River of Grass Phase I Planning

Water Resources Advisory Commission Issues Workshop
January 22, 2009

Phase I Planning
Presentation Overview

- Land Acquisition Overview
- Purpose and Scope
- Map Overlays
- Environmental Needs
- Reservoir Sizing and Operations Screening (RESOPS)
- Preliminary Findings
- Environmental Assessments
- Future Meeting Topics/Next Steps

Everglades Land Acquisition

Everglades Land Acquisition
Overview

- U.S. Sugar agreed to sell land holdings under Purchase and Sale Agreement
- Separate assignable Lease provides U.S. Sugar with option to continue agriculture operations
- U.S. Sugar to retain business assets, including railroad, sugar and citrus operations
- Both agreements were subject to review and approval by U.S. Sugar Board of Directors and District Governing Board

Everglades Land Acquisition Purchase Agreement

- Minimum of 180,000 acres of land with improvements, including water conveyance infrastructure
- $1.34 billion purchase price (Certificates of Participation)
- Closing subject to financing

Everglades Land Acquisition
Lease Agreement

- U.S. Sugar will continue historical agricultural operations
- Seven year lease
- Expires June 30, 2016
- Rent of $50 per acre for first six years
- No cost for year seven

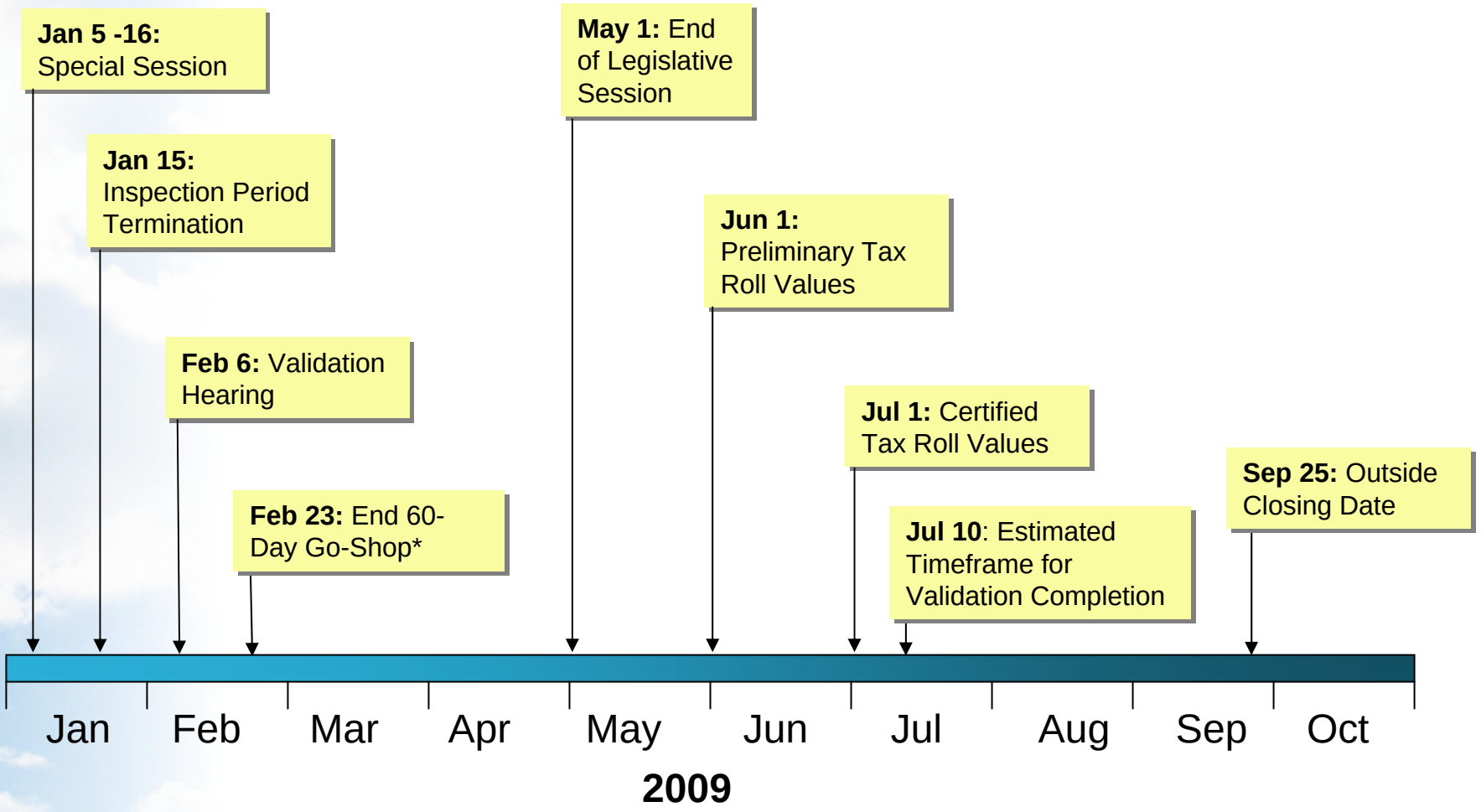
Everglades Land Acquisition
Lease Agreement

- U.S. Sugar required to:
  - Pay all property taxes and assessments
  - Control exotic and invasive plants
  - Implement Best Management Practices
- Lease will generate a minimum of $54 million; avoid more than $40 million in land management costs
- District may continue to lease land after seven years if not yet needed for restoration
- U.S. Sugar provided right to match other lease offers

Everglades Land Acquisition
Lease Agreement

- Lease allows for release of first 10,000 acres to the District with appropriate notice
  - In 2,000-acre parcels of contiguous land
- Additional 30,000 acres may be released in year six, on or after December 30, 2015
  - In 10,000-acre or more parcels of contiguous lands
- Lease allows for release of up to 3,000 acres in connection with transfers to municipalities or other governmental entities

Next Steps
Contract, Budget & Financing Timeline



*U.S. Sugar may accept a superior proposal up until validation occurs.

Everglades Land Acquisition
Public Input and Involvement

Since June 24, 2008

Meetings
- 264 Community/Government Meetings
- 10 Governing Board meetings
  - ~40 hours of presentations
  - ~125 public comments

Website – sfwmd.gov/riverofgrass
- 15,411 visits

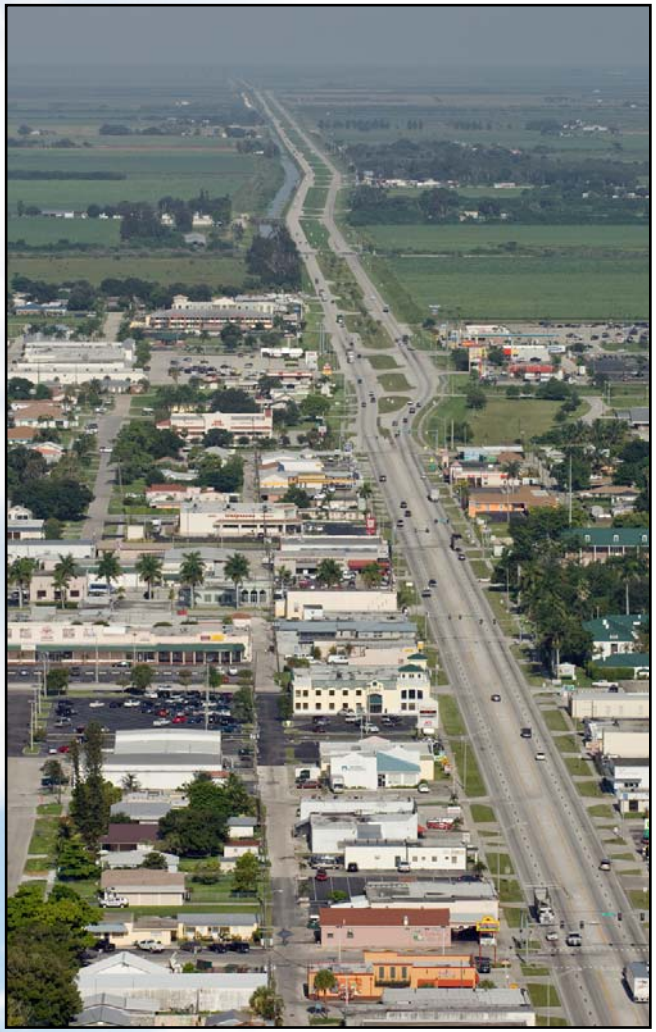
Letters and E-mails
- ~115

Resolutions
- 43 (33 in support; 10 economic concerns)

Stakeholder Comments
- Elected officials, Tribes, communities, government agencies & associations, environmental, agriculture interests, residents, businesses

Economic Activities

Office of Tourism, Trade and Economic Development



- Office of Tourism, Trade and Economic Development lead agency for economic stimulus
- December 19 meeting between Glades community leaders and OTTED
- Recommended Initiatives for Economic Stimulus
  - Acquire land for infrastructure
  - “Economic Gardening”
  - Strategic location of an inland port
- Feb 2-4 community meetings

Questions?

Phase I Planning Process – Purpose and Scope

River of Grass Phase I Planning Process

- Implement Governing Board direction
- Conduct workshops
- Hold individual meetings with stakeholders if requested

Planning Process
River of Grass Phase I Planning

- Evaluate alternative storage and treatment configurations in association with the River of Grass land acquisition
- Consider storage and treatment needs in the Northern Everglades and Everglades Agricultural Area
- Identify viable configurations
- Determine impacts and benefits of identified viable configurations, i.e. environmental, costs, economics

Planning Process
River of Grass Phase I Planning (cont.)

- Develop preliminary implementation costs of:
  - Environmental remediation
  - Planning and engineering
  - Construction, construction management and engineering during construction

Planning Process
River of Grass Phase I Planning (cont.)

- Basic planning process steps to be followed
  - Provide background information on previous work
  - Identify and discuss problems, opportunities/objectives and constraints
  - Identify and discuss alternative configurations
  - Evaluate alternative configurations
  - Present findings to WRAC and Governing Board

River of Grass Phase I Planning
Timeline and Deliverables

- WRAC Issues Workshops January through July, bi-monthly or monthly as needed
- Updates to WRAC
- Updates monthly to Governing Board
  - Initial draft alternatives scheduled for June completion
  - Final draft alternatives presented to August Governing Board to support decision making
  - More detailed future planning phases will continue after August Governing Board

Relationship of River of Grass and CERP

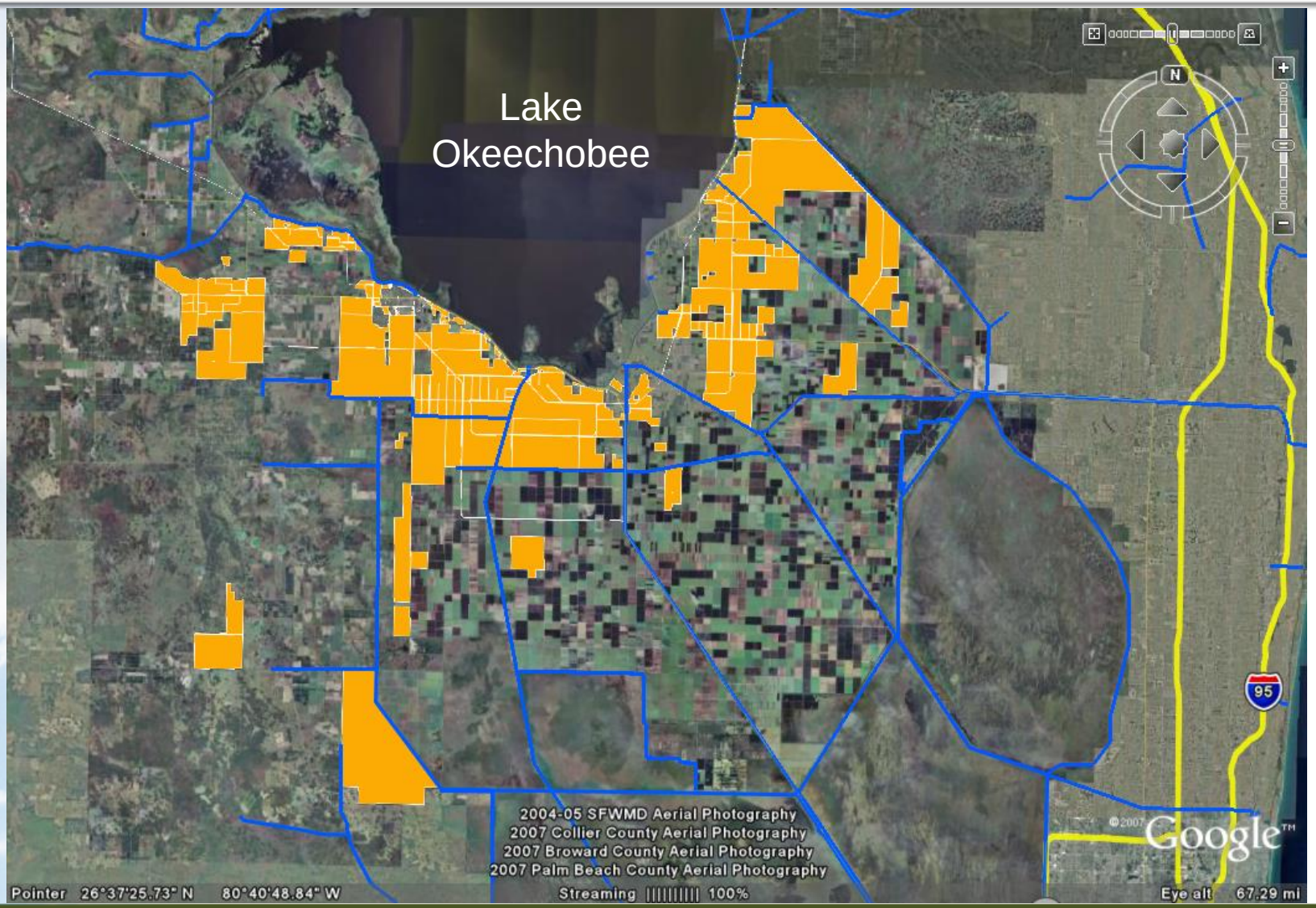
- Currently not a part of CERP
- Expected to complement CERP
- Results for Phase I planning process will be used to determine with Federal partners how River of Grass fits with CERP

Questions, Comments, Suggestions?

