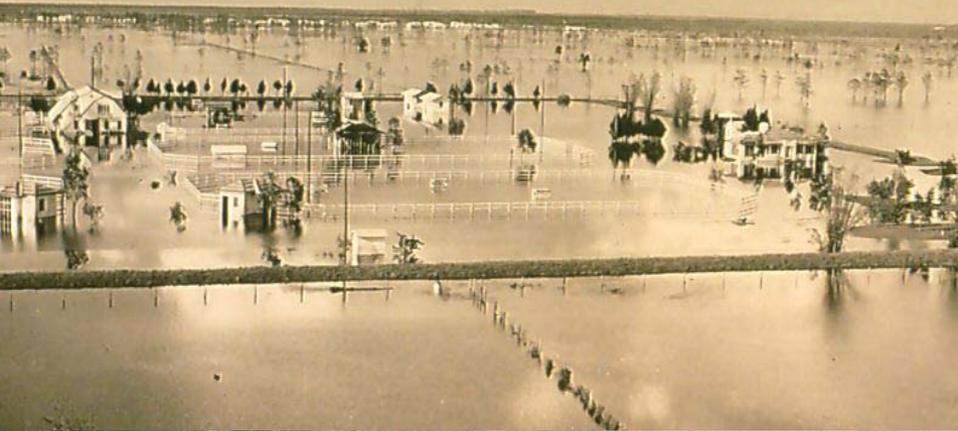
Northwest Dade County, 1944



Western Broward County, 1943



North of Tamiami Trail, 1942

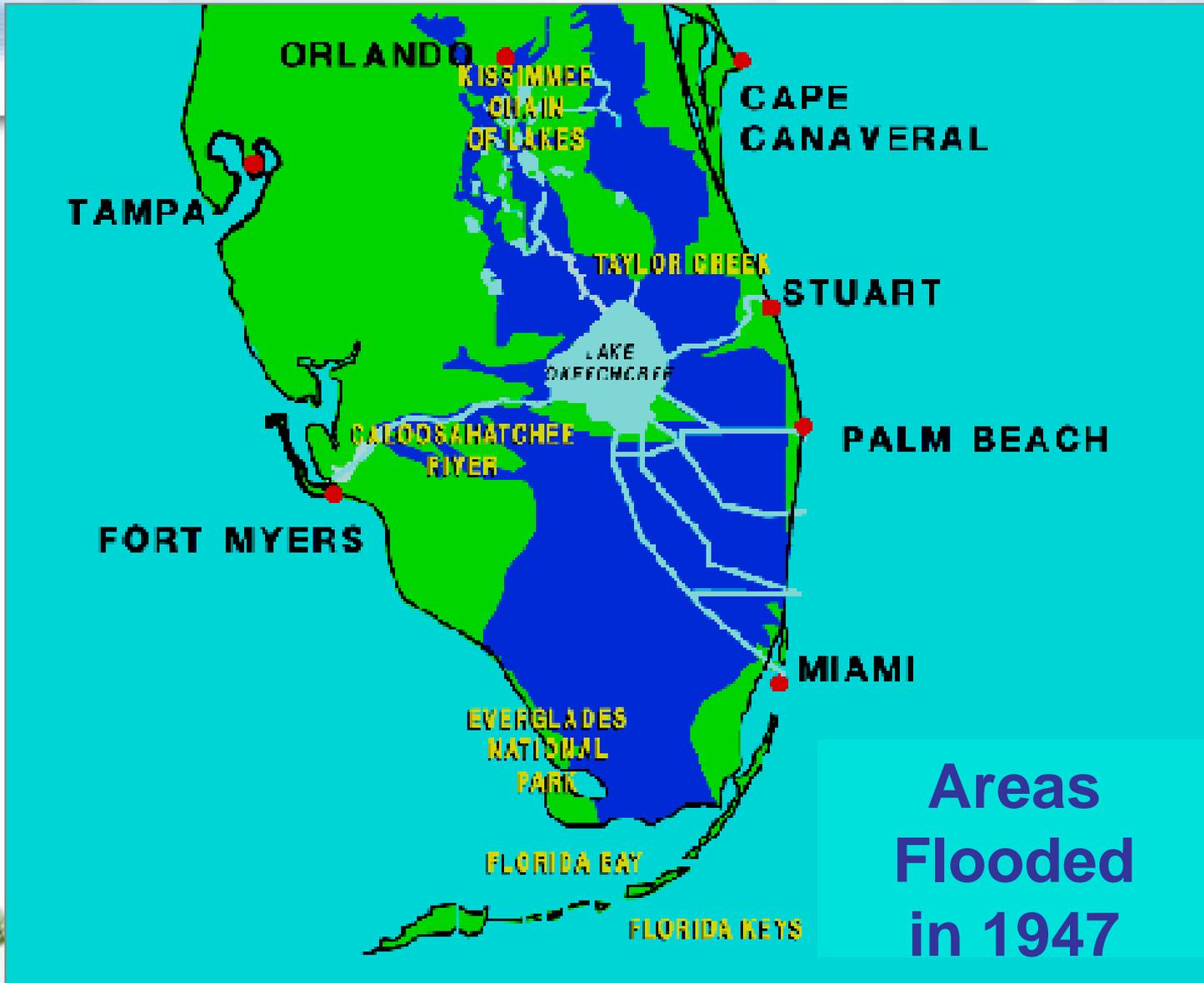


DADE COUNTY - HIALEAH RESIDENTIAL AND BUSINESS DISTRICTS UNDER WATER.

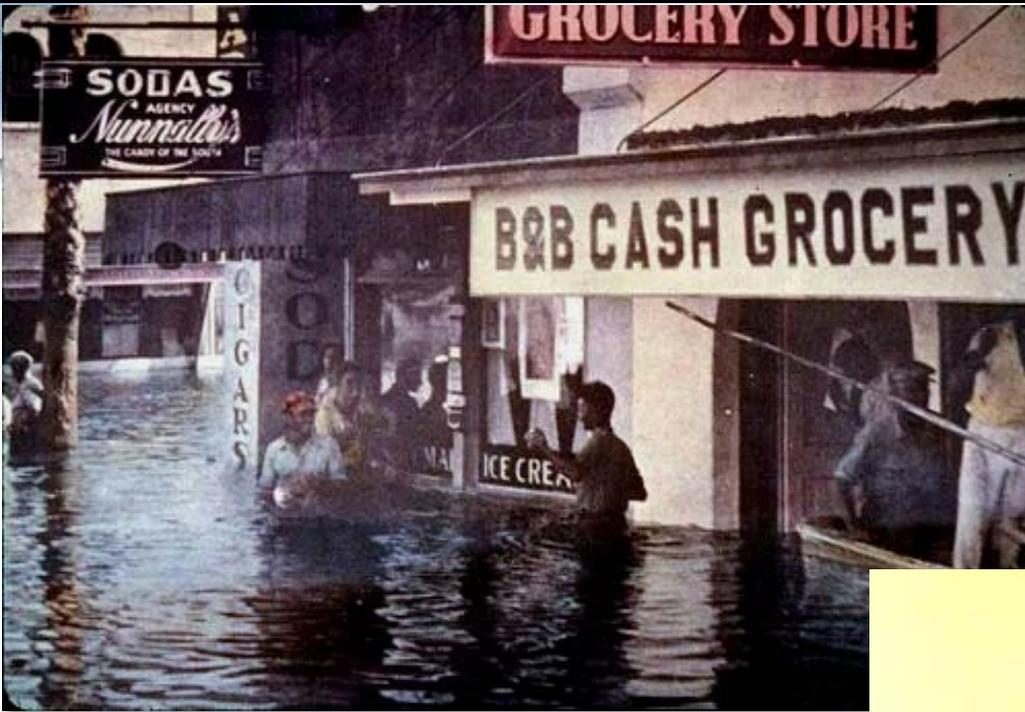
The Entire Region Floods in 1947



BROWARD COUNTY - POWER PLANT IN OPERATION EVEN DURING CREST OF FLOOD. ORANGE GROVES IN BACKGROUND RUINED



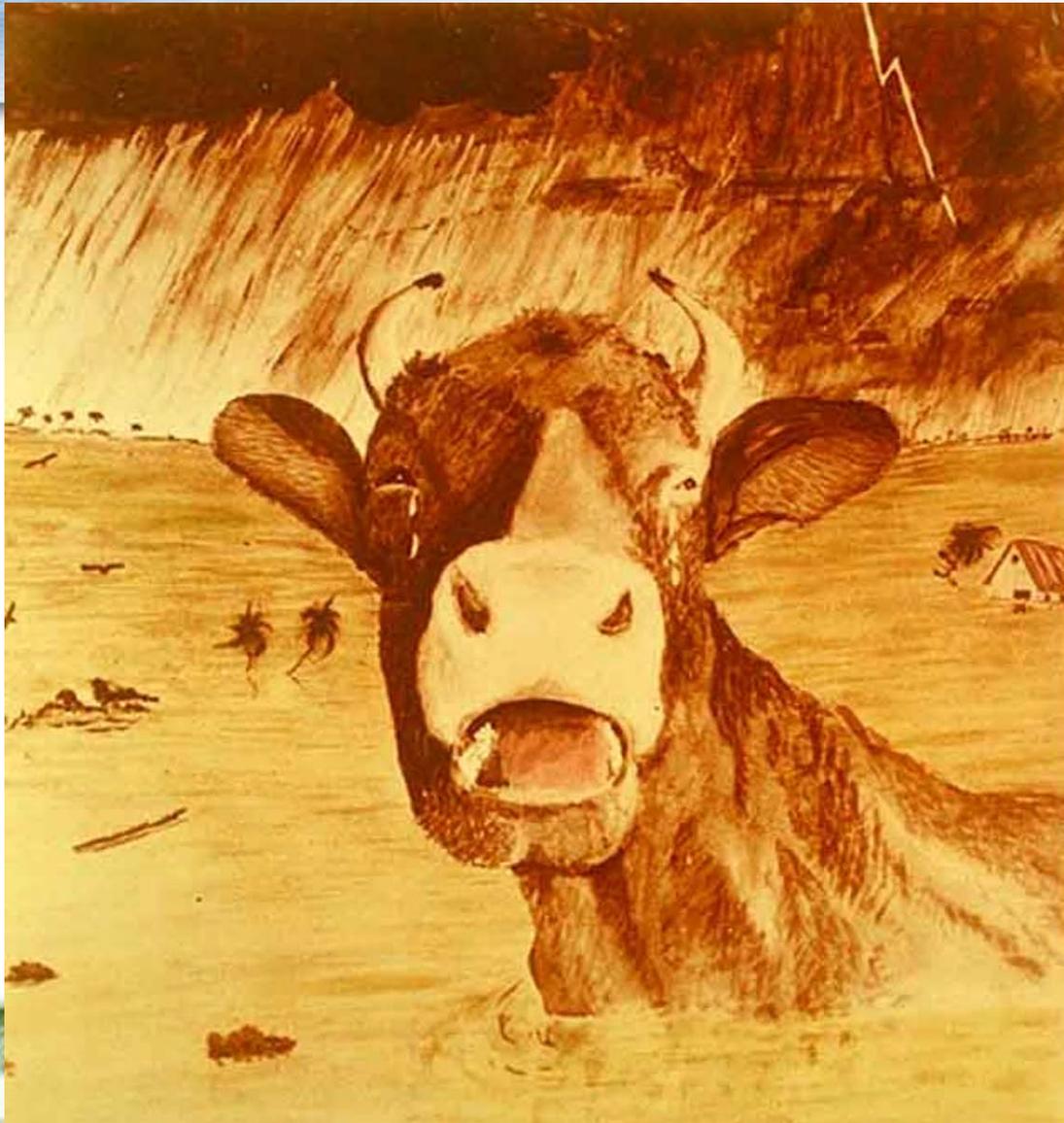
Areas
Flooded
in 1947



Downtown LaBelle

Kissimmee Railway Station





TENTATIVE
REPORT
OF
FLOOD
DAMAGE
FLORIDA
EVERGLADES
DRAINAGE
DISTRICT

1947

Flood Control Act of 1948

- Section 203. “That the following works of improvement for the benefit of navigation and the control of destructive floodwaters and other purposes are hereby adopted and authorized to be prosecuted”
- House Document 643 (1949)
 - Project purposes: “76. Lake Okeechobee levees and outlets.- Lake Okeechobee together with its outlets is, in effect, a multiple-use reservoir with *flood-control, navigation, and water-supply* functions. Its improvement and operation for these purposes is the heart of the comprehensive plan



House Document - 643

- **“Kissimmee Project yields more water to Lake Okeechobee causing a need for mechanisms to control Lake levels (i.e. levees and outlets at St. Lucie and Caloosahatchee) which, in turn, causes a need for salinity barrier -- S-79: ”**
 - **“...Lake Okeechobee is a multiple-use reservoir with flood control, navigation, and water-conservation functions.”**
 - **“...The outlet canals and the lake provide a navigable waterway across Florida.”**
 - **“... This great reservoir and its controls are the heart of any plan for flood control and water conservation in south Florida.”**
- **“... Features of the comprehensive plan proposed for the Kissimmee Basin would accelerate discharge into the lake during flood periods and would assist in maintaining its levels during dry seasons.”**

House Document - 643

- ...Completion of navigation improvement: Enlargement of the St. Lucie Canal and Caloosahatchee River, and modifications of the levee systems for Lake Okeechobee, would result in deepening existing channels for lake-control purposes.
 - This would incidentally provide depths of 8 feet or more in the waterway across Florida and would substantially complete that authorized project.
 - Deepening of the channel in the Caloosahatchee River without control works at its seaward end would aggravate salt-water intrusion and over-drainage during droughts, which are already serious problems in that area.
 - Consequently, the plan provides for construction of a new lock and spillway on the Caloosahatchee River above Fort Myers."