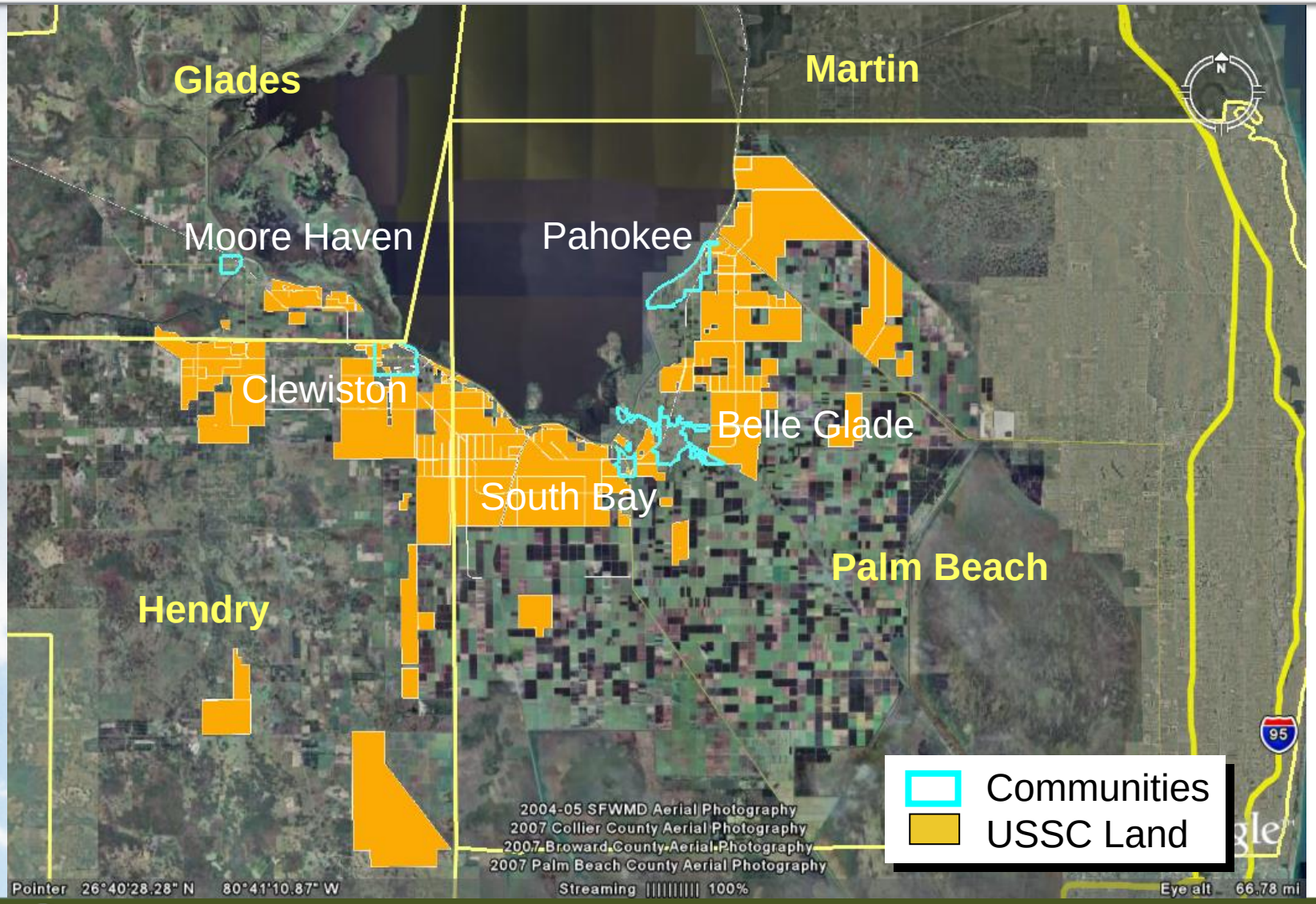
Map Overlays

Kenneth G. Ammon, P.E.
Deputy Executive Director, Everglades Restoration, SFWMD

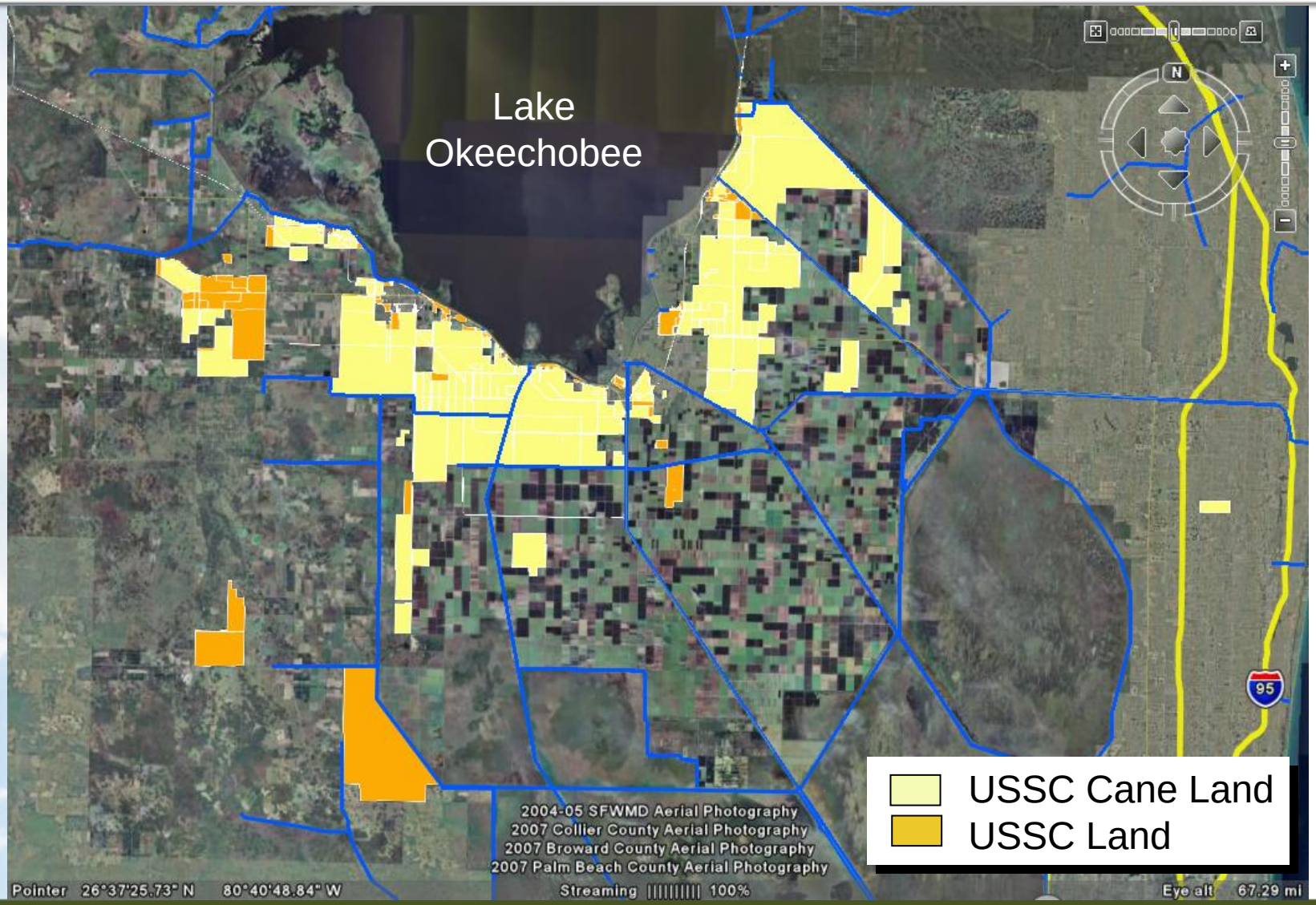
USSC Land Holdings



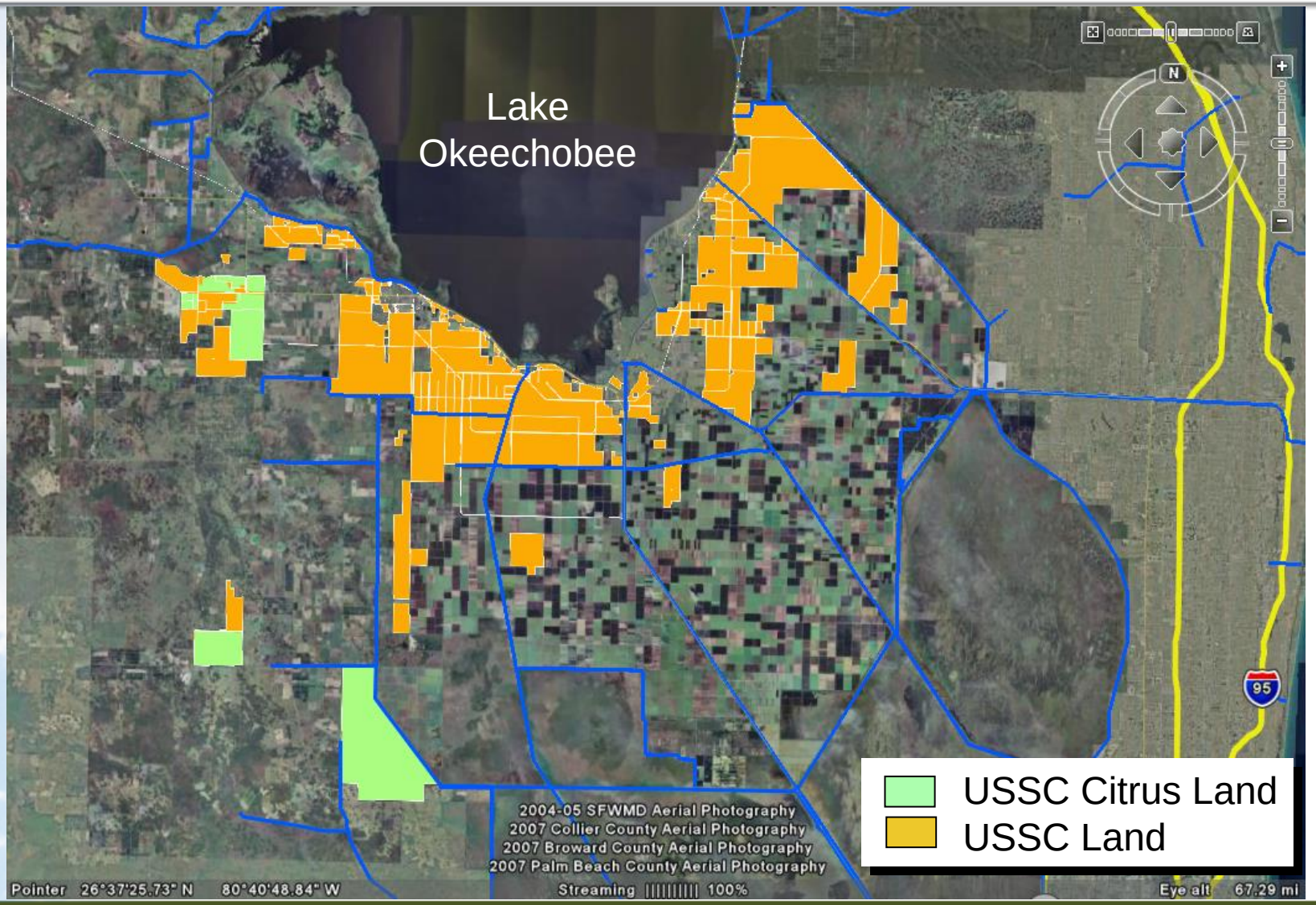
City and County Boundaries



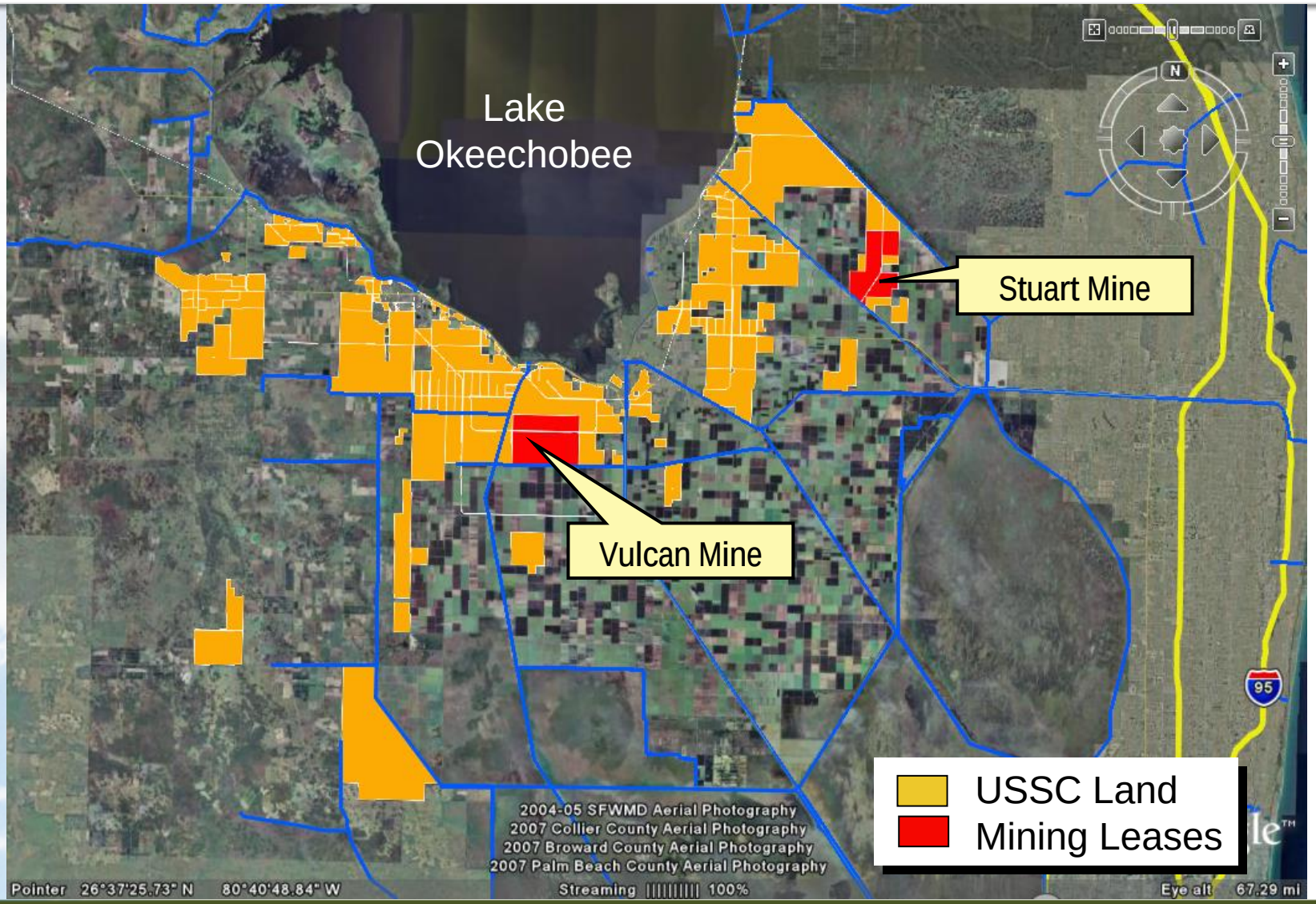
USSC Sugar Cane Fields



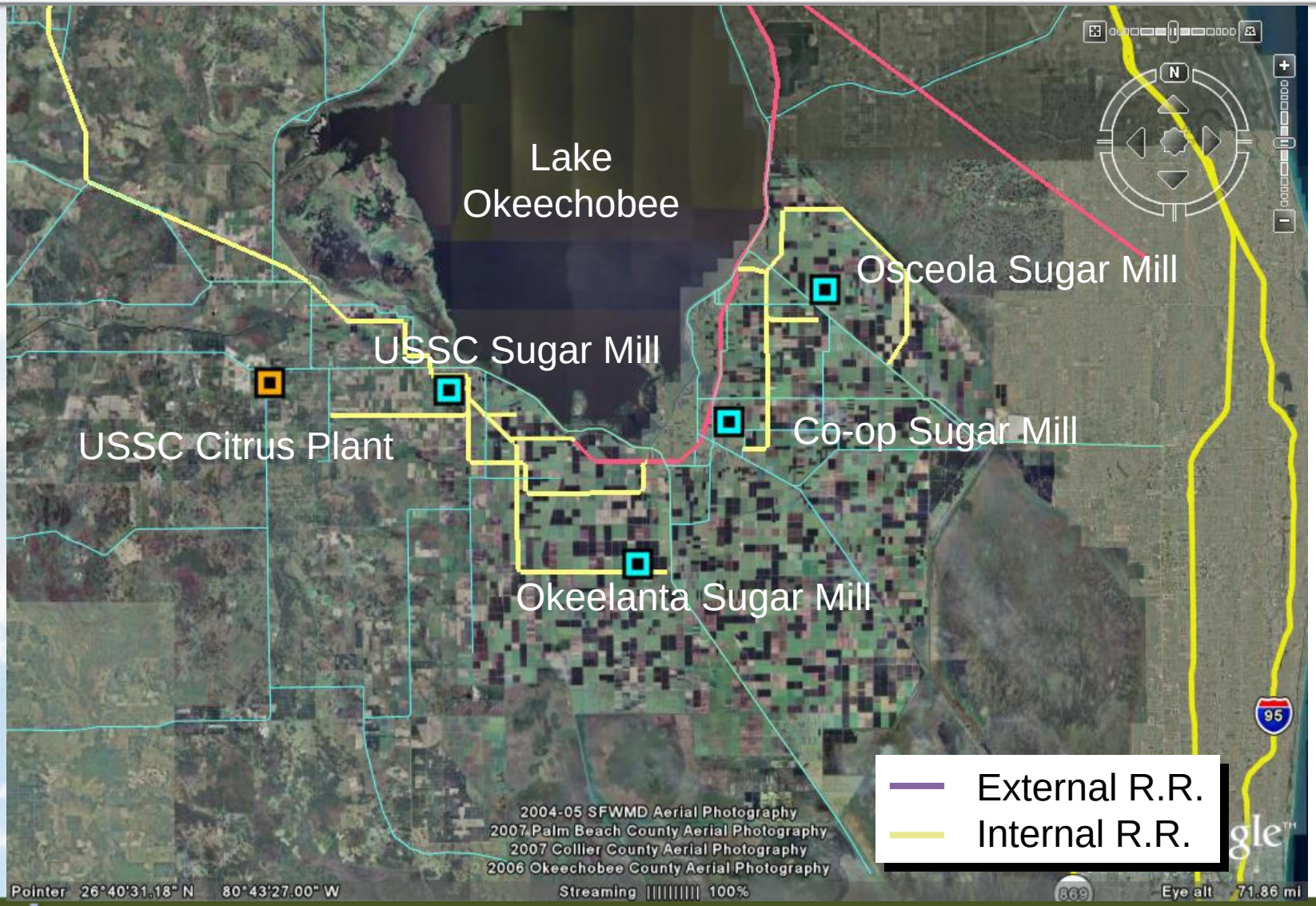
USSC Citrus


Lake
Okeechobee
N
95
2004-05 SFWMD Aerial Photography
2007 Collier County Aerial Photography
2007 Broward County Aerial Photography
2007 Palm Beach County Aerial Photography
Streaming 100%
Pointer 26°37'25.73" N 80°40'48.84" W
Eye alt 67.29 mi
USSC Citrus Land
USSC Land

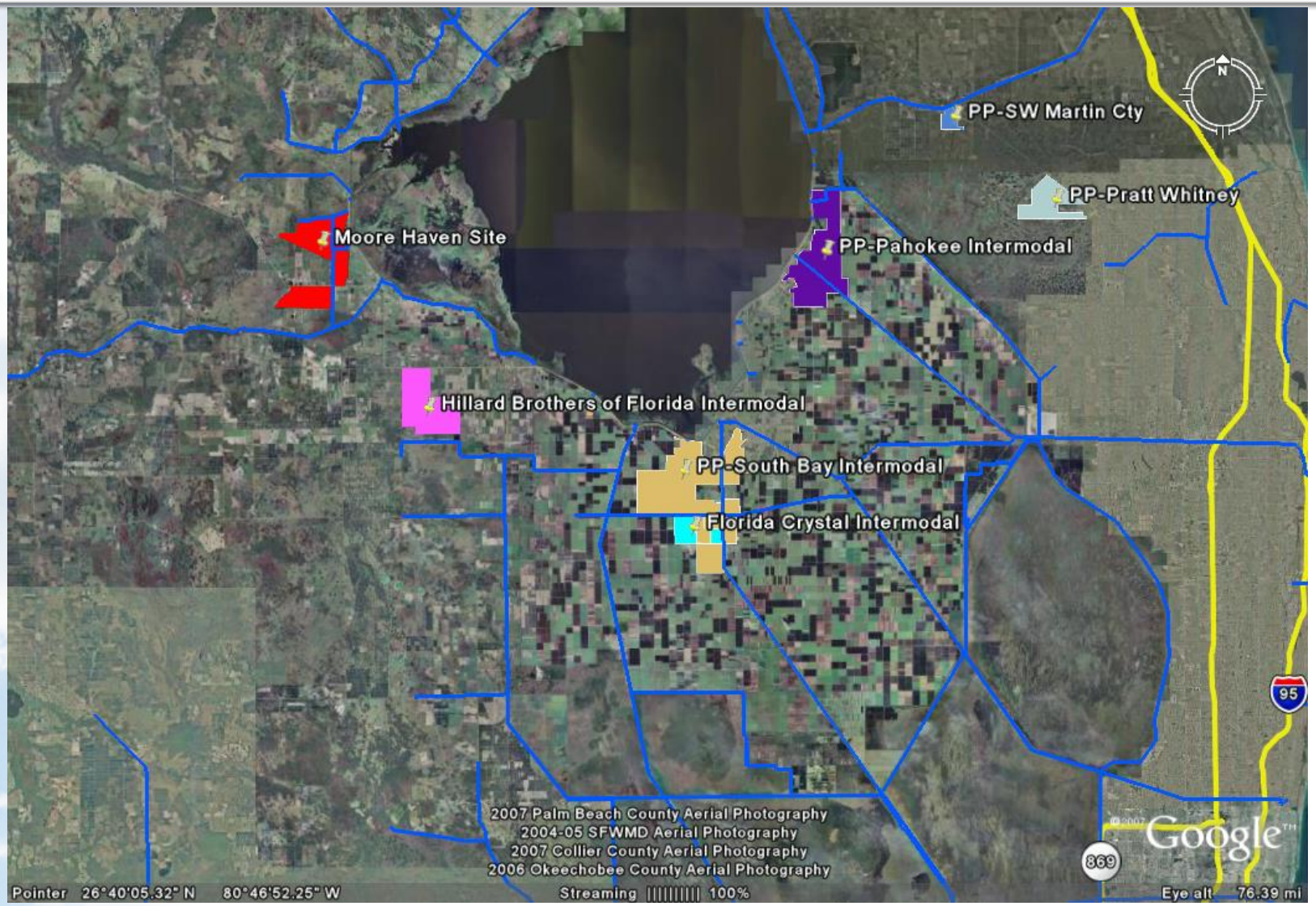
USSC Mining Acreage



Transportation Corridors/Sugar Facilities



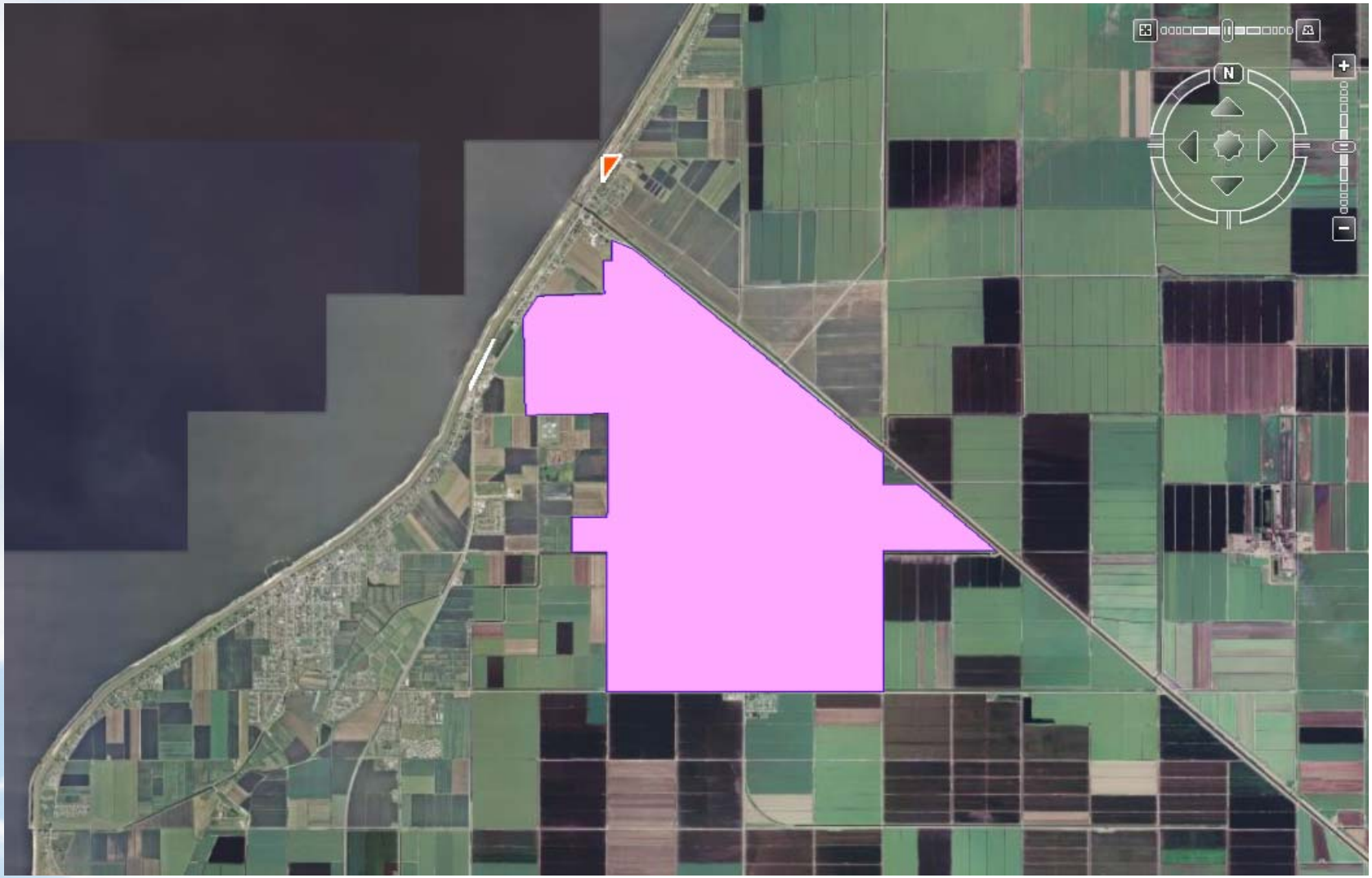
Possible Intermodal Locations



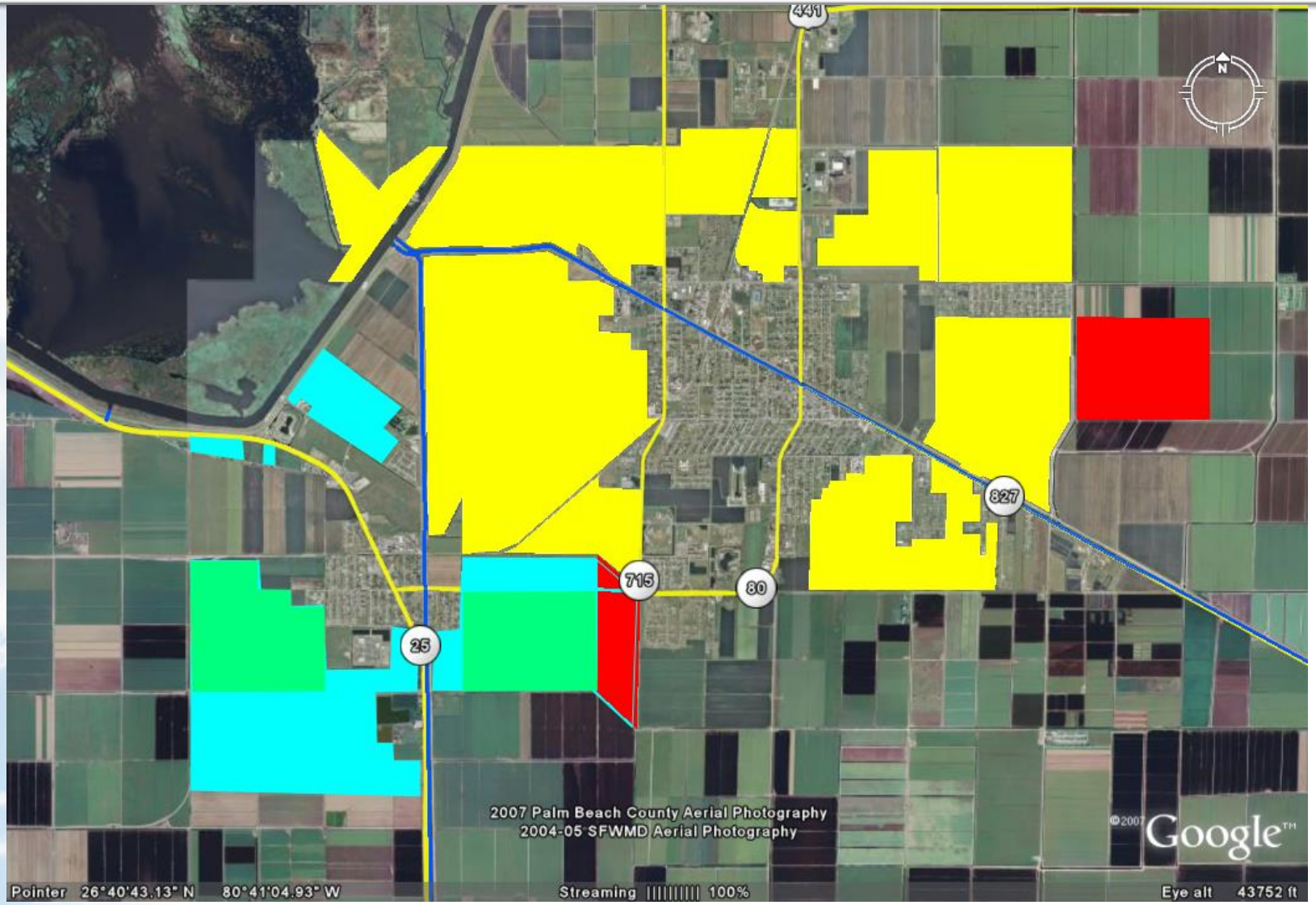
"River of Grass" Local Land Requests

January 2009

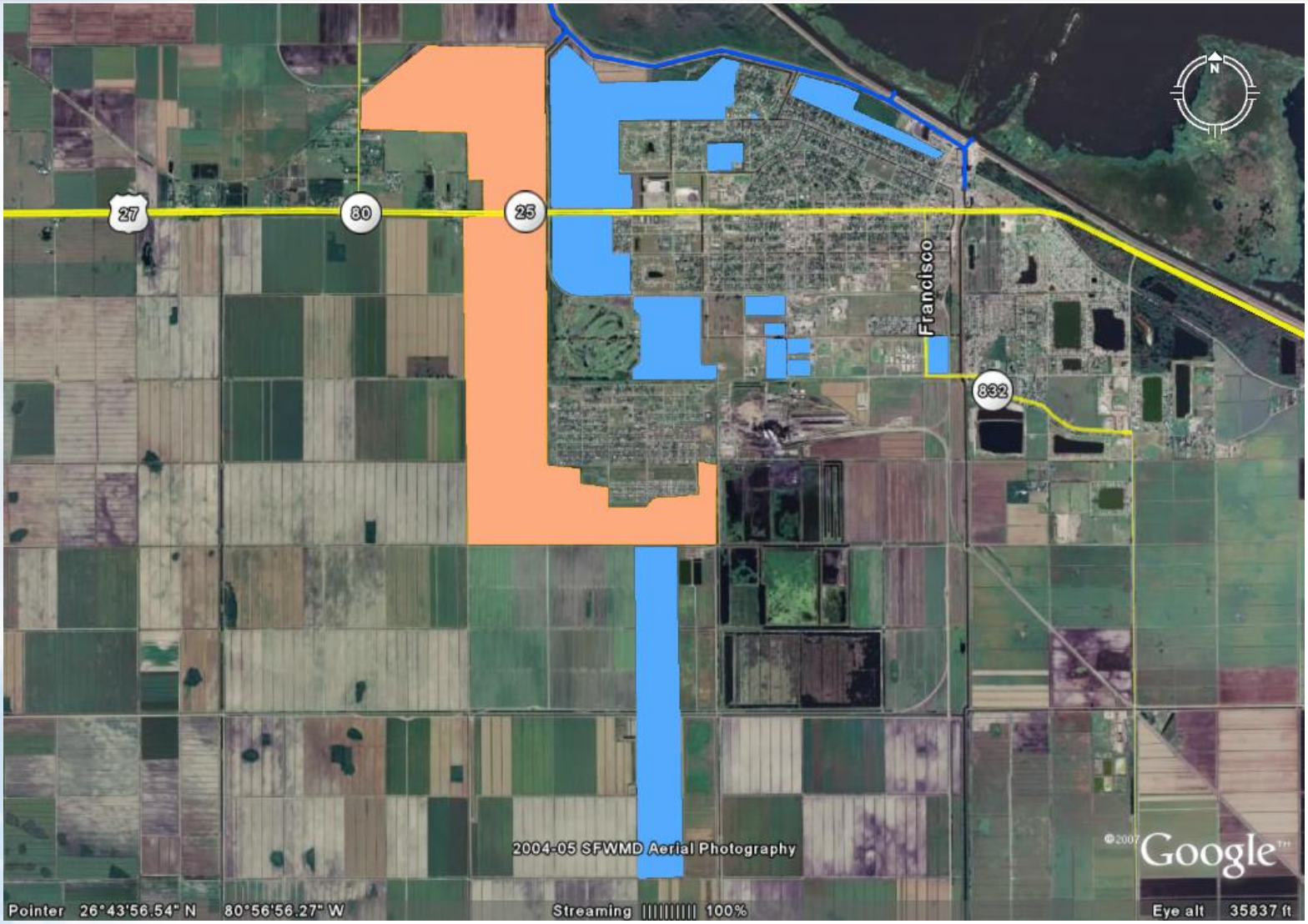
Pahokee



Belle Glade and South Bay

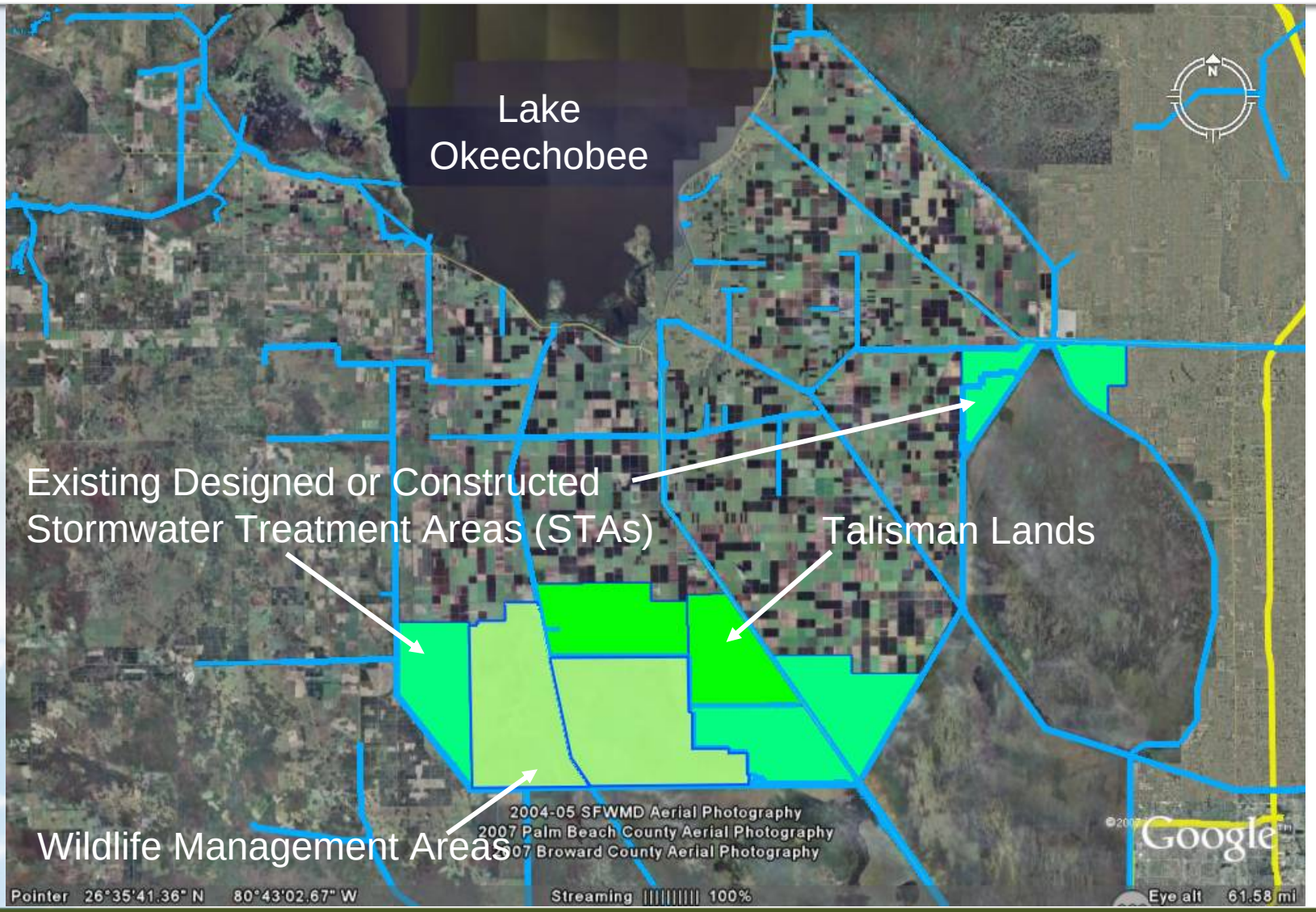


Clewiston and Hendry County

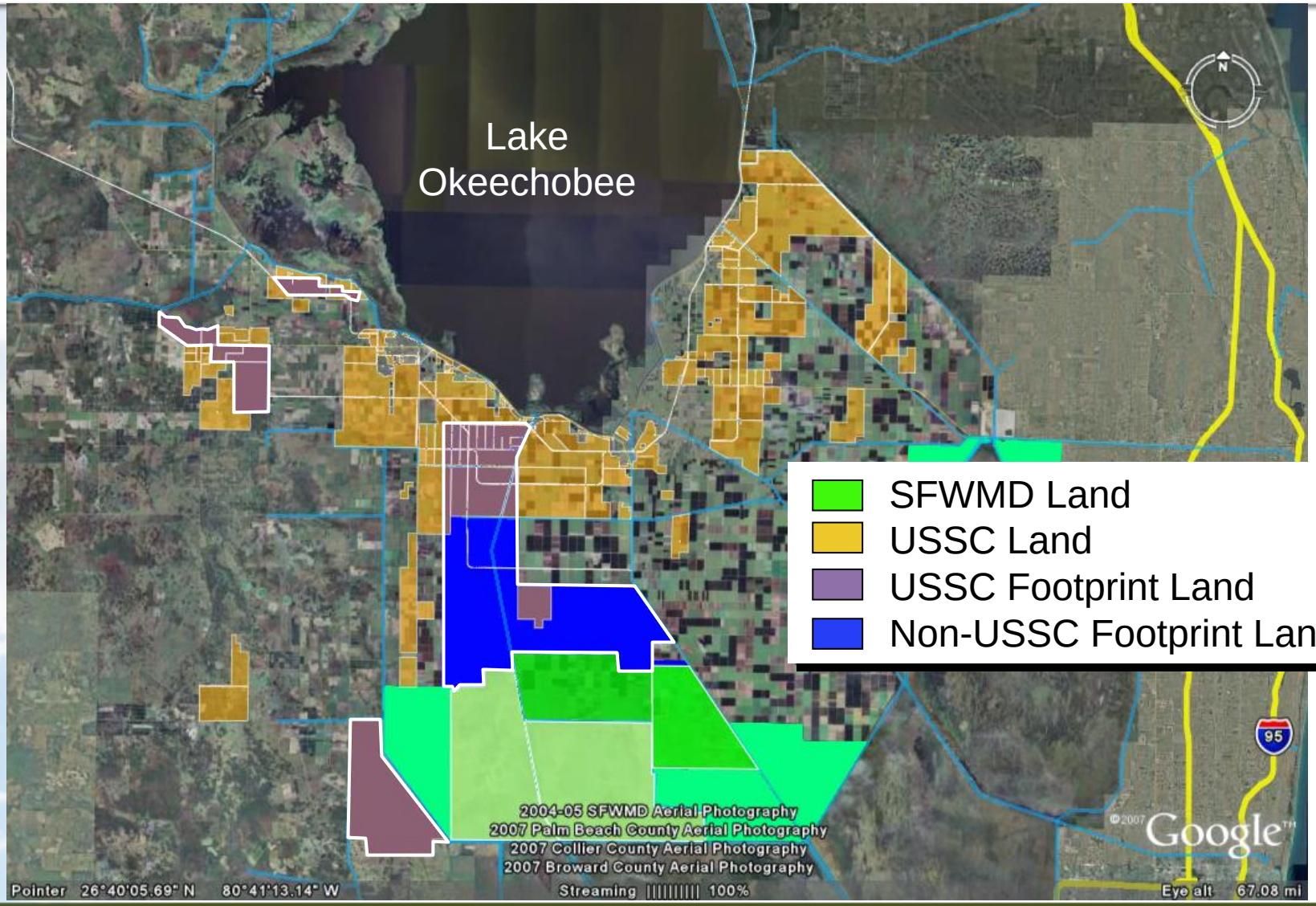


Florida Inland Navigation District

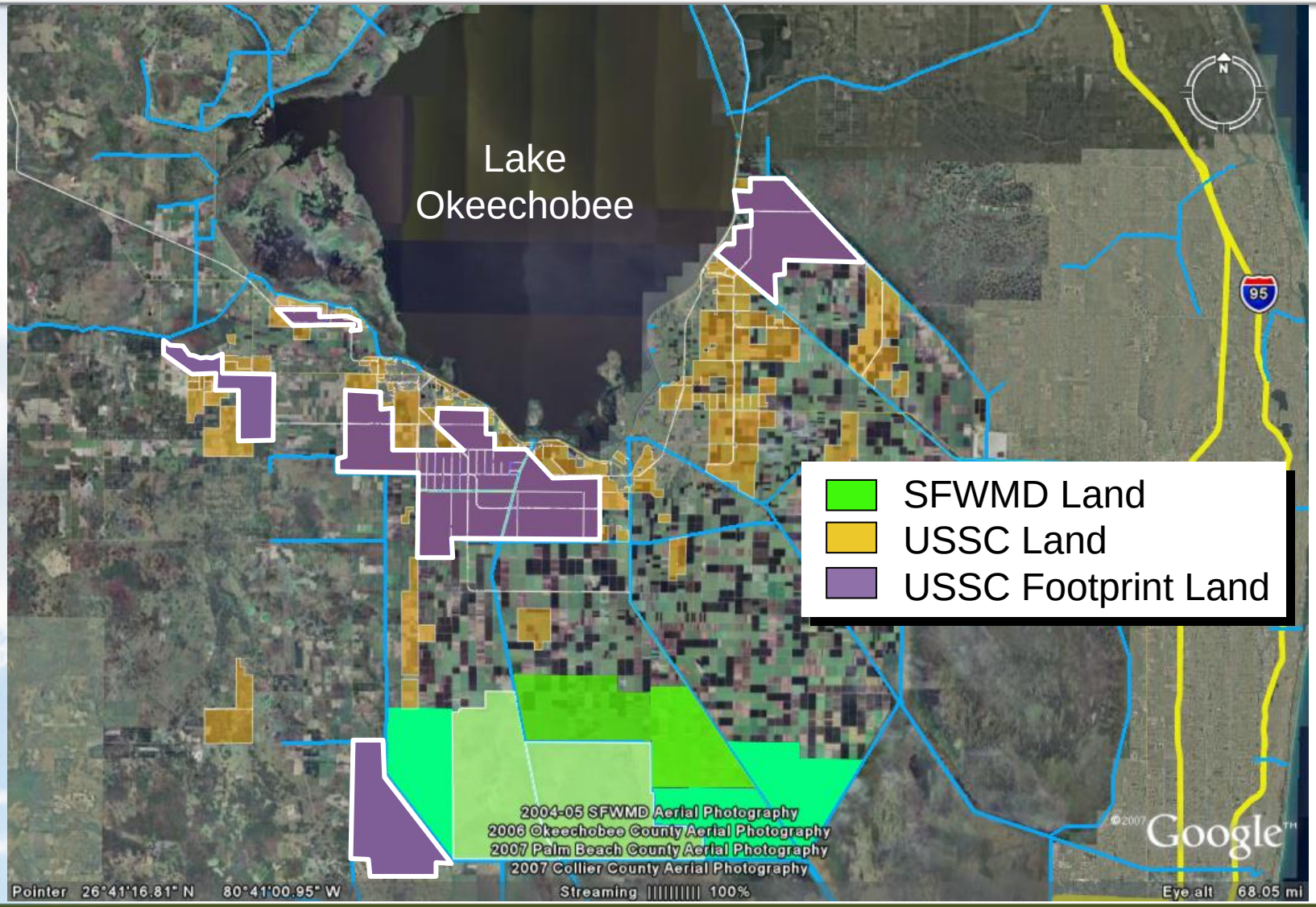
Conceptual Project Configurations
Existing Features



Conceptual Project Configurations
Adjusted to Address Land Constraints



Conceptual Project Configurations
Located Within USSC Lands



Questions, Comments, Suggestions?

Environmental Needs

Kenneth G. Ammon, P.E.
Deputy Executive Director, Everglades Restoration, SFWMD

Environmental Needs

- Lake Okeechobee-