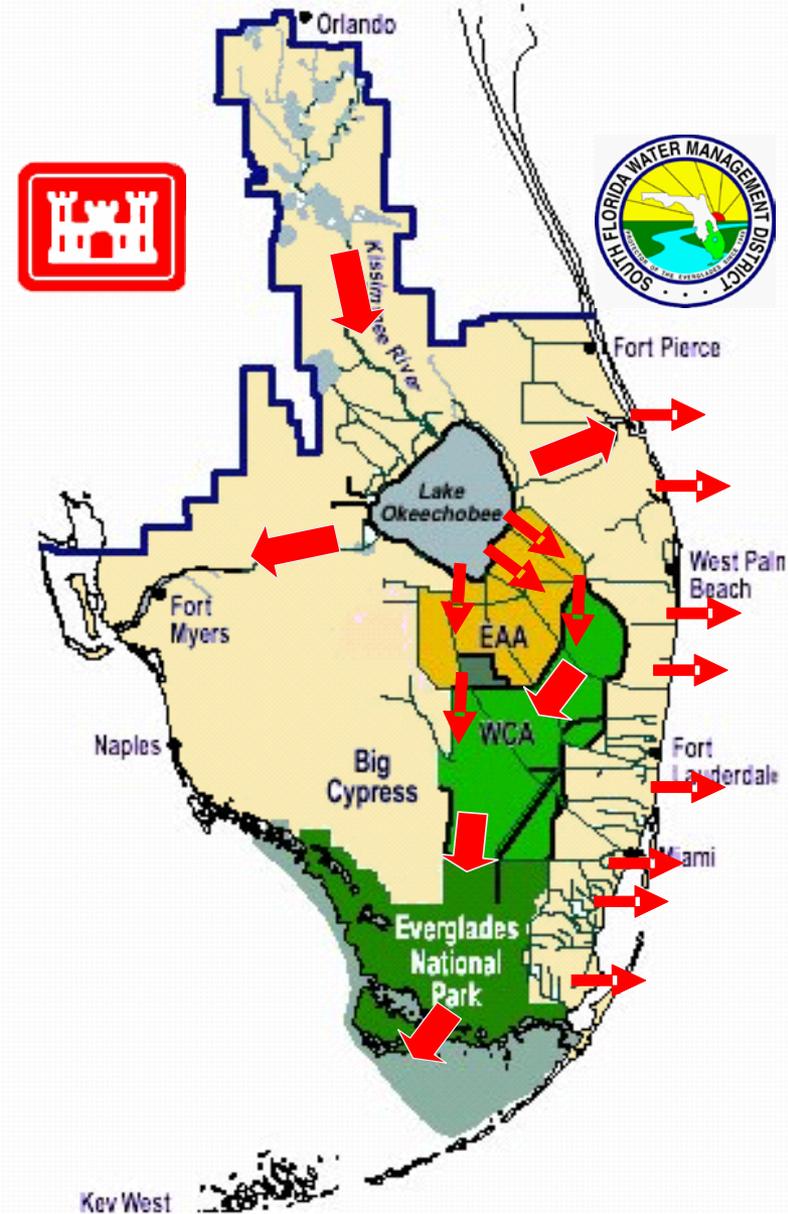
C&SF Project General Design Memorandum – Caloosahatchee River & Control Structures (1957)

- Substantial awareness of environmental impacts, particularly to salinity of Caloosahatchee Estuary, existed over 50 years ago when the design of Caloosahatchee – C-43 and S-79 occurred, (circa 1957)
- ...existing fisheries of the Caloosahatchee River and its estuary are of low quality and value due to adverse effect on the natural environment of past construction works;
- ...past regulatory and flood control discharges through the Caloosahatchee River have had adverse effects on the sport and commercial fisheries of the estuary;
- ...these conditions are likely to persist, and they may be extended by the proposed project

Source: p. 16 of Appendix to document – letter from U.S. FWS to District Engineer

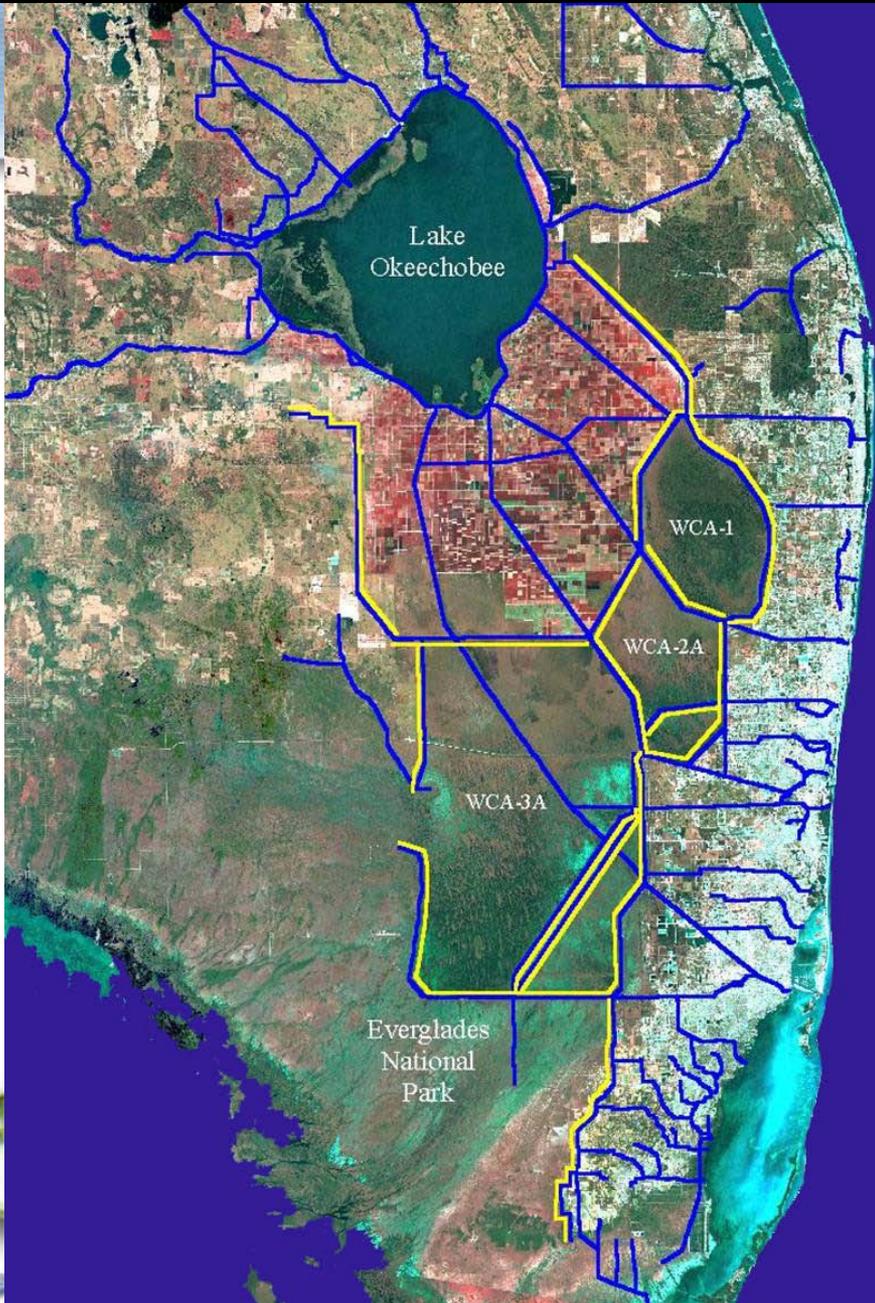
Central and Southern Project for Flood Control & Other Purposes

- Designed for multiple purposes
- Initially authorized in 1948 and constructed between 1950 & 1970
- Operated and maintained by SFWMD in accordance with USACE criteria



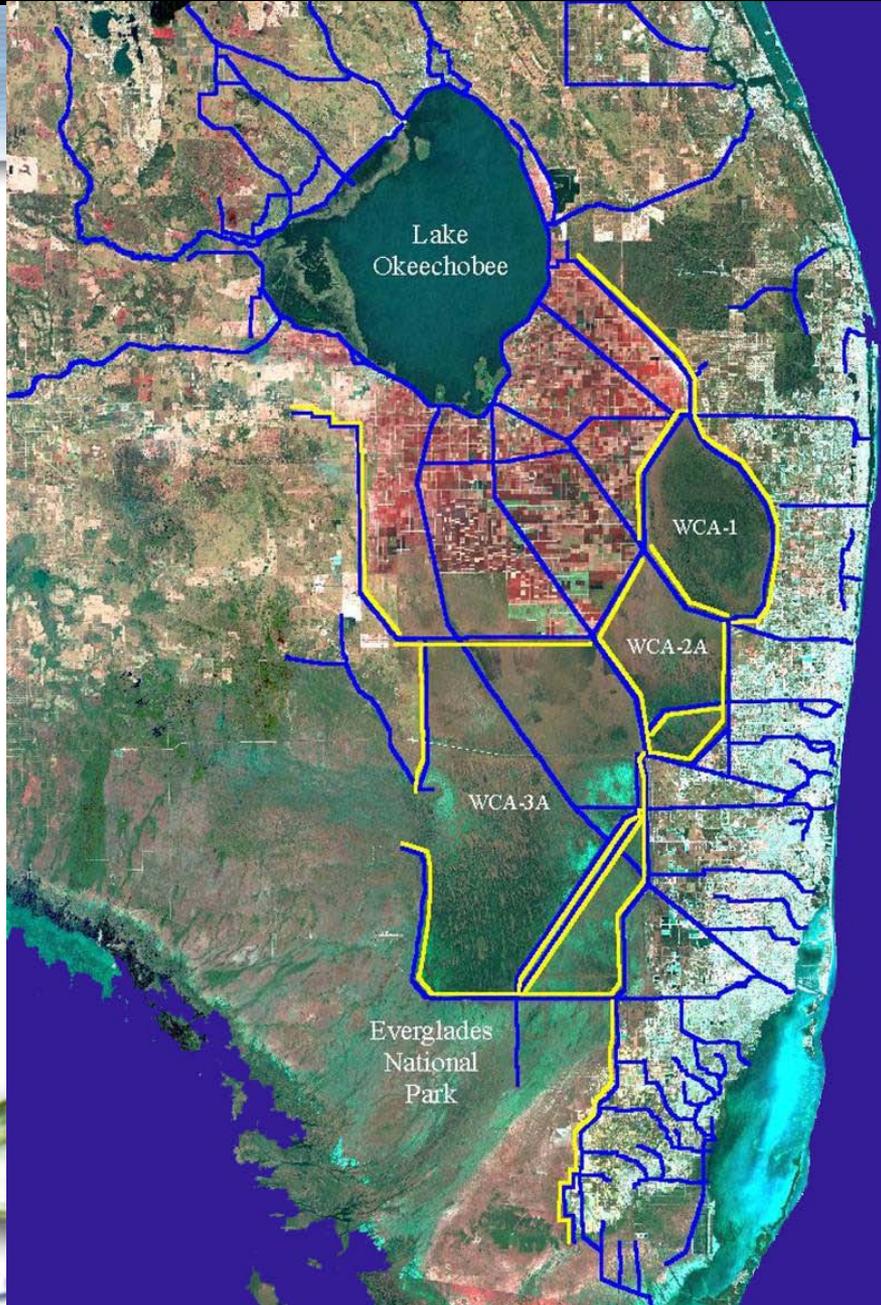
A special taxing district was established to serve the role of local sponsor for the federal project





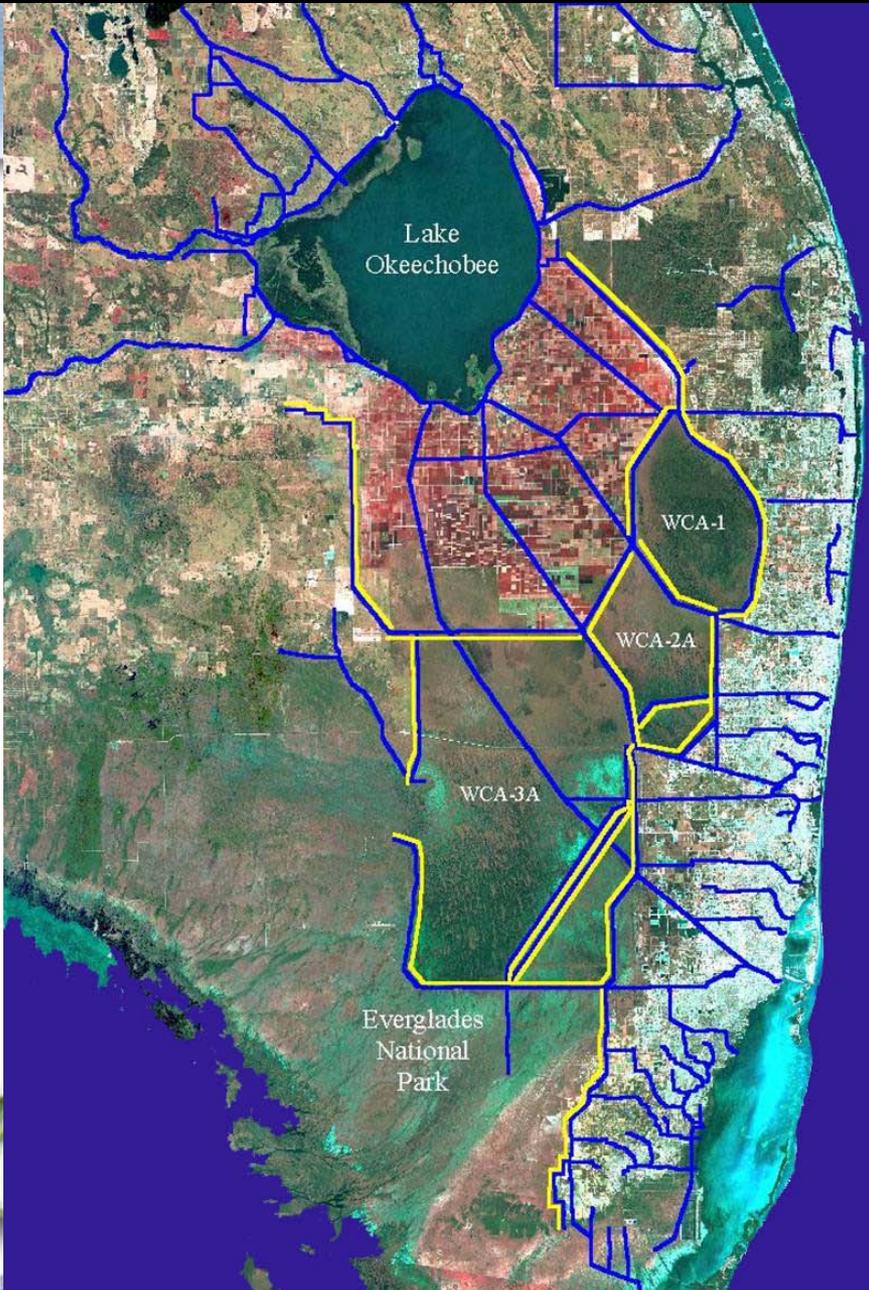
Element 1 Stop Urban Flooding

1. Wall off the Everglades
2. Drain to the ocean
 - Cheap
 - Effective
 - Minimal footprint on high priced land
 - Water lost, but we had too much anyway.