  - Managing the lake within the desirable ecological range
  - Improving the quality of water flowing into and within the lake
  - Eliminate ‘Backpumping’ to Lake Okeechobee
  - Recognizing the limitations of the Herbert Hoover Dike

Environmental Needs

- St. Lucie and Caloosahatchee Estuaries
  - Reduce high volume, long duration regulatory discharges
  - Maintaining desirable salinity ranges within the estuaries
  - Improving the quality of water flowing into the estuaries

Environmental Needs

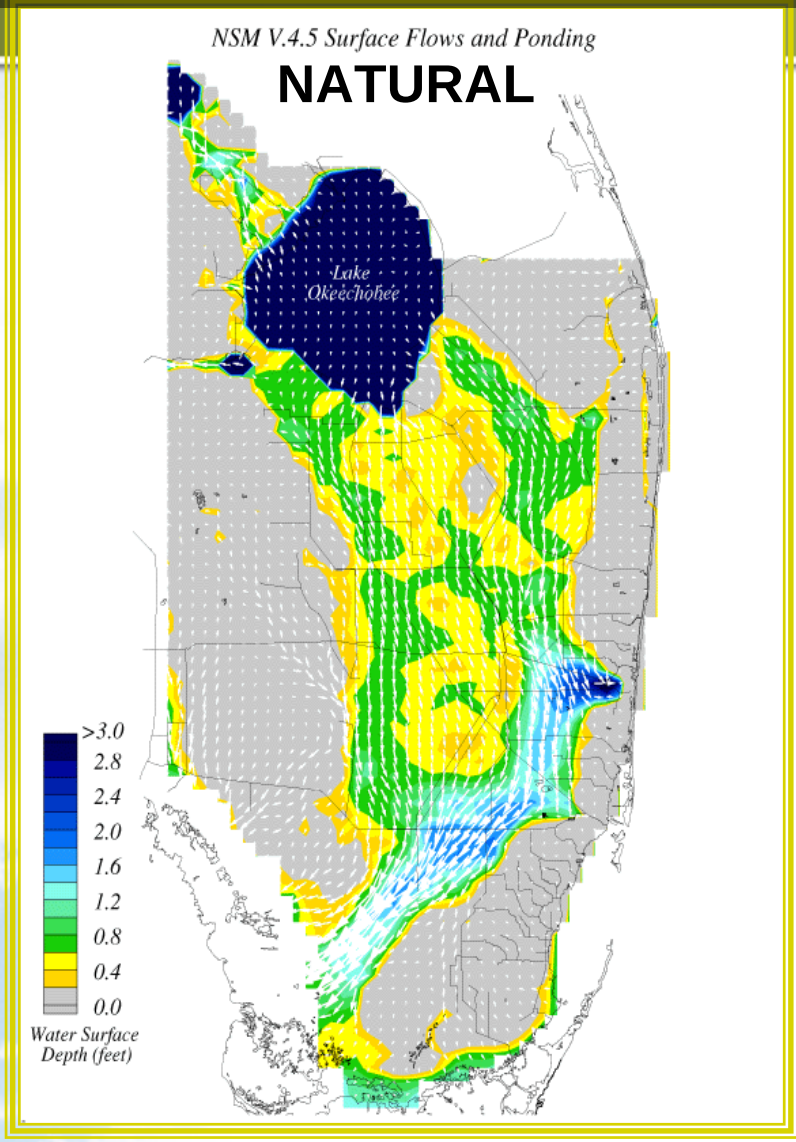
- Everglades and Florida Bay
  - Restoring pre-drainage flow volumes through the Water Conservation Areas and Everglades National Park to Florida Bay
  - Improving dry period water flows and depths
  - Improving water quality flowing into the Everglades
  - Improving timing and distribution

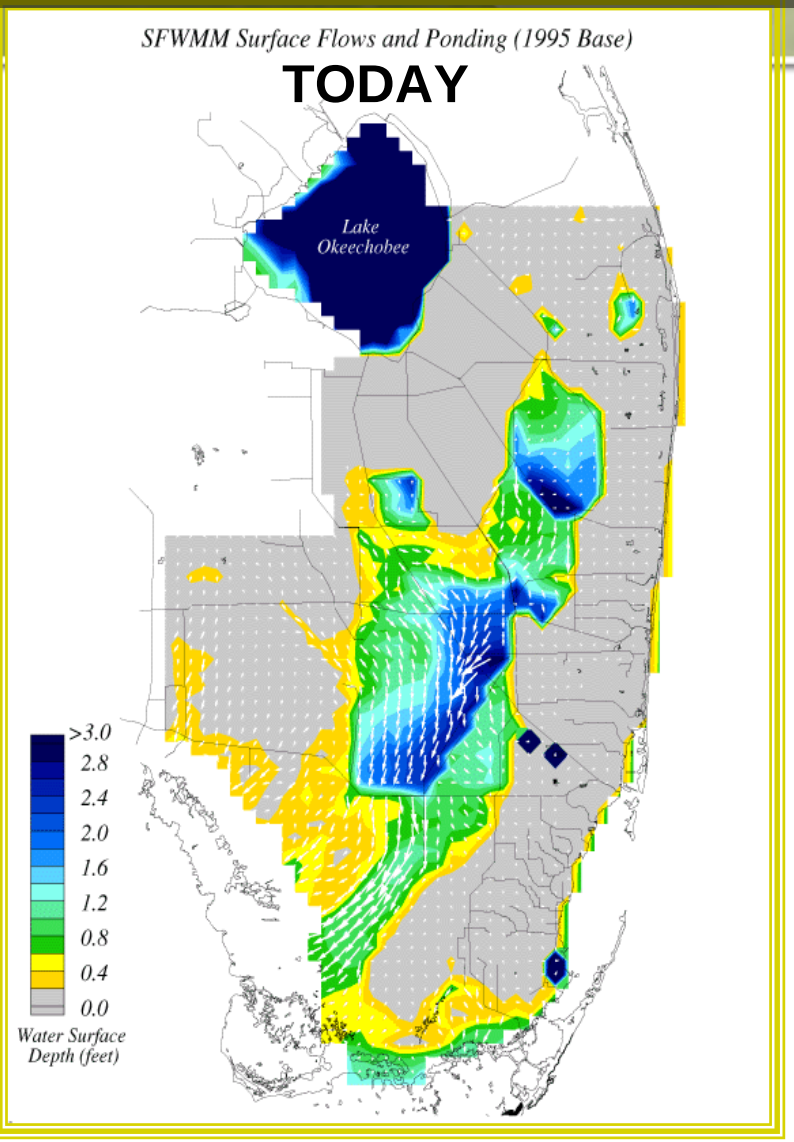
Questions, Comments, Suggestions?

Reservoir Sizing and Operations Screening (RESOPS)

Tommy B. Strowd, P.E.
Assistant Deputy Executive Director, Everglades Restoration, SFWMD

Everglades: Natural vs. Altered Ponding Depth Patterns

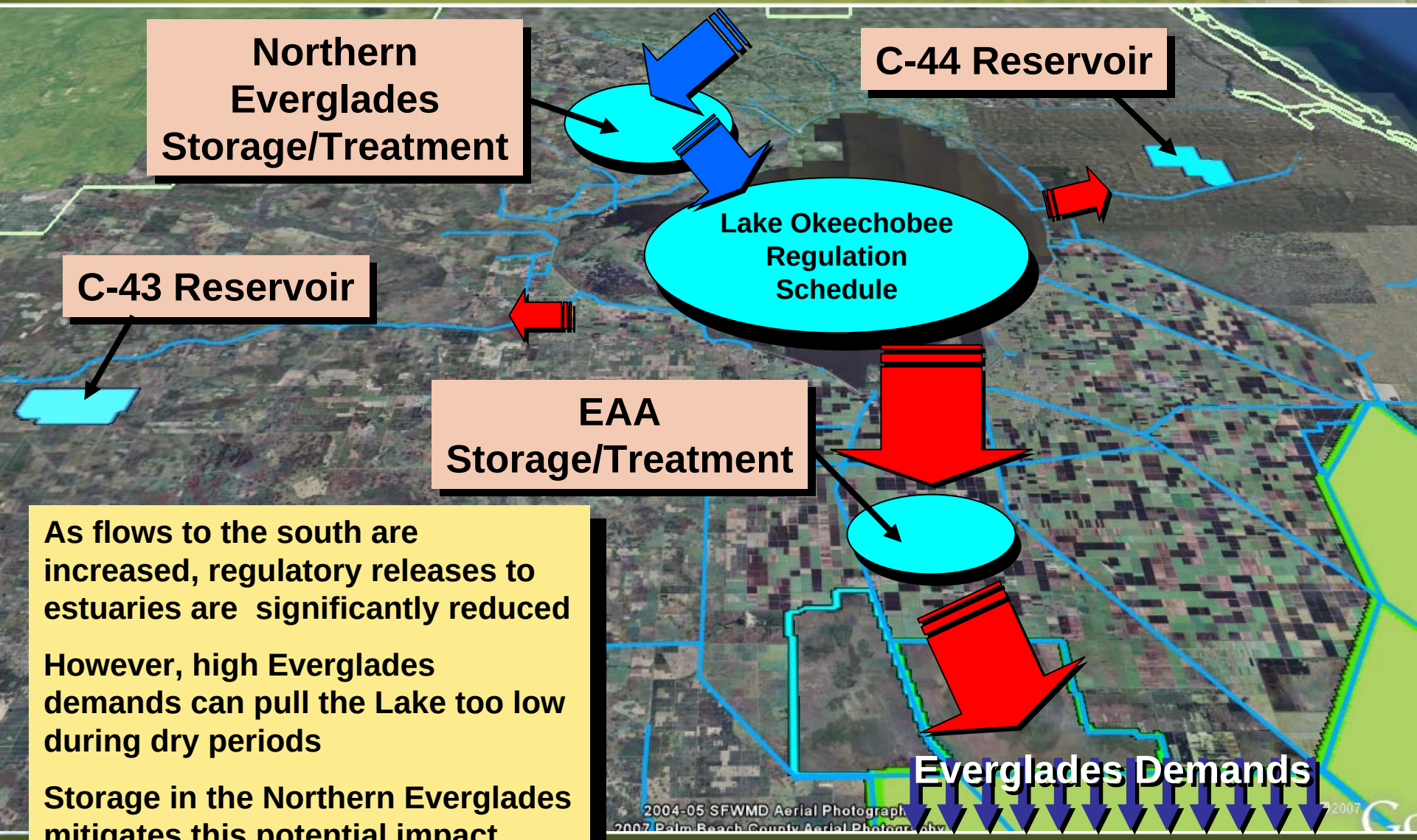




Changing the Flow

- Variables we need to consider changing
  - Storage and Treatment within the Everglades Agricultural Area (EAA)
  - Northern Everglades storage
  - Lake Okeechobee operations
  - Everglades demands

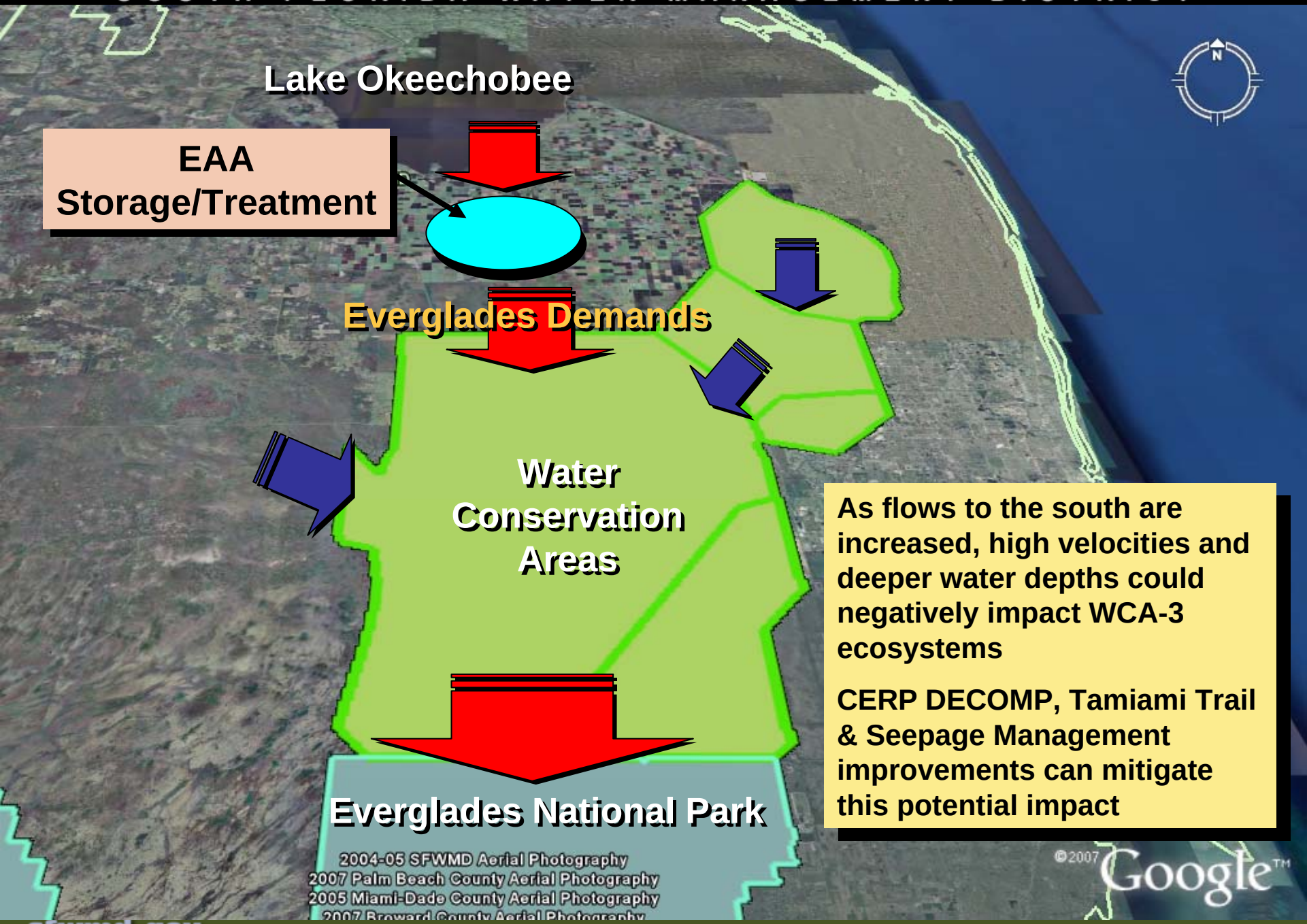
Hydrologic Relationships



As flows to the south are increased, regulatory releases to estuaries are significantly reduced

However, high Everglades demands can pull the Lake too low during dry periods

Storage in the Northern Everglades mitigates this potential impact



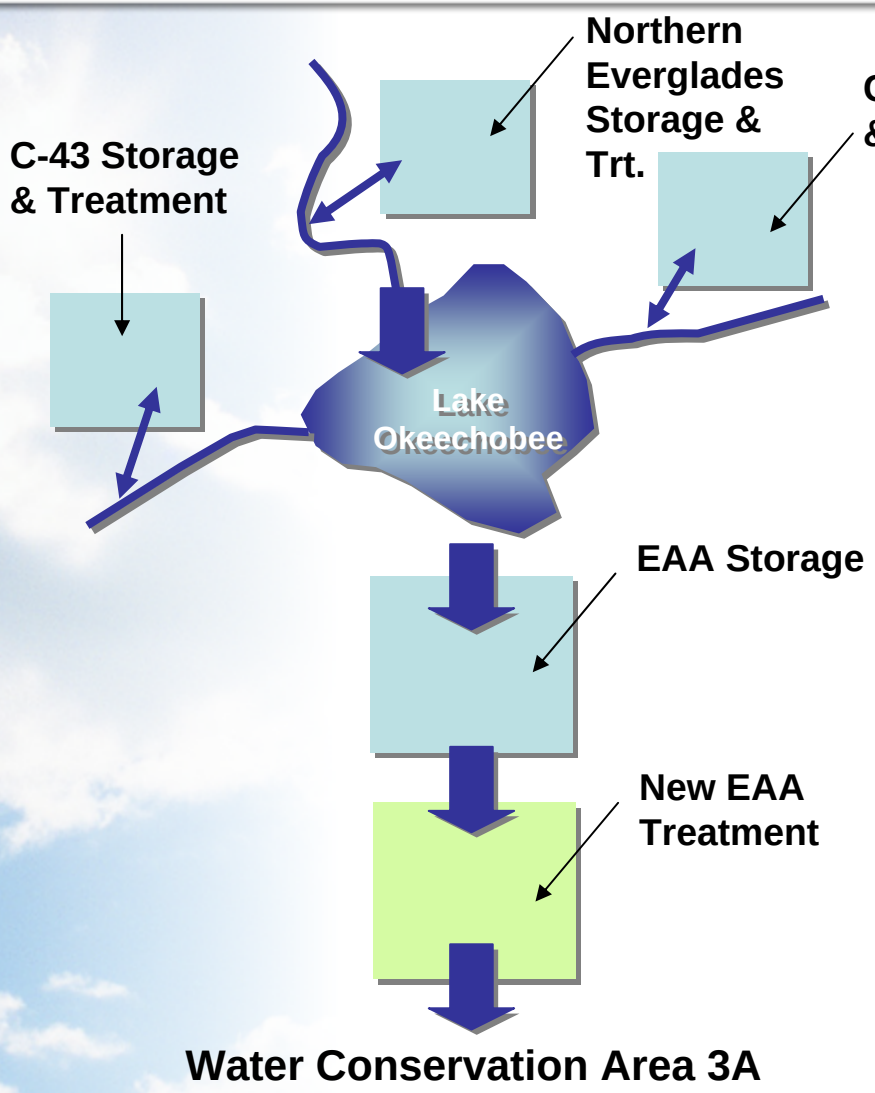
As flows to the south are increased, high velocities and deeper water depths could negatively impact WCA-3 ecosystems

CERP DECOMP, Tamiami Trail & Seepage Management improvements can mitigate this potential impact

Hydrologic Analysis Tool Selection

- Due Diligence assessment required a relatively simple tool for screening a large number of facilities and operations in a short period of time
- SFWMM (2x2) Used in CERP, can take years to evaluate
- Regional Simulation Model (RSM) Used in Northern Everglades, requires months to evaluate
- RESOPS was used as a screening tool in the Northern Everglades Plan
  - Simple, flexible and fast water budget analysis tool in an EXCEL spreadsheet format

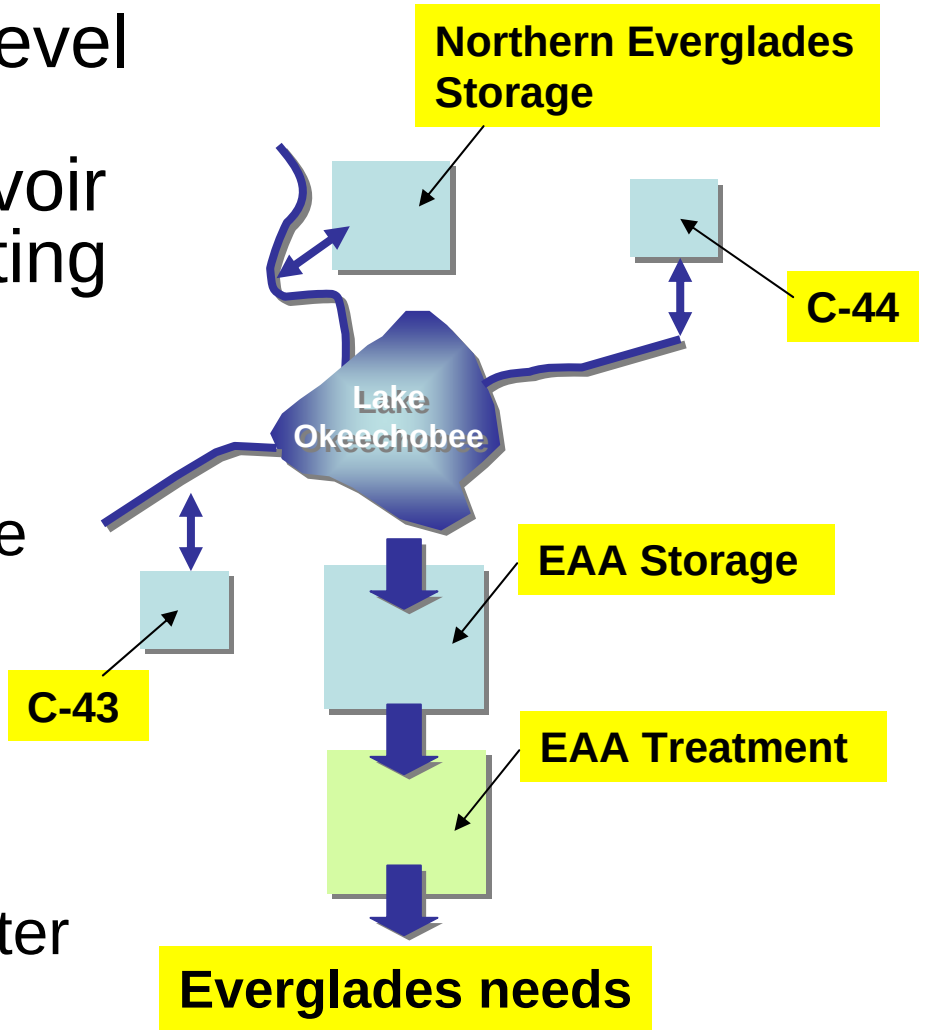
Conceptual Project Configurations
Preliminary Hydrologic Analysis



- Basic 'Water Budget' analysis
  - 41 year period of record (1965-2005)
- Considers a range of natural system flows for the Everglades
- Flows of the necessary magnitude require that the major water budget elements are considered as a system

What is RESOPS?