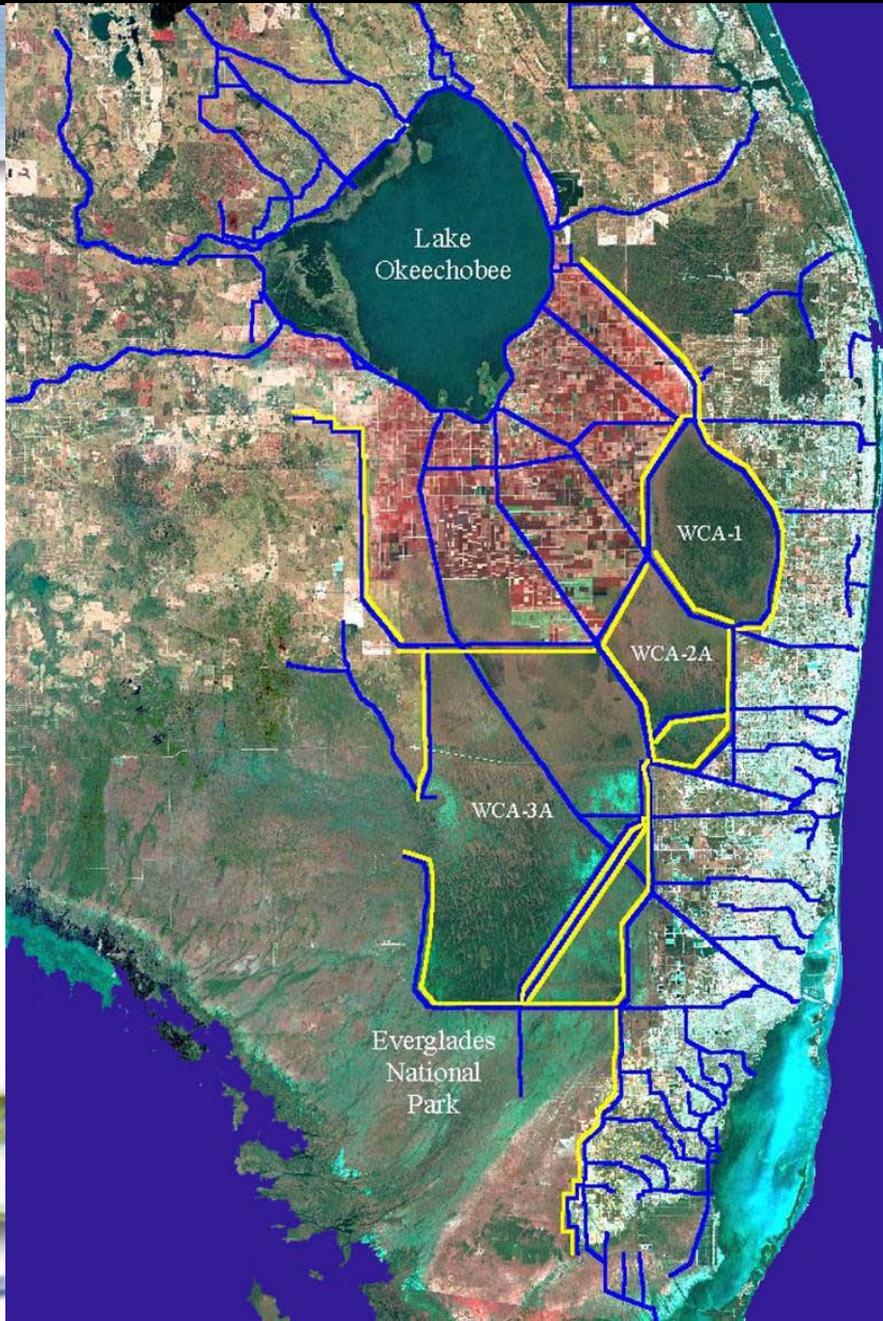
Element 2 Harvest and Store Water from the Center of the System

1. Levees around the EAA and WCAs
2. Pumps to Lake Okeechobee and the WCAs
3. Raise the level of Lake Okeechobee



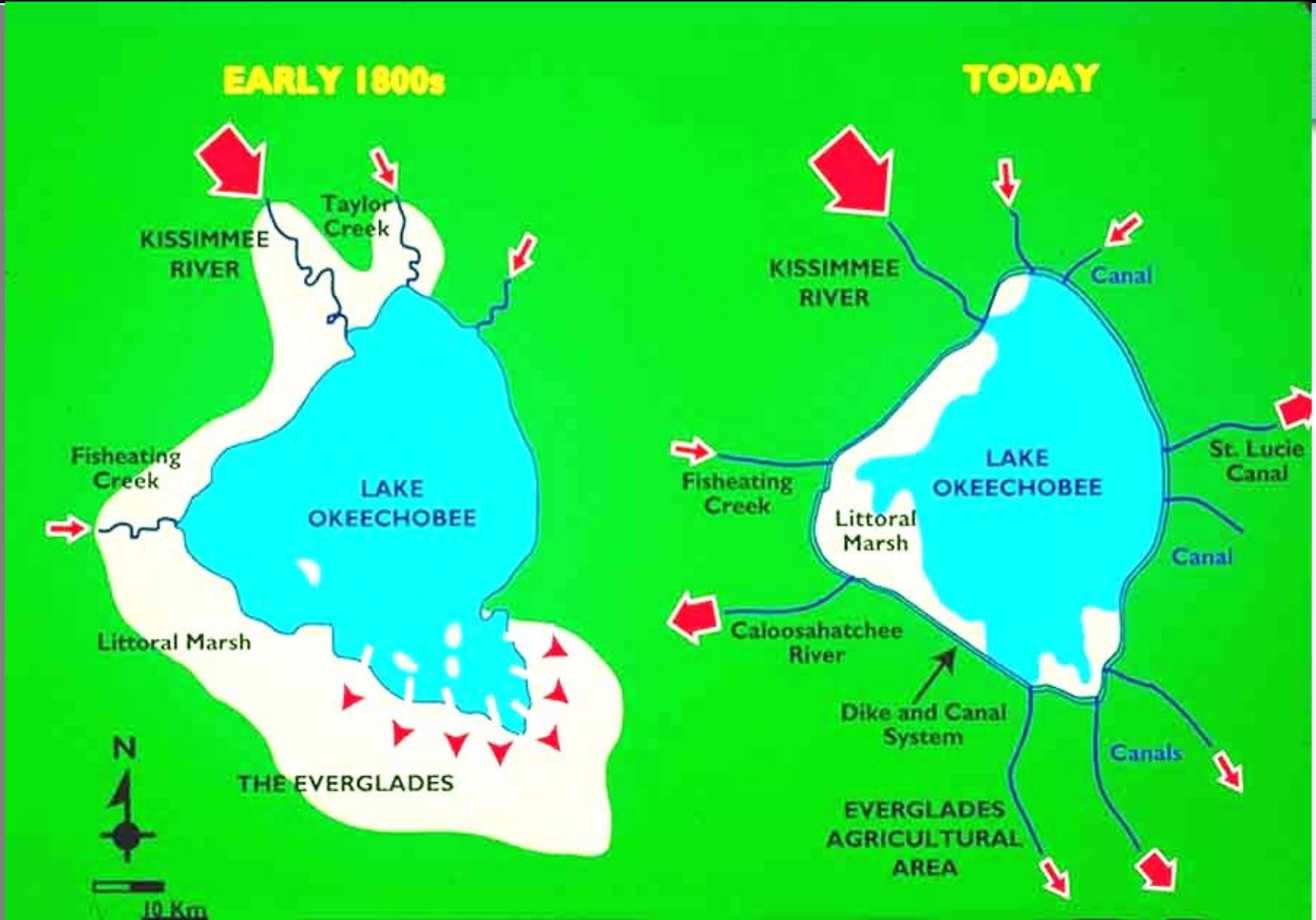
Element 3 Protect and Preserve the Environment

1. Eliminate Over-drainage of the Remaining Everglades.
2. Provide Water for Everglades National Park.

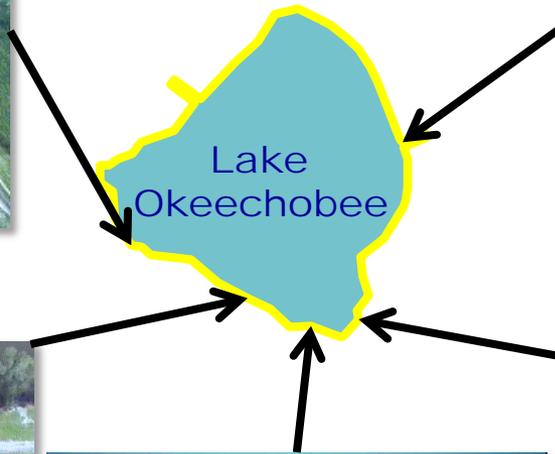


Major Changes To the 1948 Plan

1. ENP-South Dade Conveyance.
2. Interim Action Plan
3. Restoration of the Kissimmee.
4. Everglades Forever Act.
5. CERP

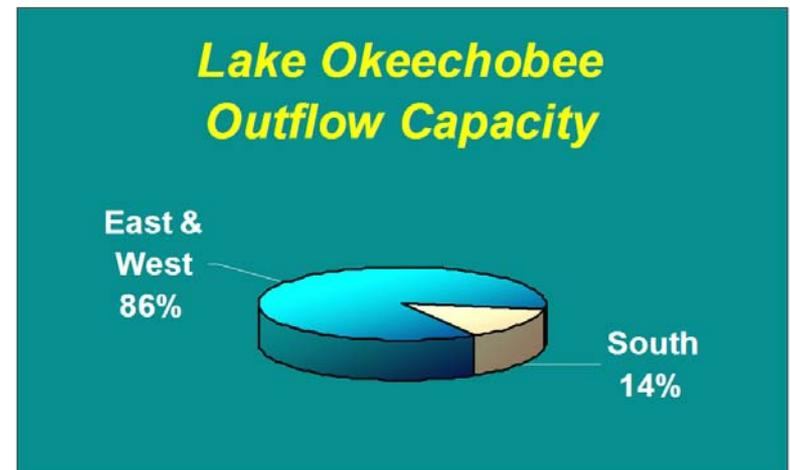
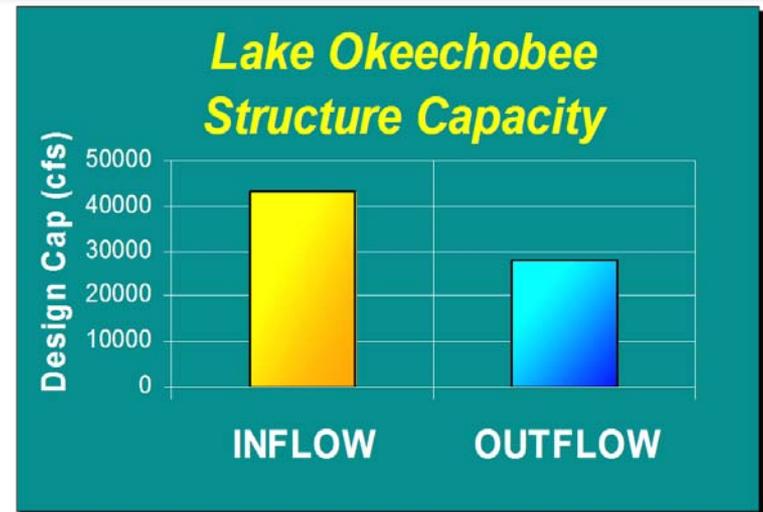