- Provides rapid screening-level testing of the integrated effects of alternative reservoir sizes and proposed operating rules for…
  - Lake Okeechobee
  - Northern Everglades Storage
  - EAA Storage
  - C-43 Storage
  - C-44 Storage
  - Flows to the Everglades Water Conservation Areas



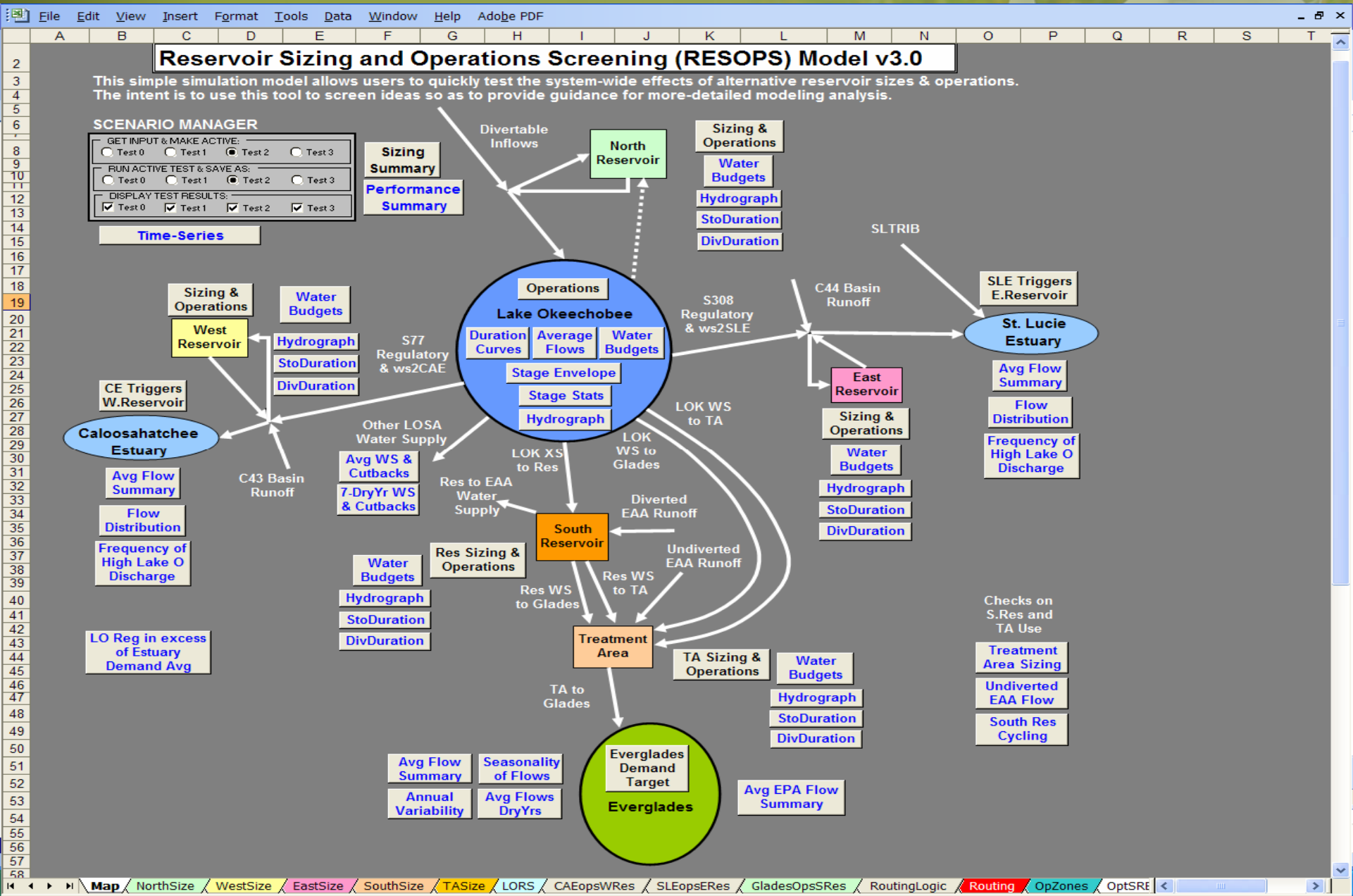
What is RESOPS? (continued)

- The strength of the RESOPS Model is its ability to quickly test the performance of alternative configurations and scenarios to screen ideas for the purposes of the Due Diligence assessment.
- It also includes an optimization routine that can automatically run a multitude of computer generated alternative scenarios
  - For this Due Diligence effort approximately **250,000** individual scenarios were tested in 60 days.

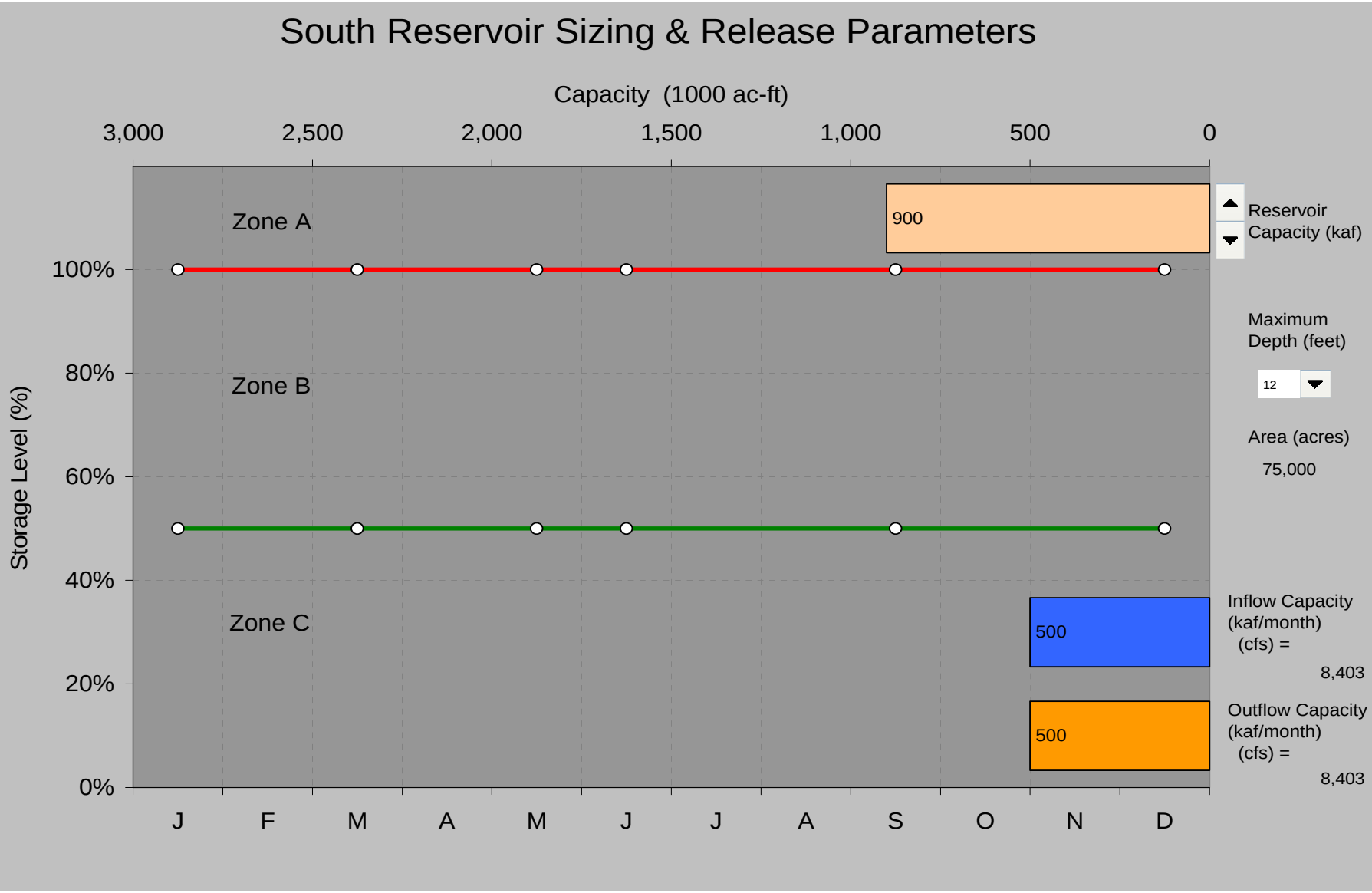
RESOPS- Input Variables

- Input requirements include:
  - Reservoir and treatment area capacities & operations, and Lake Okeechobee operations;
  - Monthly time-series (1965-2005) of rainfall, evaporation, tributary basin runoff, service area demands, estuary water needs, and
  - Everglades water needs (flow time-series)
- Source of inputs is primarily the SFWMM

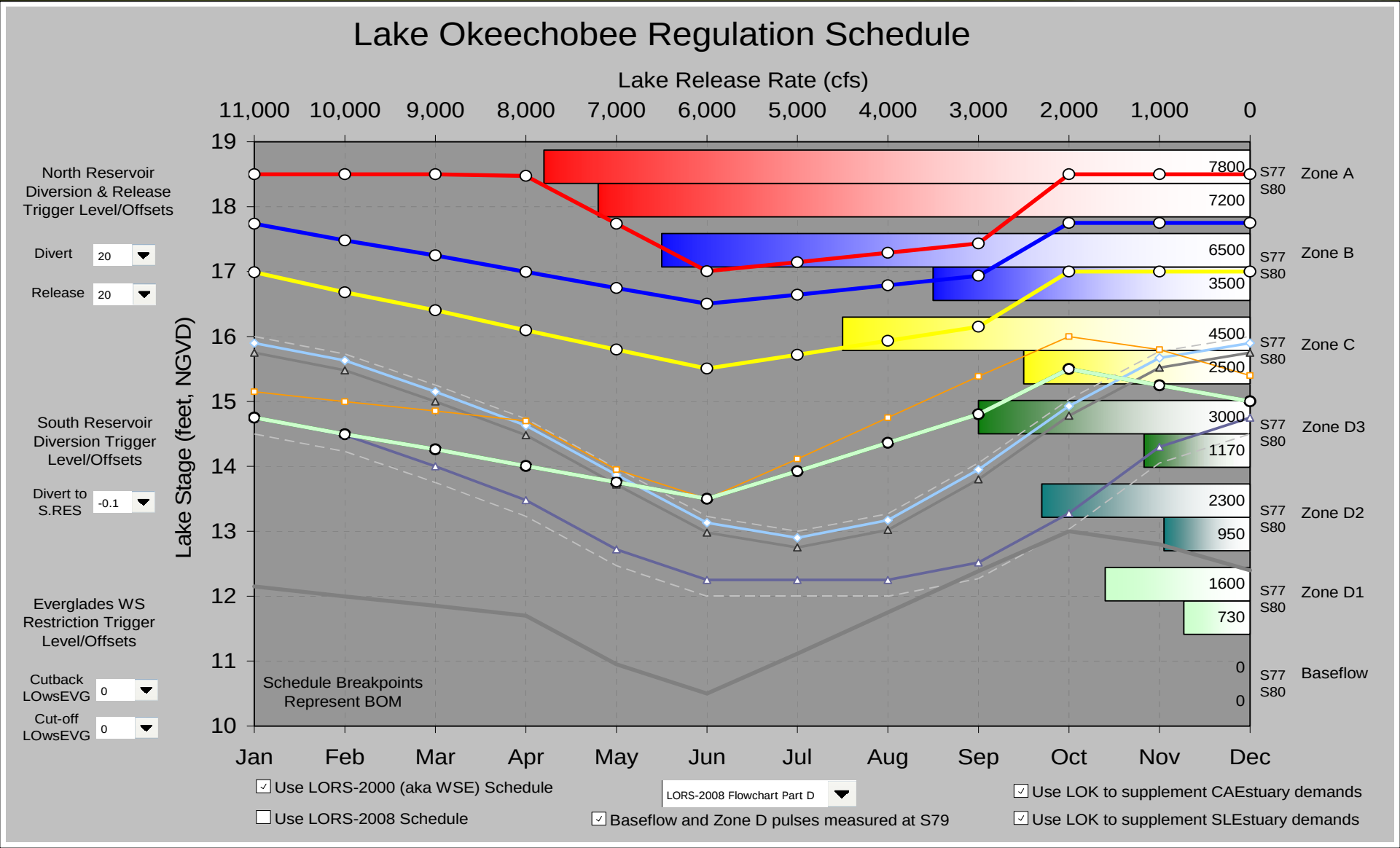
Reservoir Sizing and Operations Screening (RESOPS) Model



Input Variables – Storage Facility Capacities



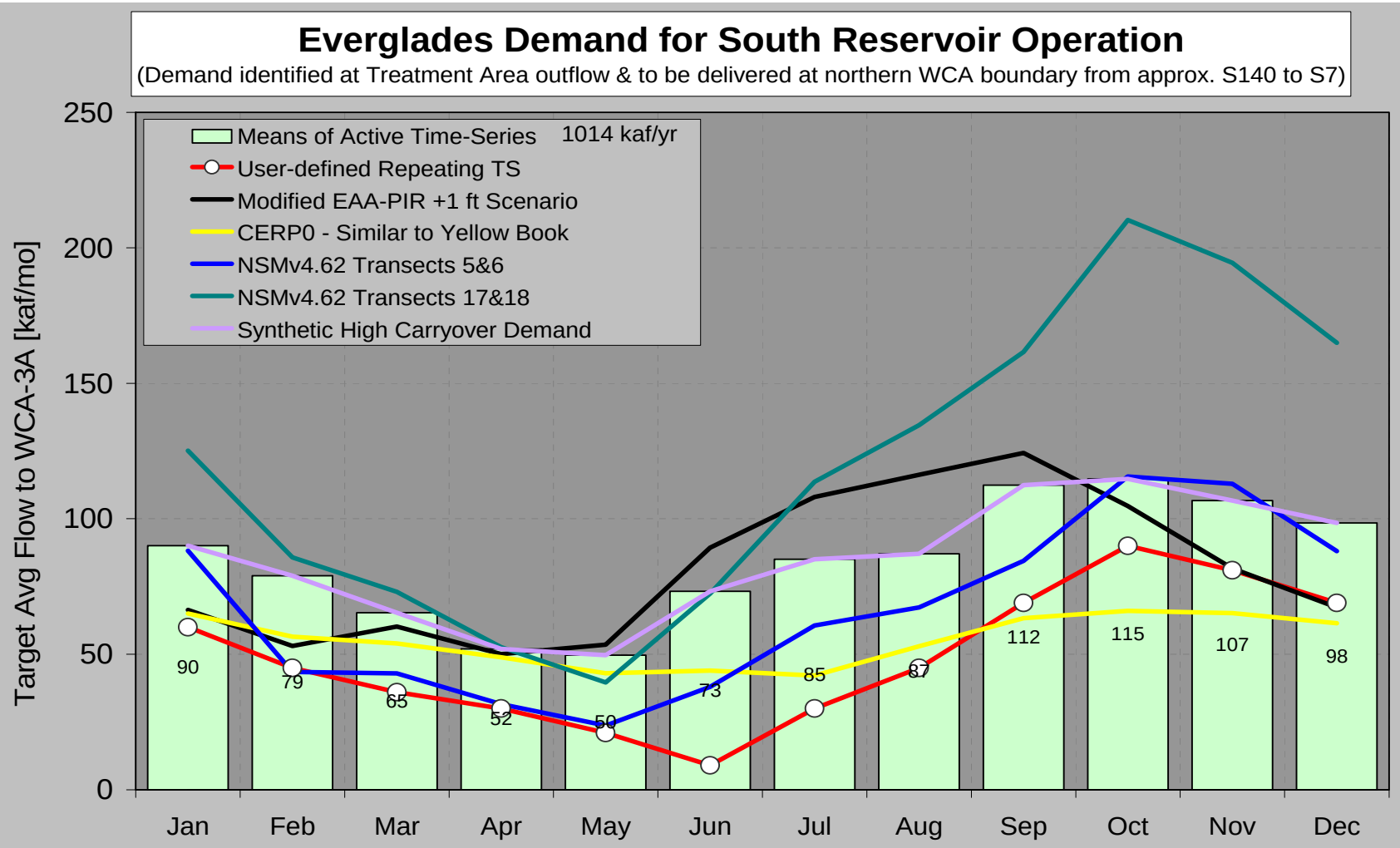
Input Variables – Lake Okeechobee Operations