Lake Okeechobee - Major Water Control Structures

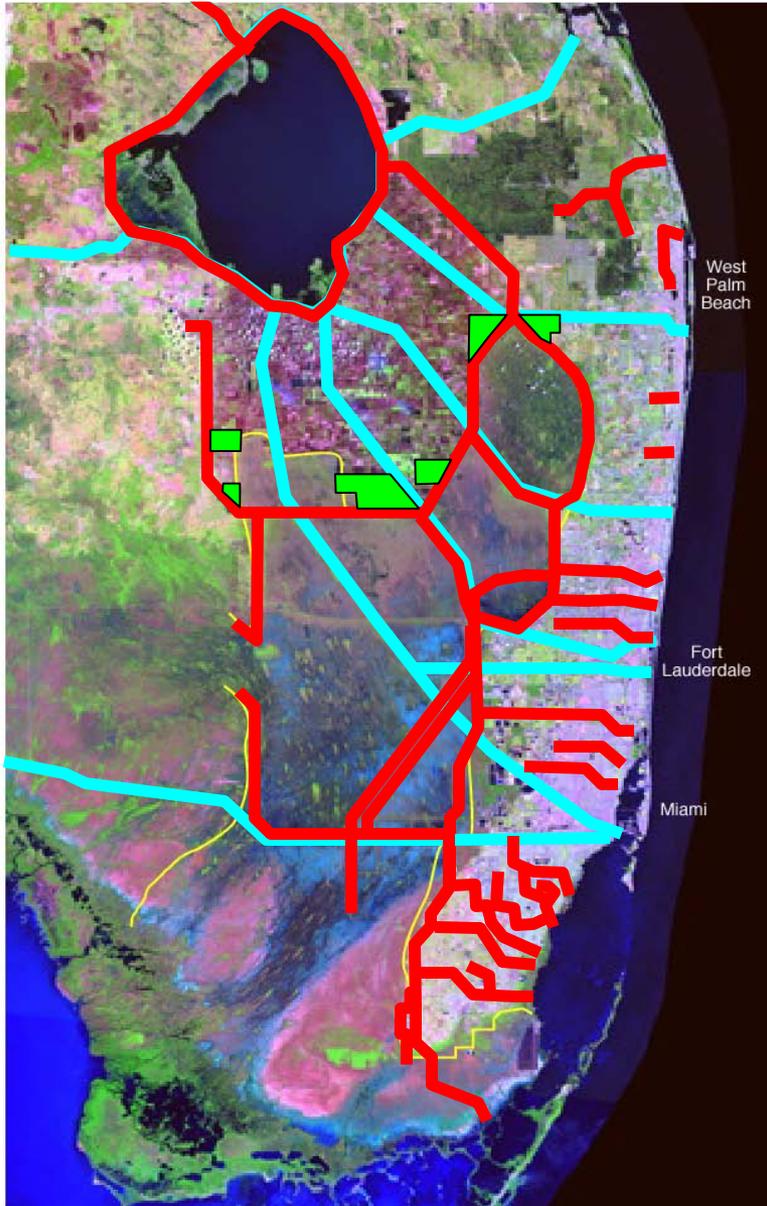


Lake Okeechobee - Structure Capacities

- Inflows to the lake frequently exceed total outflow capacity
- Outflow capacity to the St. Lucie & Caloosahatchee far exceeds outflow capacity to the Water Conservation Areas



Chronology of Water Management Changes



Managed System (2003)

Pre-Central & South Florida Projects

- Caloosahatchee/Kissimmee Rivers 1881-93
- East Coast Canals/St. Lucie Canal 1905-24
- Tamiami Trail – 1915-28
- Lake Okeechobee HH Dike – 1932-38

Central & Southern Florida Project

- Eastern Protective Levee System – 1952-54
- Everglades Agricultural Area – 1954-59
- Water Conservation Area Levees – 1960-63
- Lower East Coast Canals – 1954-65
- Lake Okeechobee Levees – 1960-64
- Kissimmee River Channelization – 1962-71
- South Dade System – 1965-83

Everglades Construction Project

- Stormwater Treatment Areas – 1994-2003

Source: Light and Dineen, 1994; SFWMD & USACE, 2008



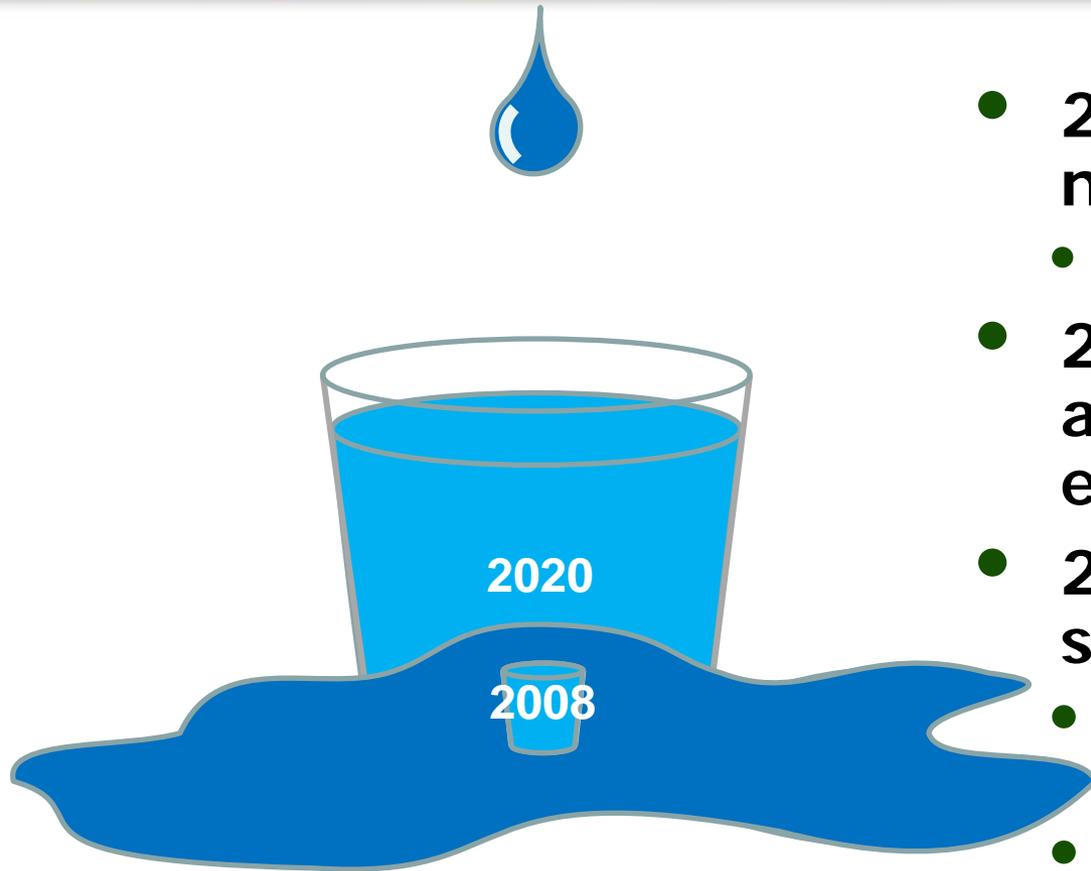
**Dedication of S-5A Pump
Station, 1953**

Legal Framework for C & SF Flood Control Project - **Lake Okeechobee**

- **U.S. Army Corps of Engineers Lake Okeechobee Regulation Schedule**
 - **Corps retained operation of Lake outlet structures**
 - **Navigation; public health and safety**
 - **District recommends operations to Corps**
- **Operations impact availability of water supply**



Legal Framework for C & SF Flood Control Project - Lake Okeechobee



- 2000: District identified need for storage
 - Incremental development
- 2005 – 2006: dike safety and high Lake level ecological concerns
- 2008 LORS shrinks the size of water supply pie
 - Less physical certainty for environment and users
 - Caloosahatchee improved



Lake Okeechobee Regulation Schedule

*Calvin J. Neidrauer, P.E.,
Chief Engineer, Operations Control Department*

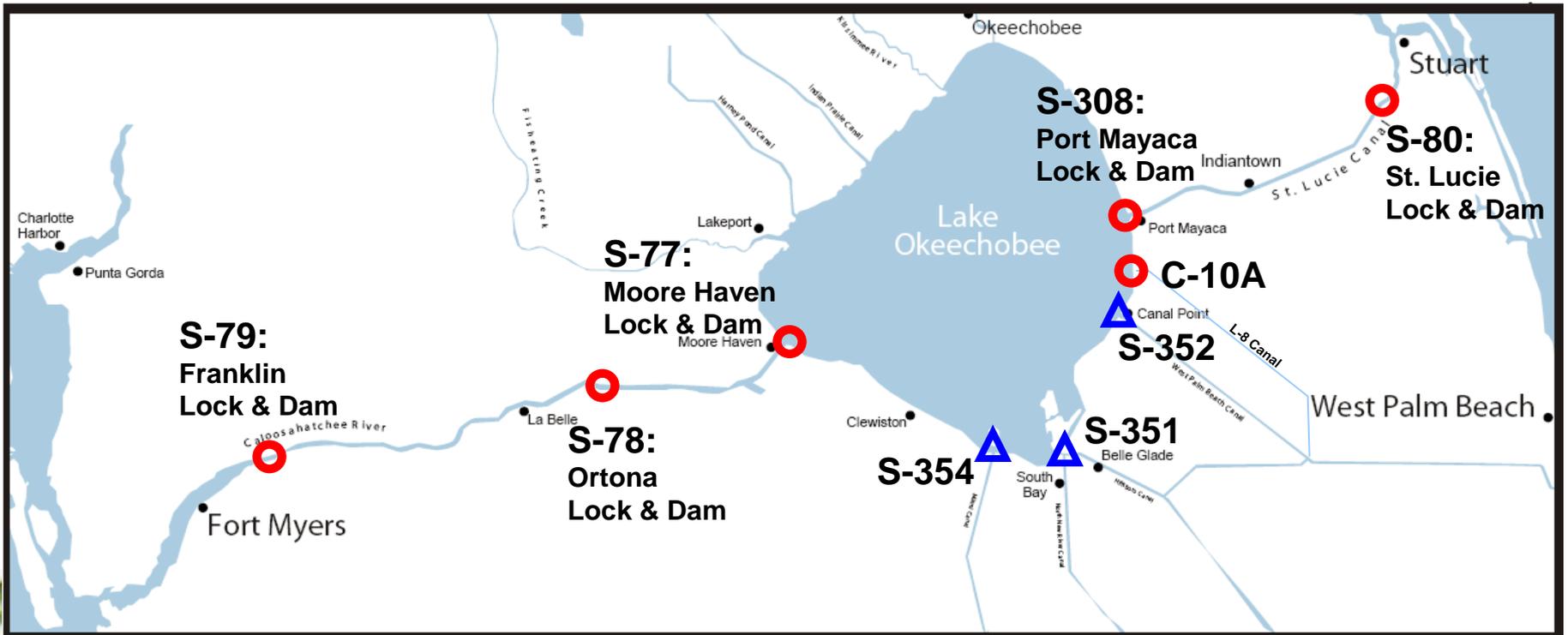
Topics

- **Brief Background**
- **Features of the 2008 Lake Okeechobee Interim Regulation Schedule (aka LORS-2008)**
- **Expected Performance of LORS-2008**



Lake Okeechobee Outlet Structures

Lake Okeechobee outlet structures managed
by the USACE (red o) and the SFWMD (blue Δ)



Brief Background & History

What is a Regulation Schedule?

- Tool for managing/regulating water levels in a reservoir/lake
- Triggers regulatory discharges (aka flood control discharges)
- Does not trigger water supply deliveries
- Designed to balance multiple objectives (flood control, navigation, water supply, enhancement of fish & wildlife, and recreation)

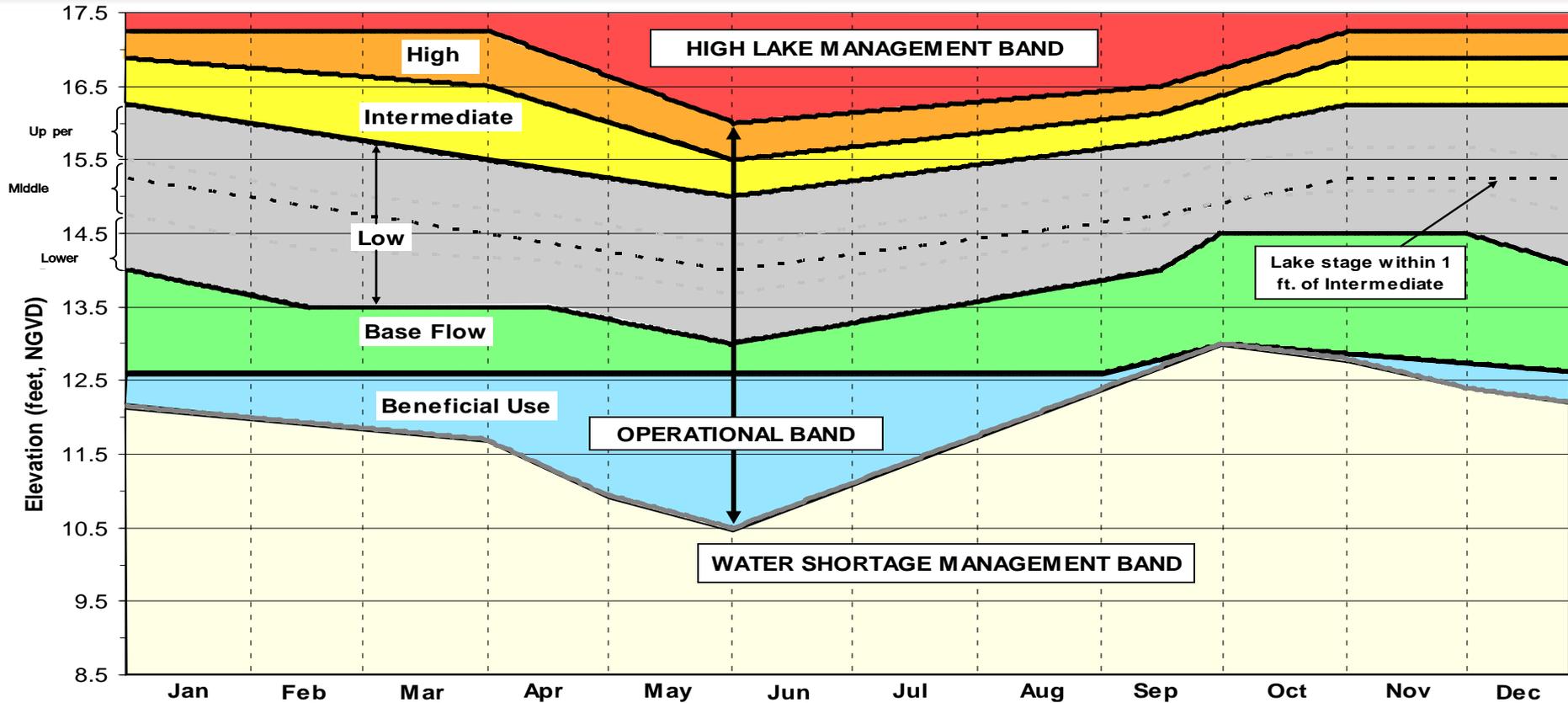


Traditional Tools for Managing Lake Stages

- **Regulation Schedule**
 - Traditionally used to manage high water levels
 - Designed to preserve flood protection and balance competing objectives
 - Releases generally increase as water levels rise
- **Water Shortage Management Plan**
 - Designed to stretch water supplies by restricting water deliveries during periods of low stages
 - Water use cutbacks generally increase as water levels fall



Features of the 2008 Lake Okeechobee Interim Regulation Schedule (LORS-2008)



NOTES:

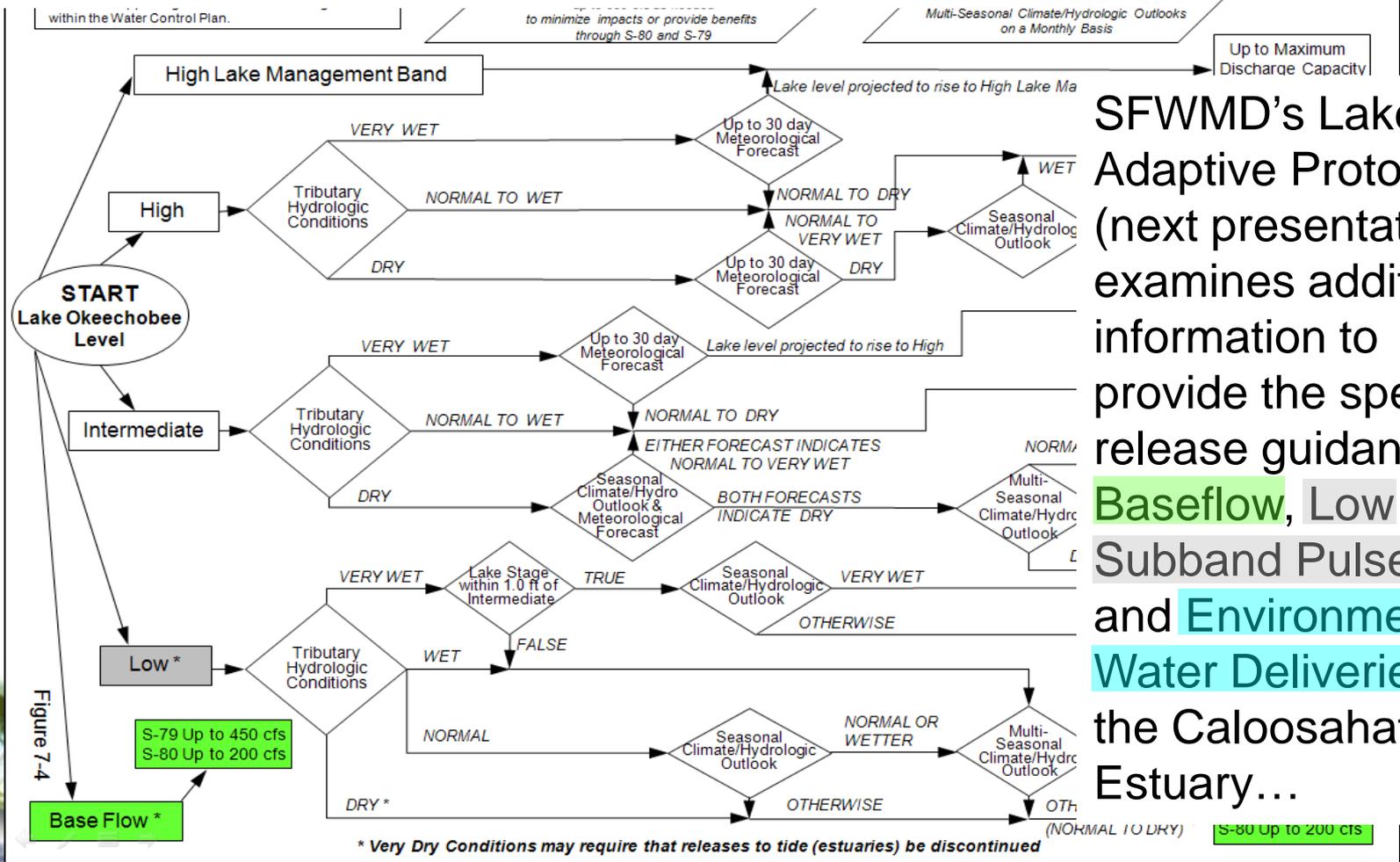
- High Lake Management Band:** Outlet canals may be maintained above their optimum water management elevations.
- Operational Band:** Outlet canals should be maintained within their optimum water management elevations.
- Water Shortage Management Band:** Outlet canals may be maintained below optimum water management elevations.

CENTRAL AND SOUTHERN FLORIDA PROJECT
 2008 LAKE OKEECHOBEE
 INTERIM REGULATION SCHEDULE
 PART B

DATED: March 2008
 DEPARTMENT OF THE ARMY, JACKSONVILLE DISTRICT
 CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA

LORS 2008 Release Guidance Flowchart (Part C)

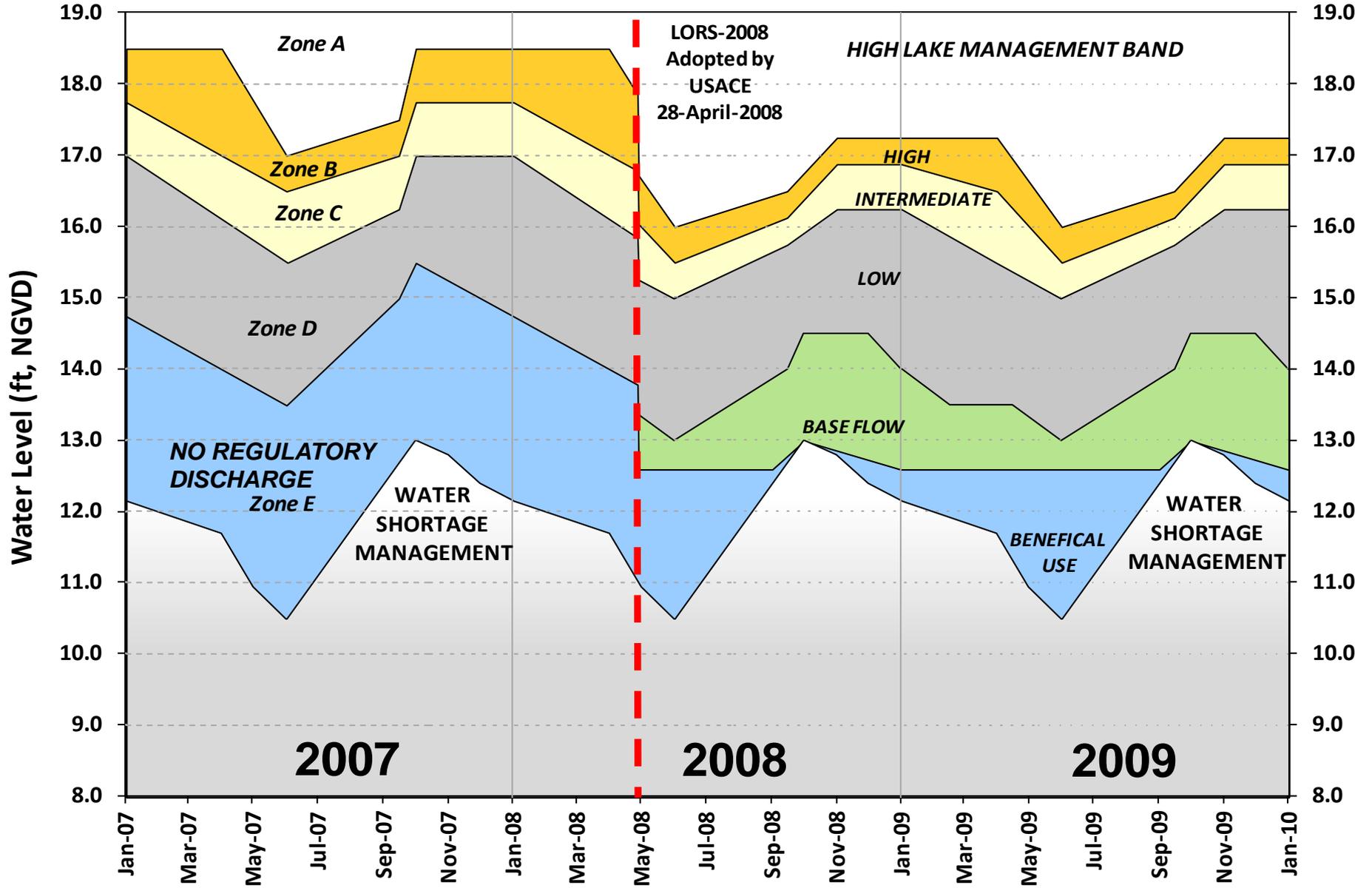
LORS 2008 provides “up to” discharge limits, but does not provide guidance regarding specific release amounts.



SFWMD’s Lake O Adaptive Protocol (next presentation) examines additional information to provide the specific release guidance for **Baseflow**, **Low Subband Pulses**, and **Environmental Water Deliveries** to the Caloosahatchee Estuary...



Lake Okeechobee Regulation Schedule Lowered in 2008



Features of the 2008 Lake Okeechobee Interim Regulation Schedule (aka LORS-2008)

- **Lowered Upper Limit of Regulation by 1.25 feet**
 - Reduction from 18.5 ft, NGVD to 17.25 ft, NGVD to decrease peak stage and duration of high stages
 - Reduces storage capability of the Lake
- **Included a Water Shortage Management Band on the "schedule"**
 - Refers to SFWMD's Water Shortage Management Plan
- **Added a Baseflow Band to enable low-volume releases of excess Lake water to the Caloosahatchee and St. Lucie Estuaries**
 - helps to keep lake stage down via estuary-friendly releases



Features of the 2008 Lake Okeechobee Interim Regulation Schedule (aka LORS-2008)

- **Defined an Operational Band - included the entire range down to the Water Shortage Management Band**
 - **Renamed the “No Regulatory Discharge” (Zone E) to “Beneficial Use Sub-band”**
- **Included “Additional Operational Flexibility”**
 - **Language added to Water Control Plan to enable USACE to depart from normal operations in limited circumstances**

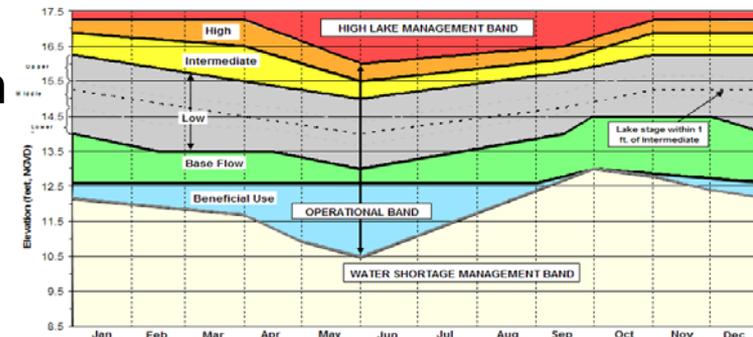


Expected Performance of LORS



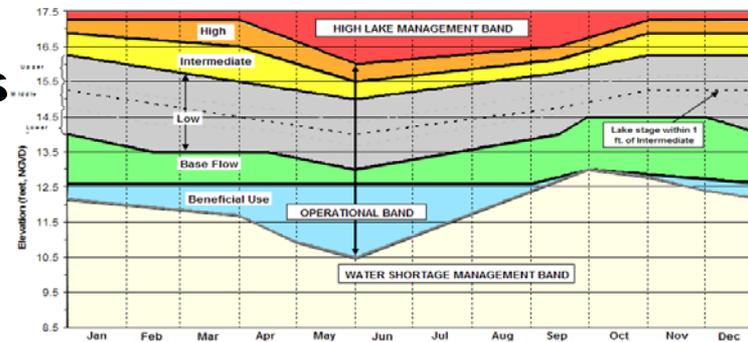
LORS-2008 Simulated Benefits

- Reduces high Lake stages:
 - Addresses HH Dike safety concerns
 - Promotes protection of aquatic vegetation by lowering average Lake stages
- Increases frequency & duration of low Lake stages:
 - Potential benefits of periodic extreme low lake levels:
 - Encourages bulrush germination (10-10.5')
 - Oxidizes organic muck in littoral zone



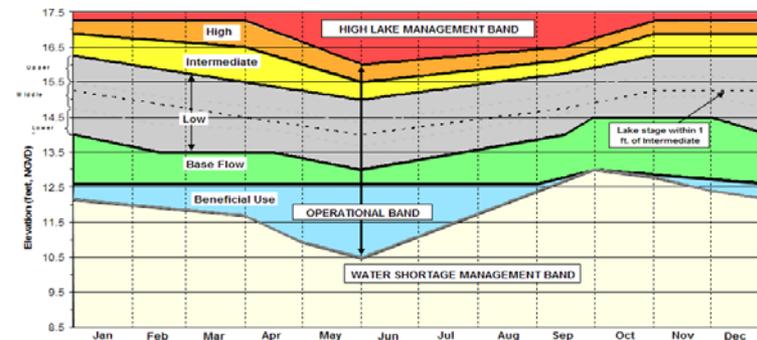
LORS-2008 Simulated Benefits

- **Benefits to Caloosahatchee & St. Lucie Estuaries:**
 - Small reduction in Lake-triggered damaging high discharges
 - Some improvement in low flows to Caloosahatchee Estuary
 - Resulted from Base-flow releases when Lake stage was within the Base-flow sub-band
 - Note: Schedule design and simulations assumed no releases to the Caloosahatchee Estuary when the Lake stage was below the Base-flow sub-band.