RESOPS- Input Variables (continued)

- Simulates flows to the Everglades by attempting to meet a flow target time-series at the northern boundary of WCA-3A
  - Users can experiment with alternative time-series, or use a multiplier to simulate what-if scenarios
- Specific benefits or impacts to the Everglades hydropatterns from additional flows cannot be estimated from RESOPS
  - Requires more detailed models such as the SFWMM or RSM to evaluate

Input Variables – Everglades Water Needs



Select Everglades Demand

Synthetic High Carryover Demand

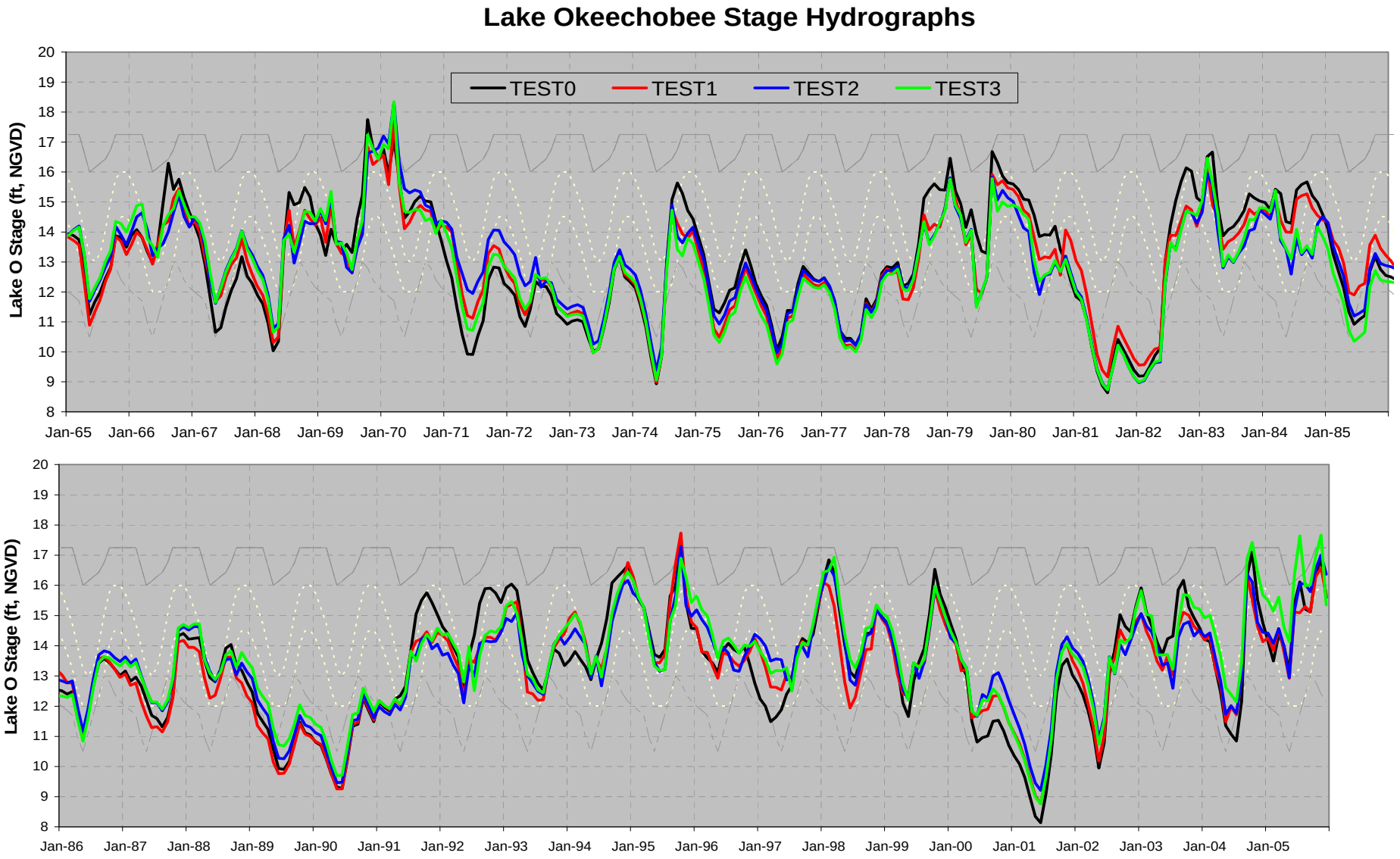
Multiplier **1.000**

Due to high uncertainities in the Everglades water needs & complexities with modeling the Everglades, the Glades water needs are simulated by the RESOPS Model as a user-defined flow time-series. Users can experiment with alternative time-series, or use a multiplier to simulate what-if scenarios. The impacts to the Everglades hydropatterns from additional flows cannot be estimated from RESOPS. Users need to understand that more flow may cause adverse impacts to the Glades.

RESOPS- Outputs

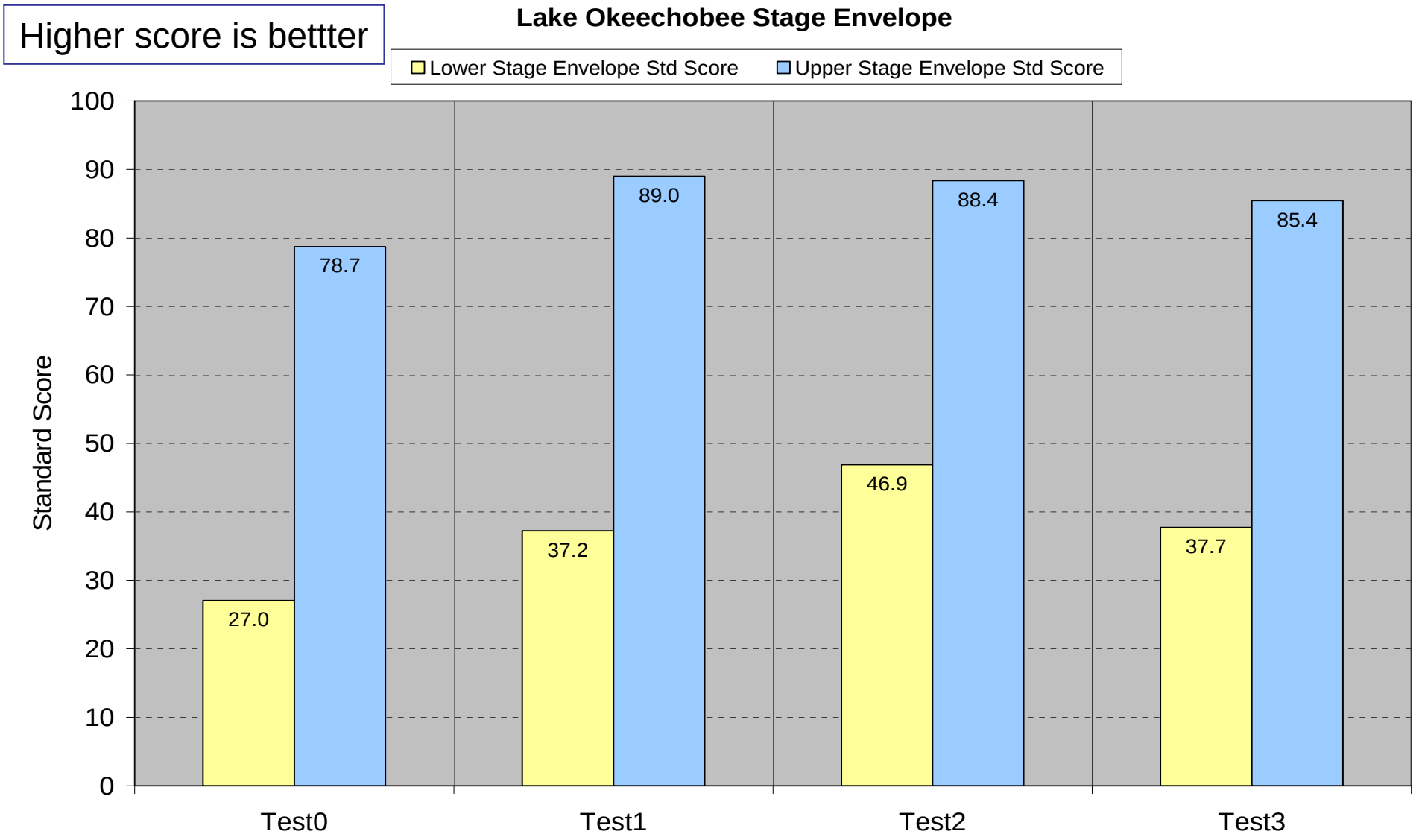
- Outputs include:
  - Water budgets,
  - Stage hydrographs,
  - Stage and flow duration curves
    - Lake Okeechobee
    - Storage;
  - Typical planning-level hydrologic performance measures
    - Lake stage envelope scores,
    - estuary flow distributions,
    - water deliveries to the Everglades,
    - water shortage indicators; and
  - Performance curves that enable systematic evaluation of multiple storage facility capacity configurations.

RESOPS sample outputs - Lake hydrograph



RESOPS sample outputs - Lake stage envelope

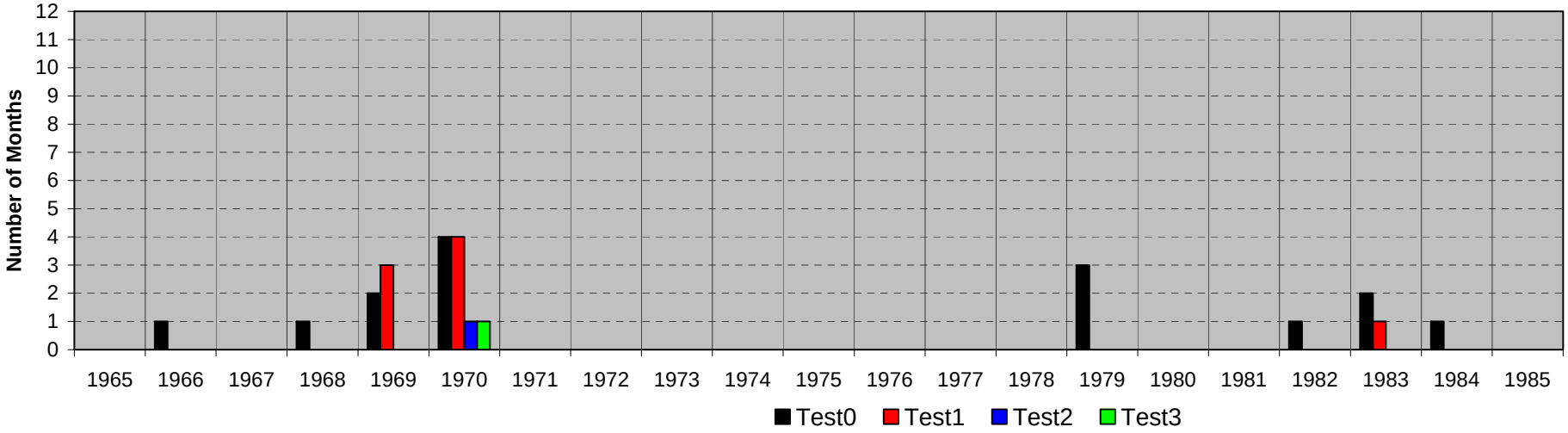
Higher score is bettter



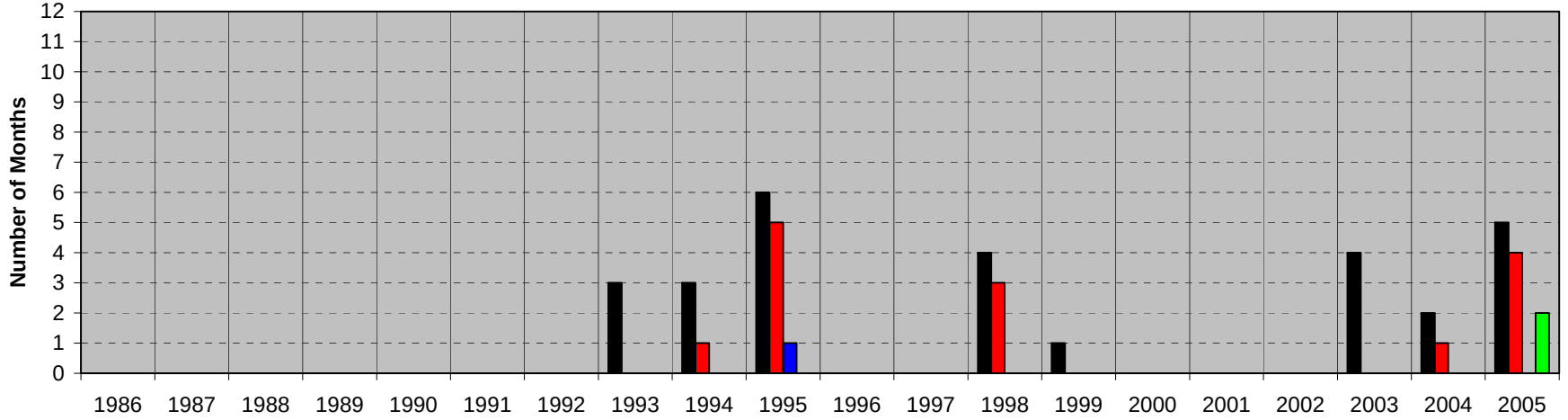
RESOPS sample outputs – Caloos. Estuary

Annual Frequency of Caloosahatchee Estuary High Discharge Events

# of Months S77reg contributed to S79 > 2800cfs

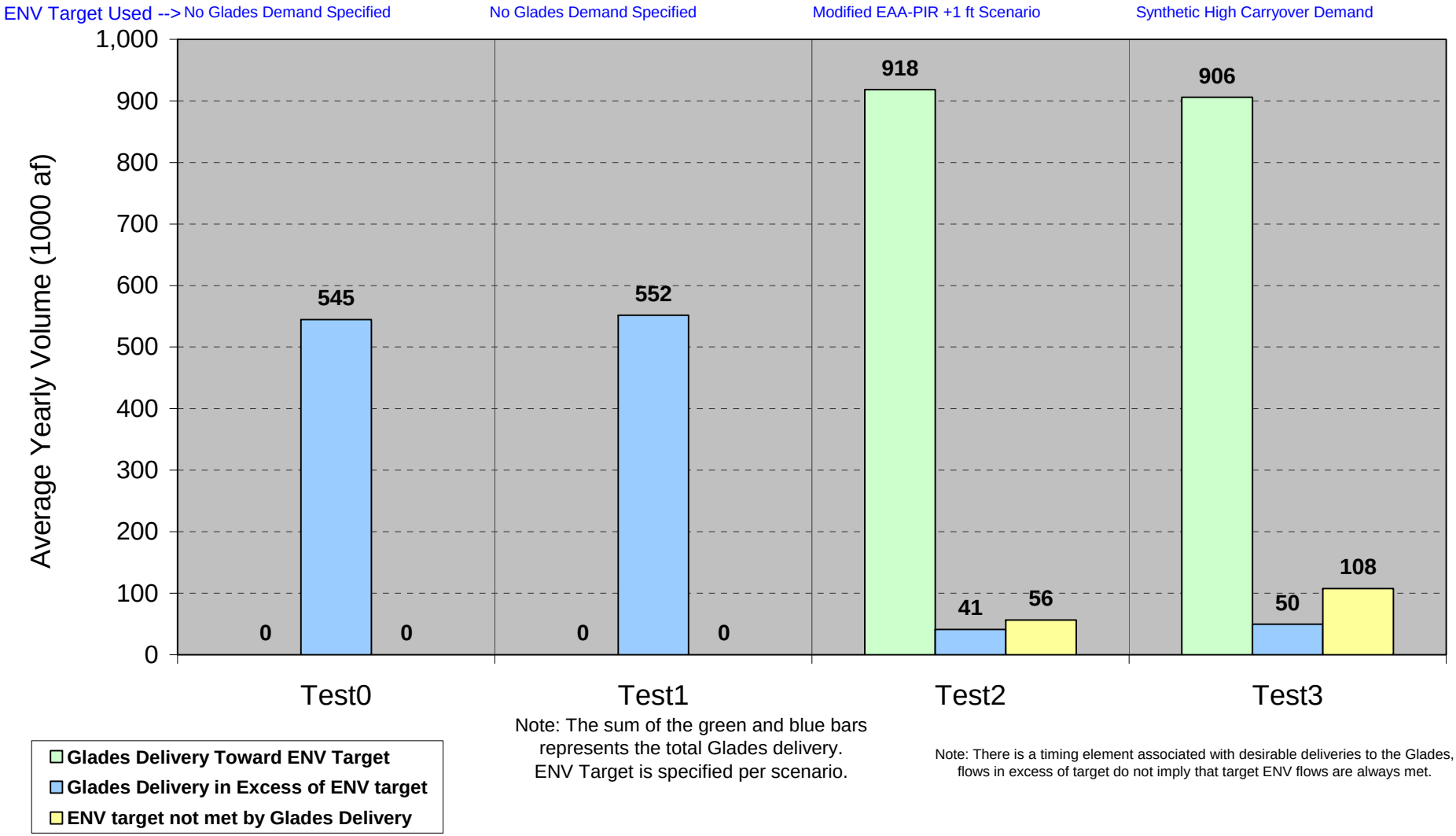


	Test0	Test1	Test2	Test3
# of months in 41yrs (492 months)	43	22	2	3
# of years with at least 1 month)	16	8	2	2
% of years with at least 1 month)	39%	20%	5%	5%
Return Period (years)	2.6	5.1	20.5	20.5