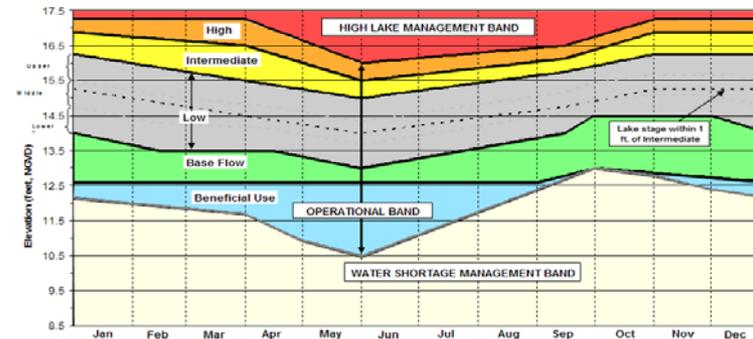
LORS-2008 Simulated Impacts

- **Increases potential for Lake MFL violations**
 - **Increases the probability of Lake MFL exceedances**
 - **Lake O MFL exceedance occurs when stage falls below 11.0' for longer than 80 days...**
 - **Average # of days of Lake MFL exceedance increased by 50%**
 - **Note: Sensitivity testing showed that increasing water shortage cutbacks do not improve poor MFL performance**
- **Impact to permitted users' supply & level of certainty**
 - **Potential that water shortage cutbacks will occur more frequently than 1-in-10 years, more like 1-in-6 yrs.**



LORS-2008 Simulated Impacts

- **Impacts to Lake ecology**
 - Snail Kite habitat & food source impacted
 - Loss of native habitat & exotic plant expansion
 - Fish reproduction impacted
- **Impacts to Navigation**
 - >70% increase in duration of time stage is below elevation 12.56 ft, NGVD



LORS-2008 Implementation Timeframe

- **Interim nature of LORS-2008**
 - **Excerpt from LORS FSEIS Executive Summary (November 2007)**

"...The Corps expects to operate under LORS until the earlier of (1) implementation of a new Lake Okeechobee schedule as a component of the system-wide operating plan to accommodate the Comprehensive Everglades Restoration Plan (CERP Band 1 projects) and the State of Florida's fast track Acceler8 projects, or (2) completion of HHD seepage berm construction or equivalent dike repairs for reaches 1, 2 and 3..."



Summary

- LORS-2008 implemented primarily to lower high stages in an effort to reduce risk to HH Dike
- Analysis in the LORS-2008 SEIS shows a reduction in both high stages and low stages
 - Reduced risk to HH Dike
 - Adverse impacts to water supply capability and Lake MFL
- USACE relies on SFWMD input when stages are in the Beneficial Use and Water Shortage subbands
 - Water Control Plan, sec 7-02.a. Beneficial use subband:
...Fish and wildlife enhancement and/or water supply deliveries for environmental needs may involve conducting an environmental release from Lake Okeechobee through the SFWMD's "Adaptive Protocols" or other SFWMD authorities.

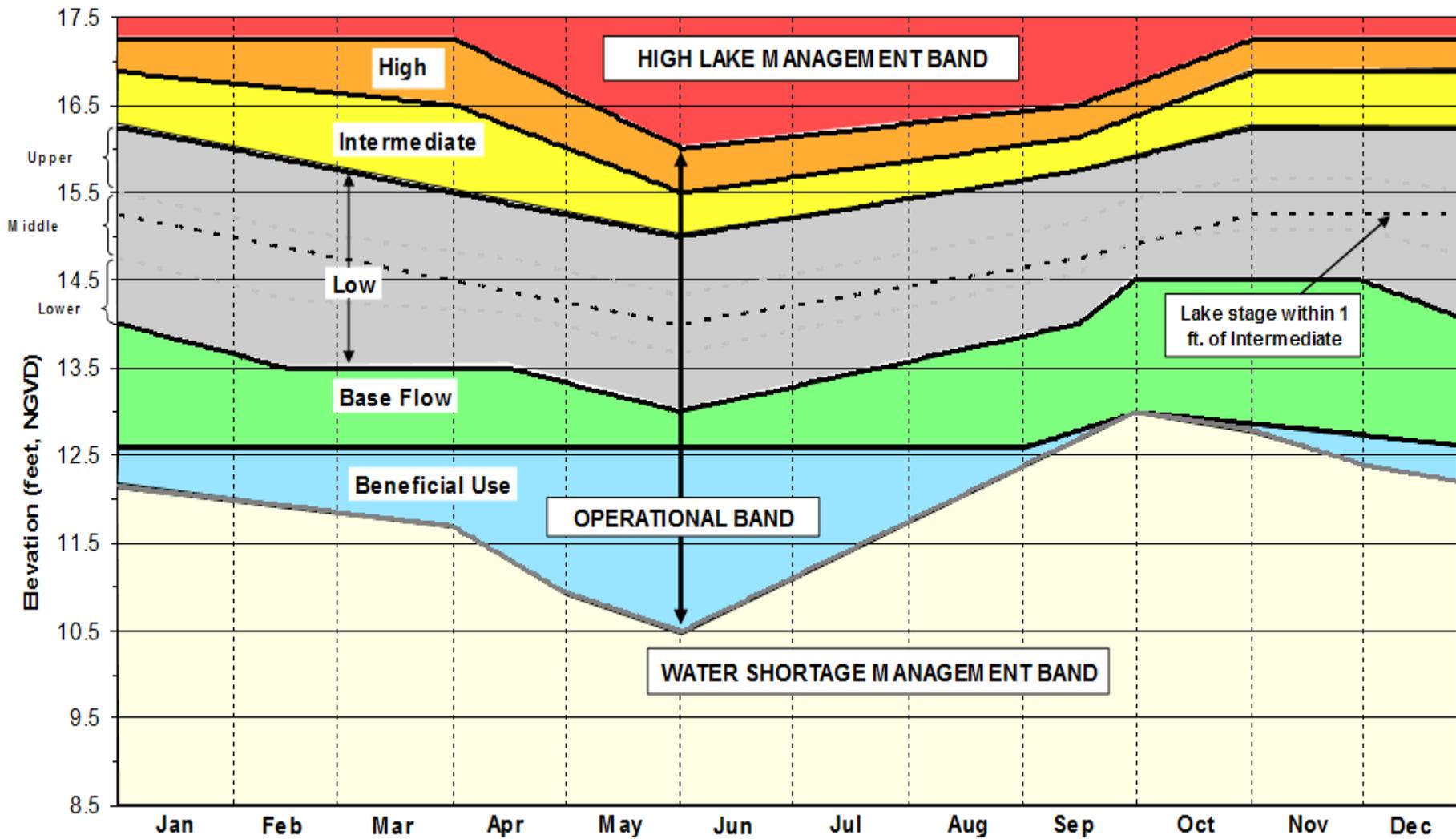
Questions?



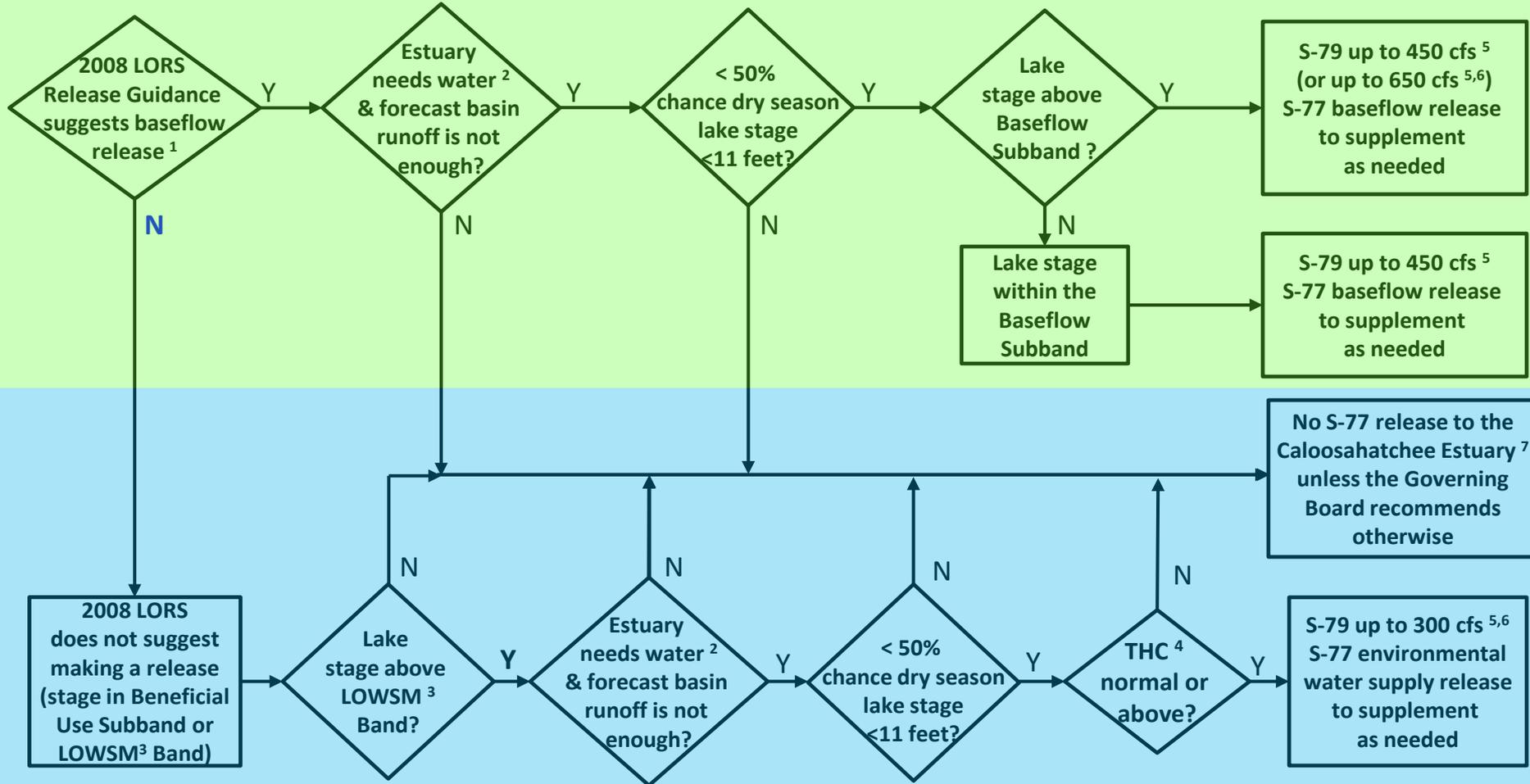
Adaptive Protocols for Lake Okeechobee Operations

*Susan Gray, Ph.D., Chief Scientist
Applied Sciences Bureau*

2008 Lake Okeechobee Interim Regulation Schedule *(aka 2008 LORS)*



Flowchart to Guide Recommendations for Lake Okeechobee Releases to the Caloosahatchee Estuary for 2008 LORS Baseflow & for Environmental Water Supply



¹The 2008 LORS Release Guidance (Part D) can suggest baseflow releases in the Intermediate, Low, or Baseflow Subbands.

²Estuary “needs” water when the 30-day moving average salinity at I-75 bridge is projected to exceed 5 practical salinity units (psu) within 2 weeks.

³LOWSM = Lake Okeechobee Water Shortage Management.

⁴Tributary Hydrologic Condition (THC) is based on classification of Lake Okeechobee Net Inflow and Palmer Index.

⁵Can release less than the “up to” limit if lower release is sufficient to reach or sustain desired estuary salinity; cfs = cubic feet per second.

⁶After reviewing conditions in Water Conservation Areas (WCAs), Stormwater Treatment Areas (STAs), ENP, St. Lucie Estuary and Lake Okeechobee.

⁷Should this condition be reached, the Governing Board will be briefed at their next regularly scheduled meeting as part of the State of the Water Resources agenda item.

Adaptive Protocols were developed to:

- Provide guidelines for determining specific volumes for regulatory discharges where not otherwise specified
- Include procedures for making discharges to protect downstream ecosystems (e.g., salinity impacts in Caloosahatchee River)
- Include quantitative performance measures for environment(s) and water users
- Be within the bounds of the existing Lake regulation schedule (LORS) and Water Shortage management plan

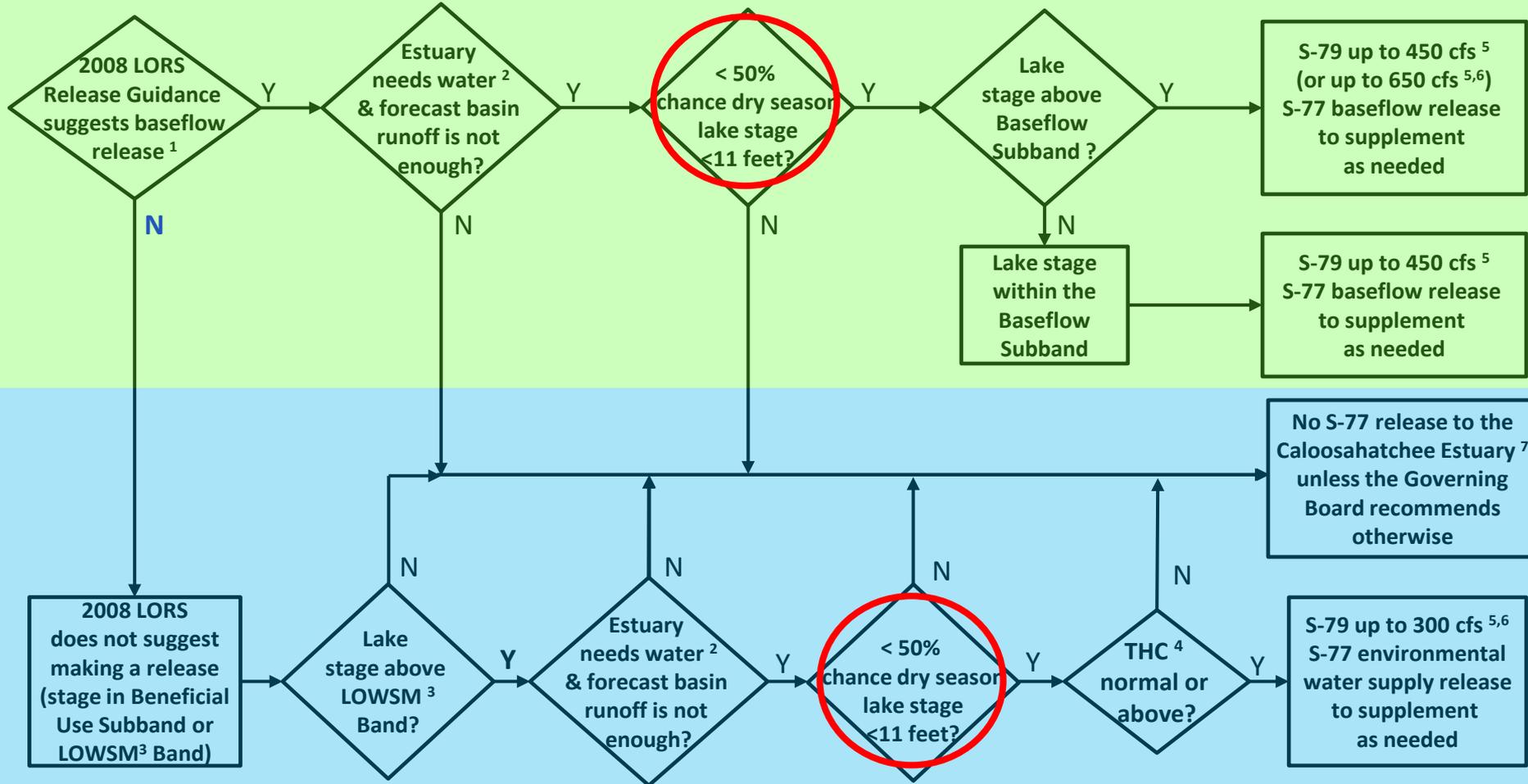


Lake O Adaptive Protocols Key Components

- Clarified SFWMD advisory role to make release recommendations to the USACE
- Provide guidance where releases are expressed as a range of volumes, i.e. "up to 2000 cfs"
- Identify "win-win" or "win-neutral" improvements
- Provide guidance on releases to the estuaries in the Low, Base Flow and Beneficial Use sub bands
- Recommend "conservative" releases in the Low sub band at the beginning of the dry season to the USACE (if no impact to dike safety)
- Define framework for District recommendations



Flowchart to Guide Recommendations for Lake Okeechobee Releases to the Caloosahatchee Estuary for 2008 LORS Baseflow & for Environmental Water Supply



¹The 2008 LORS Release Guidance (Part D) can suggest baseflow releases in the Intermediate, Low, or Baseflow Subbands.

²Estuary “needs” water when the 30-day moving average salinity at I-75 bridge is projected to exceed 5 practical salinity units (psu) within 2 weeks.

³LOWSM = Lake Okeechobee Water Shortage Management.

⁴Tributary Hydrologic Condition (THC) is based on classification of Lake Okeechobee Net Inflow and Palmer Index.

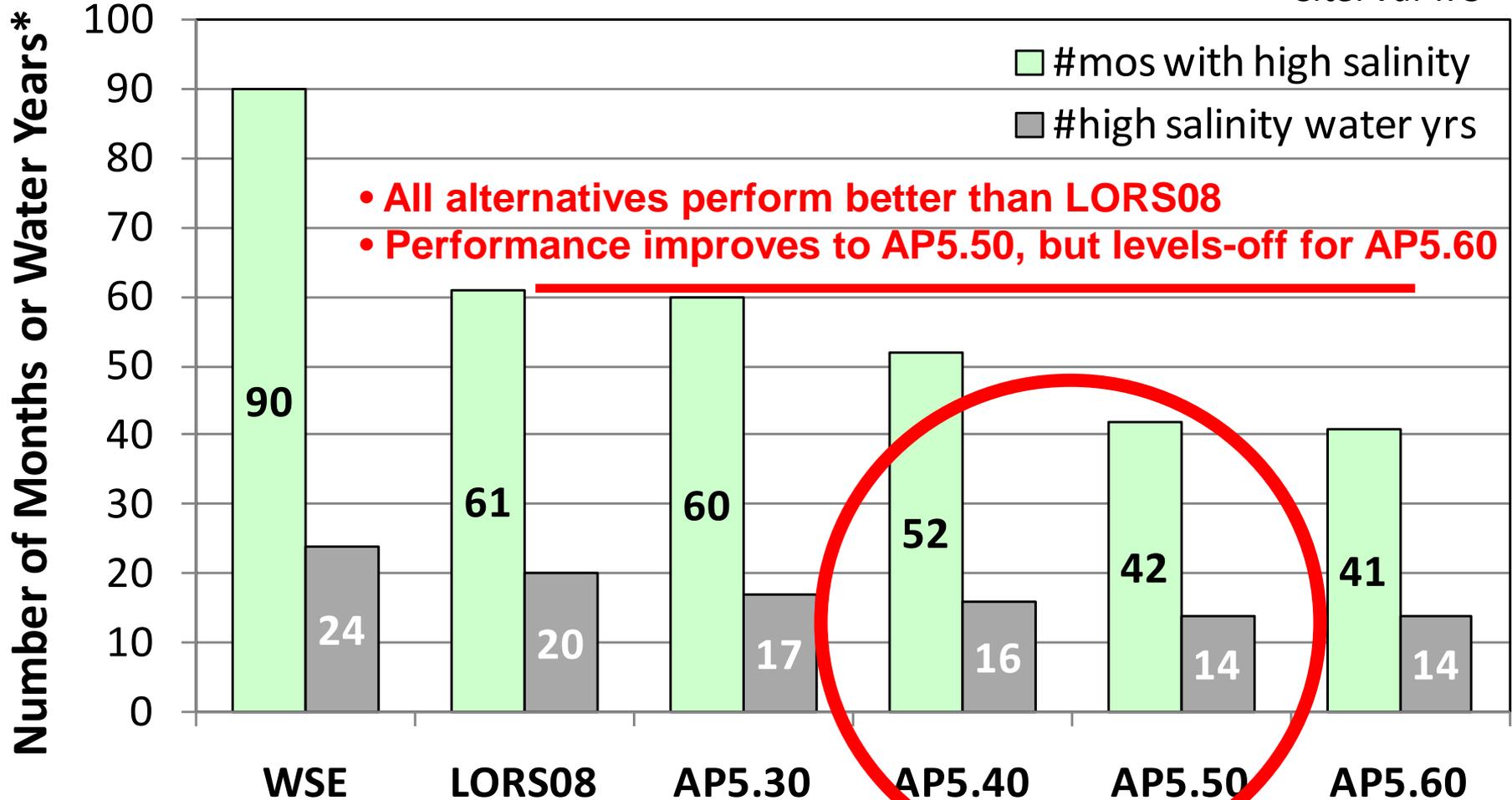
⁵Can release less than the “up to” limit if lower release is sufficient to reach or sustain desired estuary salinity; cfs = cubic feet per second.

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Caloosahatchee Estuary Simulated High Salinity Months & Years

Site: Val-I75



- All alternatives perform better than LORS08
- Performance improves to AP5.50, but levels-off for AP5.60

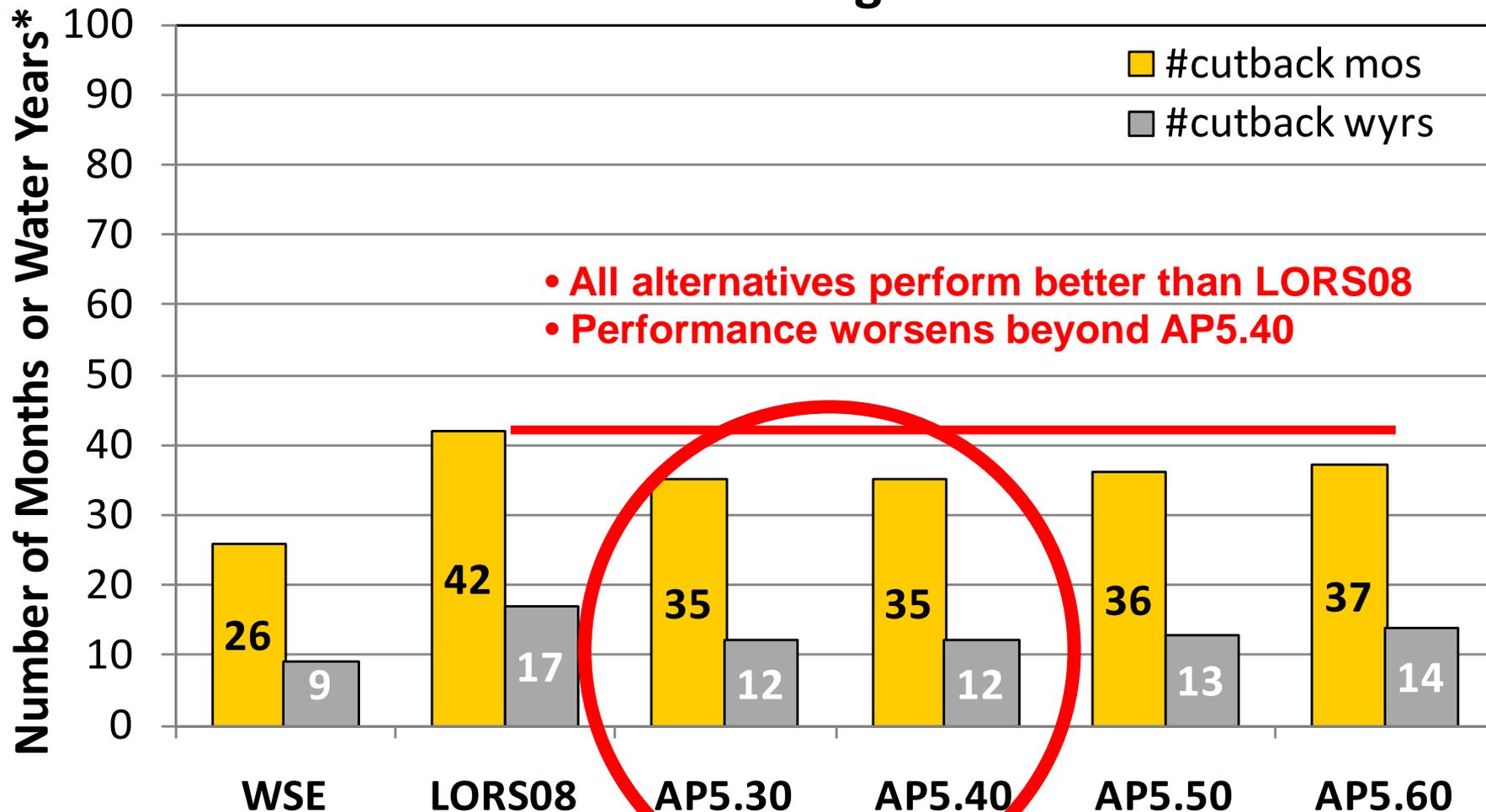
A high salinity event is: 30-day moving average salinity > 10 psu for duration ≥ 7days

The #months with high salinity = (#days 30-day moving avg salinity > 10 psu)/30.4

*A high salinity water year is a water year (Oct-Sep) with at least one high salinity event

LOOPS Model (daily time-step) simulation period: 492 months, 41 calendar yrs, (40 water yrs)

Lake Okeechobee Service Area Simulated Water Shortage Months & Years

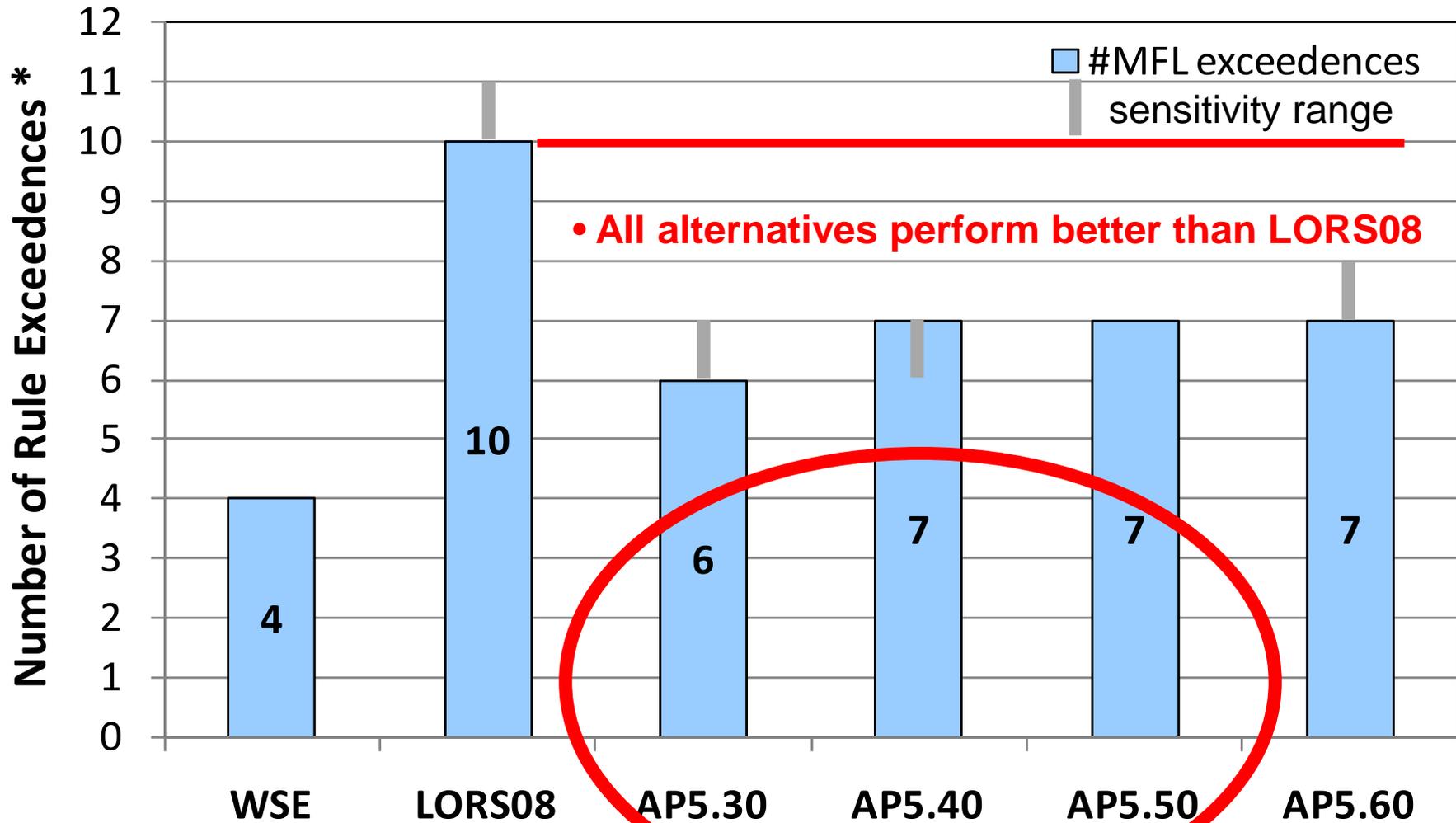


A cutback month has: (1) duration ≥ 7 days, (2) cutback $> 10,000$ af, cutback/demand $\geq 10\%$