RESOPS sample outputs – Everglades Flows

Average Annual Flows to Glades



Note: The sum of the green and blue bars represents the total Glades delivery. ENV Target is specified per scenario.

Note: There is a timing element associated with desirable deliveries to the Glades, flows in excess of target do not imply that target ENV flows are always met.

Questions, Comments, Suggestions?

Preliminary Findings

Tommy B. Strowd, P.E.
Assistant Deputy Executive Director, Everglades Restoration, SFWMD

Preliminary Findings

- Increasing the storage size in the EAA generally improves system performance for most of the key performance measures
- There is generally a range of diminishing returns where additional increases in EAA storage capacity does not result in large performance improvements
  - Exceptions include low Lake stages and dry year flows to the Everglades

Preliminary Findings
Water Quality

- Additional treatment area beyond currently planned STA capacities is required when providing increased flows to the Everglades
  - Based on a range of 100 to 200 ppb inflow concentrations and assuming a flow volume of approximately 1 million acre-feet per year, additional treatment area between 12,000 and 45,000 acres may be required.
- Evapotranspiration losses in a wetted treatment area can significantly impact the ability to achieve system objectives
  - New treatment area design and operational concepts may be needed to optimize water usage for facilities at this scale.

Preliminary Findings
Lake Okeechobee

- Increasing regional water flow to the south from Lake Okeechobee tends to increase the frequency and duration of low Lake stages
- Northern Everglades storage is effective in improving Lake Okeechobee lower stage envelope performance
  - Allows water to be released to Lake Okeechobee to offset low stages in dry periods
- Lake Okeechobee Regulation Schedule modifications need to take into consideration storage added to the system

Preliminary Findings
Estuaries

- Significant reduction in Lake-triggered high discharge events are observed with additional storage/treatment
- Estuary performance is highly sensitive to Everglades needs
  - Larger Everglades needs = better estuary performance
  - Larger Everglades needs lead to more storage facility releases from the EAA to the Everglades
  - Storage in the EAA has larger available capacity to receive Lake releases
  - Fewer Lake Okeechobee regulatory releases to estuaries are needed
- Both North and South storage can be used to effectively meet estuary objectives

Preliminary Findings
Everglades

- Specific environmental water needs are generally uncertain and can heavily influence storage capacity
- Flows to the Everglades can be substantially increased with the addition of EAA storage and treatment.
- Timing of flows to the Everglades improves with additional storage
- Year-to-Year (Inter-annual) variability of flows to the Everglades is likely to increase with additional storage
- Meeting dry period needs of the Everglades increases the need for storage

Summary

- Based on the analysis to-date, the proposed acquisition can facilitate additional storage and treatment capacities to provide significant benefits to Lake Okeechobee, the Caloosahatchee and St. Lucie estuaries and the Everglades
- Careful future consideration must be given to potential issues of treatment area management and water depths in the Water Conservation Areas
- The optimal size, capacity, configuration and costs of facilities and the associated operations will be developed through subsequent planning phases

Questions, Comments, Suggestions?

Due Diligence - Environmental Assessments

Robert Kukleski, Lead Environmental Engineering Specialist, Land Acquisition, SFWMD

Due Diligence
Environmental Assessments

- Ten firms led by Professional Service Industries, Inc.
- Hired to conduct both Phase I and Phase II environmental audit for all 292 square miles of property under consideration for acquisition
- Conducted with and according to ecological risk assessment protocols approved by U.S. Fish & Wildlife and Department of Environmental Protection

Due Diligence
Environmental Assessments

- Remediation to commercial standards responsibility of seller
- Remediation to ecological standards responsibility of purchaser
- Ecological standards generally more stringent than commercial clean-up standards

Due Diligence
Environmental Assessments

- **Report compiled using:**
  - Data from sediment, soil and water samples
  - Extensive aerial and ground reconnaissance
  - Review of historical and company records
  - Assistance from state and federal experts

Due Diligence
Environmental Assessments

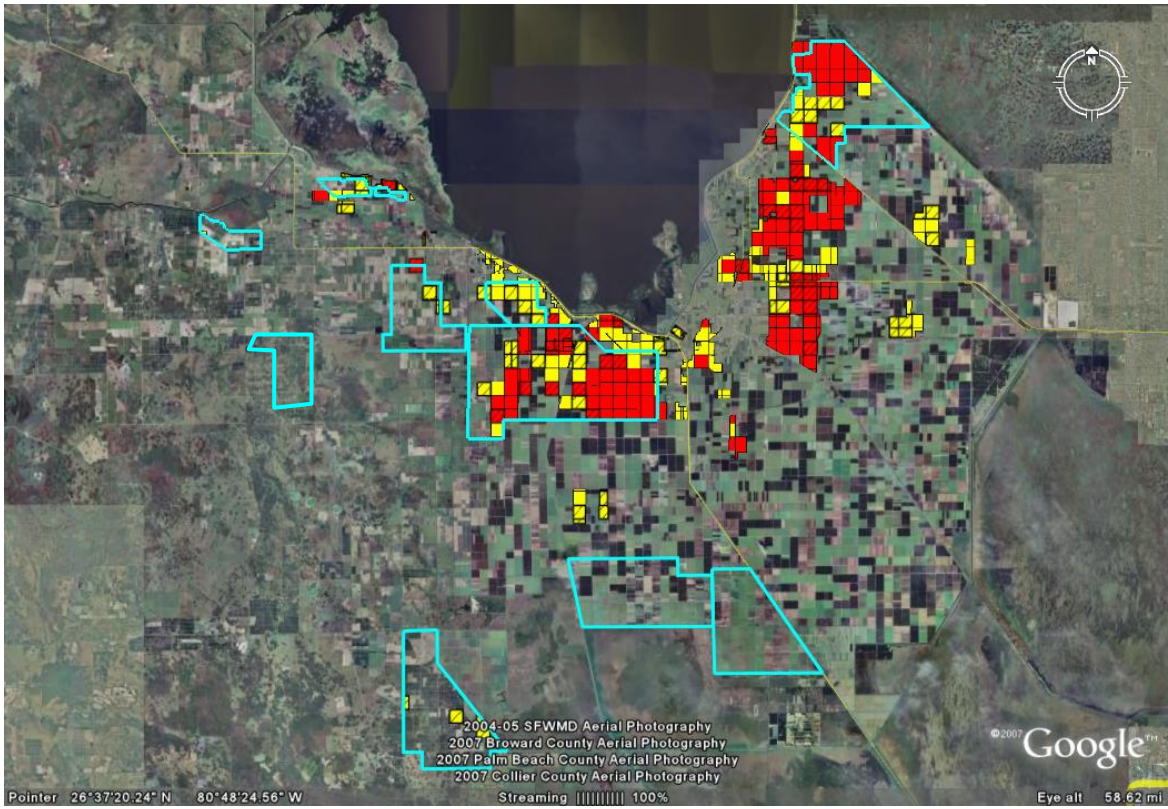
- **Investigation included:**
  - Assessment of 193 remote point sources (e.g. fuel storage areas, pump stations)
  - Assessment of 187,000 acres of land
  - Collection of more than 500 water samples and 12,500 soil samples

Due Diligence
Environmental Assessments

- Key report details:
  - Pollutant concentrations below commercial criteria on 95% of acreage; no remediation required by seller
  - U.S. Sugar required to conduct corrective action on 5% of acreage exceeding standards
    - Estimated cost $16.5 million
- Approximately 52% of acreage determined to pose no significant ecological risk
- Final remediation costs for achieving ecological standards dependent on location of restoration project

Environmental Assessments
Conceptual Project Configurations

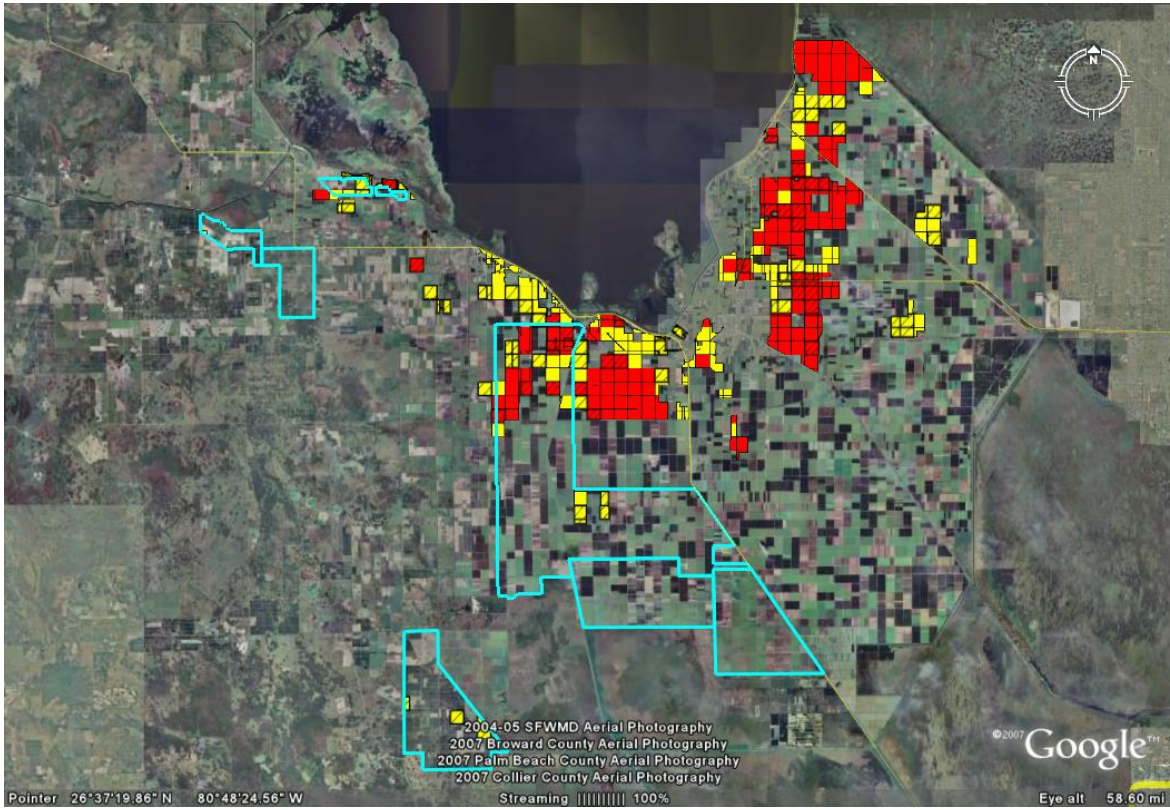
- Project located within U.S. Sugar lands only
  - Eco-Risk Category 2 ~15,340 acres
  - Eco-Risk Category 3 ~ 22,680 acres
  - Additional sampling may reduce hatched blocks



Significantly Exceeds Ecological Thresholds
Marginally Exceeds Ecological Thresholds
Facilities Footprint

Environmental Assessments
Conceptual Project Configurations

- Project adjusted to address land constraints
  - Eco-Risk Category 2 ~6,790 acres
  - Eco-Risk Category 3 ~ 5,650 acres
  - Additional sampling may reduce hatched blocks



Significantly Exceeds Ecological Thresholds
Marginally Exceeds Ecological Thresholds
Facilities Footprint

Environmental Assessments
Restoration Construction Techniques

Summary of Previous Soil Inversion Pilot Studies and Remediation Projects:

- Inversion in Sandy Soils (Performed by the District):
  - Reduction greater than 50% observed
  - Contaminants located in upper 12-inches
  - No impacts generally below 12-inches
  - Maximum available plowing depth – 2 feet
- Inversion in Muck Soils (Performed by St. Johns):
  - Reduction greater than 65% observed
  - Contaminants located in upper 12-inches
  - No impacts generally below 12-inches
  - Maximum available plowing depth – 4 feet

Environmental Assessments

Restoration Construction Techniques

Summary of Bench Tests Performed:

- ***Mix Test*** - indicated that mixing of surface soil with subsurface soil show reduction of contaminants
- ***Trench Tests*** - indicated differences in soil composition between upper 12-inches (worked by USSC for 60+ years) and lower depths (peat)
- ***Trench Test Discrete Sampling*** - indicated that contaminants are generally located within the upper 12-inches of soil with significantly reduced concentrations below 12-inches

Environmental Assessments

Restoration Construction Techniques

Summary of Bench Tests Performed (cont.):

- ***Scraping Test*** **-** indicated significant reduction of contaminants after plowing was conducted in an area where 6-inches of soil was removed with a bulldozer
- These tests suggest that where a clear difference between surface and subsurface soil concentrations exist, plowing can be successful in reducing surface soil concentrations
- Results suggest that if larger plows are used to go deeper, more uncontaminated soil is available to reduce ending top layer of soil by affecting mass balance

Environmental Assessments
Restoration Construction Techniques

CORRECTIVE ACTION CONSTRUCTION METHODS ~ SORTED BY COST	COST PER ACRE
Soil Inversion	$ 1,471
Soil Scraping and Soil Inversion	$ 7,550
Capping Onsite Borrow ~ Contractor Direct Cost Pushing Material From Adjacent Area ~ No Hauling No Liner	$ 14,668
Remove and Stockpile Onsite ~ No Cap Material	$ 19,339
Remove and Stockpile Offsite ~ Contractor Direct Cost ~ No Cap Material	$ 37,719
Capping Offsite Borrow ~ Contractor Direct Cost Pushing Material From Adjacent Area ~ No Liner	$ 96,490
Remove and Disposal at Offsite Disposal Center ~ Contractor Direct Cost ~ T&D Landfill	$ 247,915

Restoration Construction Techniques
Soil Inversion Pilot Study Status

- Eight fields selected and sampled to determine the final four fields to be inverted
- Four 40-acre fields were selected based on detected concentrations
- The four fields were divided into 40 one-acre subplots. One surface and one subsurface sample was collected from each subplot. Analysis included pesticides, arsenic, copper, and phosphorus
- Four 20-acres fields were inverted with a moldboard plow, four 20-acre fields with a standard disk plow, and one 20-acre field with a modified disk plow

Restoration Construction Techniques
Soil Inversion