*A cutback water year is a water year (Oct-Sep) with at least one cutback month

LOOPS Model (daily time-step) simulation period: 492 months, 41 calendar yrs, (40 water yrs)

Lake Okeechobee Simulated MFL Rule Exceedences



*An MFL violation occurs in Lake Okeechobee when an exceedance, as defined herein, occurs more than once every six years. An “exceedance” is a decline below 11 feet NGVD for more than 80, non-consecutive or consecutive, days, during an eighteen-month period. The eighteen-month period shall be initiated following the first day Lake Okeechobee falls below 11 feet NGVD, and shall not include more than one wet season, defined as May 31st through October 31st of any given calendar year.

LOOPS Model (daily time-step) simulation period: 492 months, 41 calendar yrs, (40 water yrs)

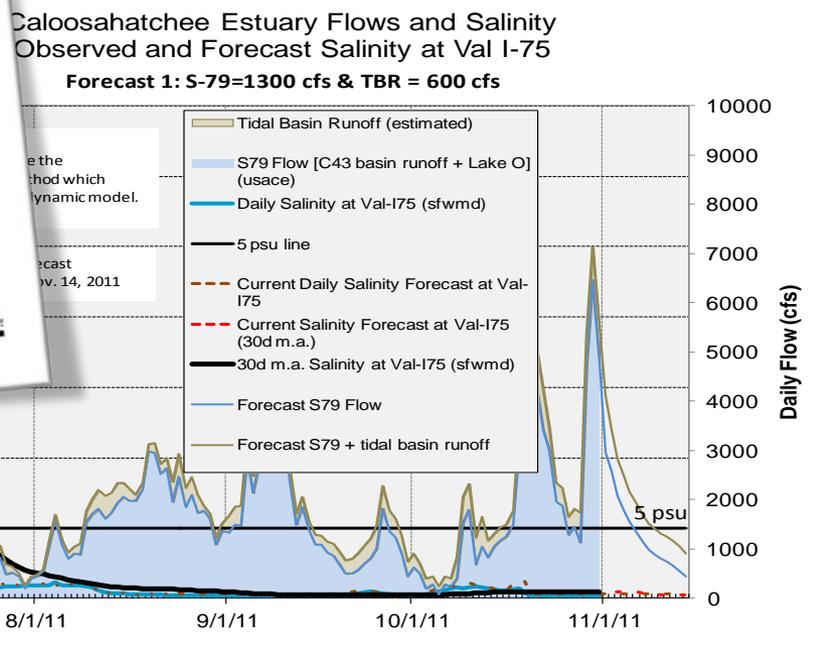
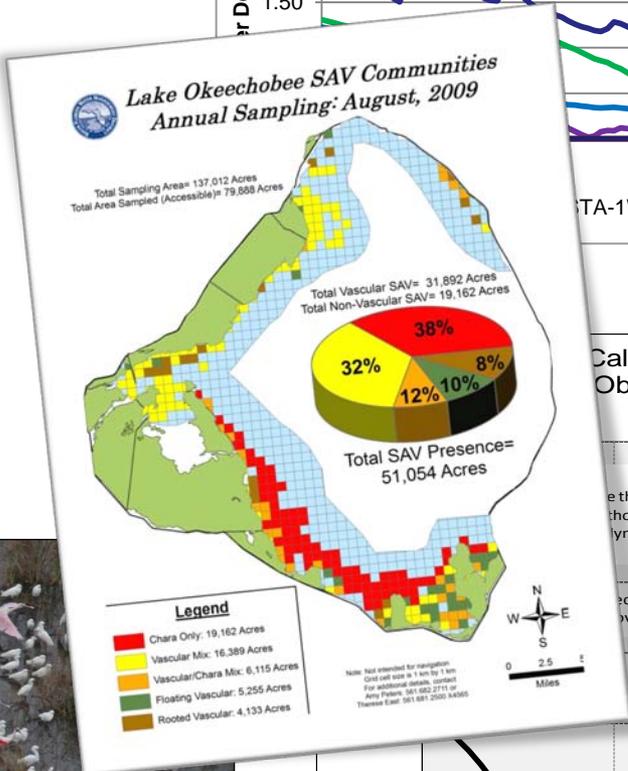
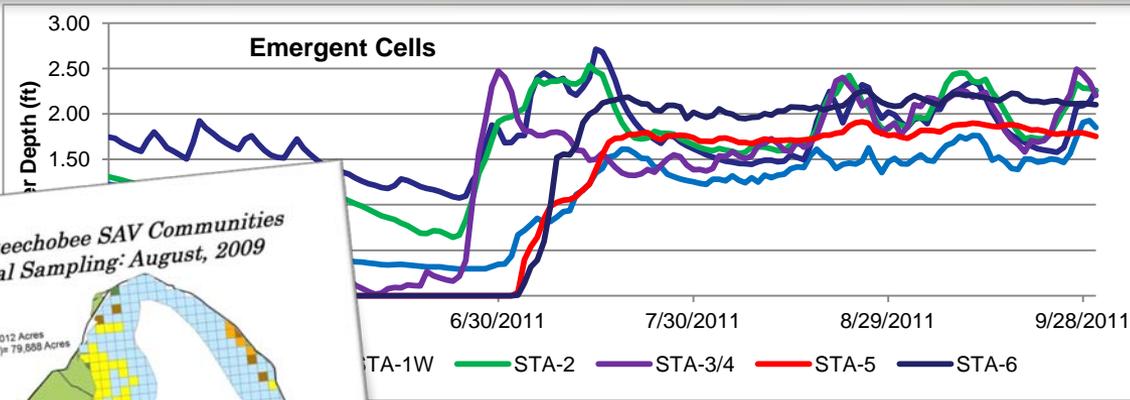
Implementation of Adaptive Protocols

- **Weekly operational recommendations based on ecological, meteorological, water supply and climate forecasting data and the AP release guidance**
- **The Governing Board is briefed monthly on current and anticipated conditions**
- **Semi-annual public workshops on systems operations and conditions for the prior 6 months and looking ahead 6 months to solicit public input**



Examples of Weekly Performance Measures

- Lake & WCA stages
- Salinity
- Wildlife
- STA condition
- Vegetation



Summary of Lake Okeechobee Adaptive Protocol (AP) implementation

- Sep 2010: AP accepted by SFWMD Governing Board
- Nov 2010: First AP releases recommended
- SFWMD consistently followed AP release guidance
- USACE implemented most SFWMD recommendations
- Caloosahatchee Estuary received approx 41,000 ac-ft of environmentally-beneficial releases from Lake Okeechobee
- AP discontinued releases for extended periods during the dry season due to dry tributary hydrologic conditions, low Lake stages, and water shortage
- No Lake O releases to CE during the wet season

How this all Ties Together

- Construction of the Central and South Florida Flood Control Project in 1947 altered the landscape to primarily address concerns about flood control
- State law (Ch. 373, F.S.) authorizes both local sponsor and water allocation roles
- Operational changes in the Lake Okeechobee regulation scheduled have been made to address ecosystem conditions and, most recently, the Herbert Hoover Dike
- The Comprehensive Everglades Restoration Program was developed to address the unintended environmental impacts associated with the C & SF Project through increased storage and more natural flow distribution



How this all Ties Together

- **Implementation of LORS 2008 resulted in**
 - Improved low flows for the Caloosahatchee Estuary
 - Increased MFL violations for Lake Okeechobee
 - A reduced level of certainty for permitted water users
- **Adaptive Protocols were developed to clarify operations given the flexibility in the schedule and provide more certainty to all users of the Lake's resources**
- **Adaptive Protocols results in slight improvements for water supply, the Lake MFL and low flows to the Caloosahatchee estuary**



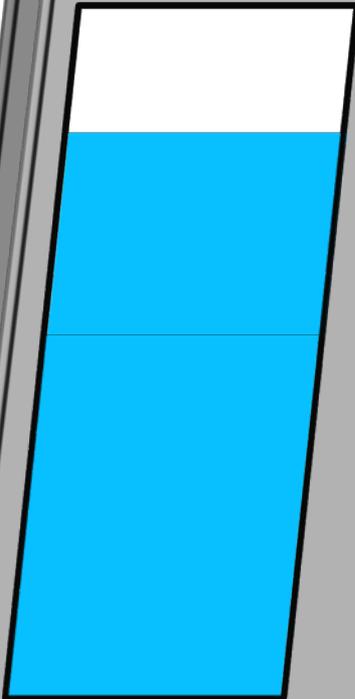
How this all Ties Together

- Adaptive Protocols does not change the existing perceived “inequity” between permitted allocations and the natural system
- Water for natural systems is addressed through a variety of approaches including operations, restoration projects, restricted allocation area rules, MFLs, reservations, etc.



WATER SUPPLY CONTROL PANEL

SUPPLY



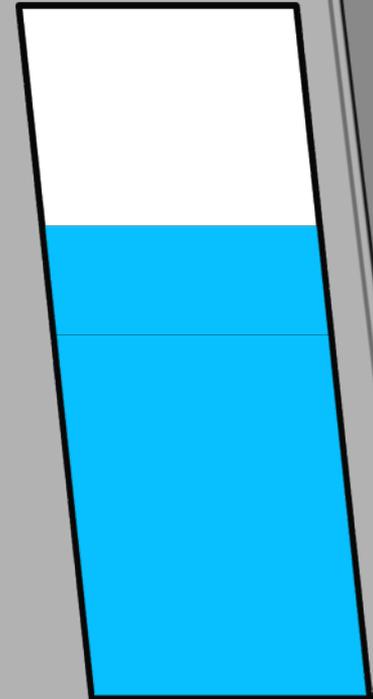
RAINFALL



EVAPO-
TRANSPIRATION



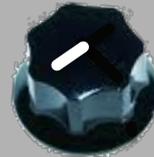
FREQUENCY



ALTERNATIVE
SUPPLY



STORAGE



OPERATIONS



WITHDRAWALS



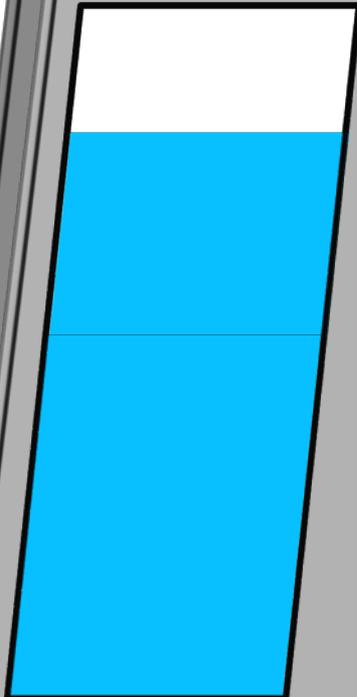
How this all ties together

- **Water Supply Control Panel - "Operations dial"**
 - **Inherent constraints:**
 - C & SF Project and a variety of historic actions got us to today's situation
 - 2008 LORS reduced supplies available
 - Limited improvements can be made with existing infrastructure
 - Substantial investments rely on predictable Lake operations
- **Next month: How District adapted its water supply program to address 2008 LORS**



WATER SUPPLY CONTROL PANEL

SUPPLY



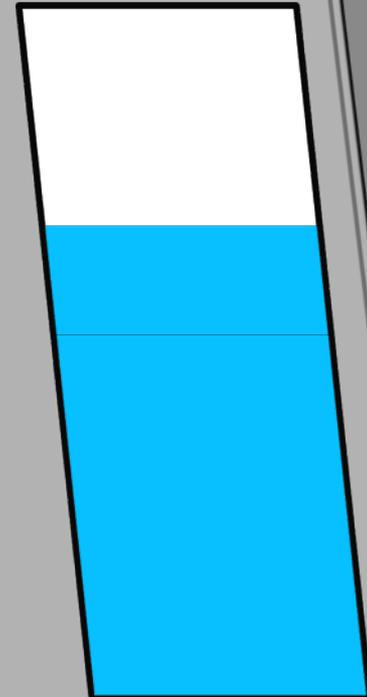
RAINFALL



EVAPO-
TRANSPIRATION



FREQUENCY



ALTERNATIVE
SUPPLY



STORAGE



OPERATIONS



WITHDRAWALS

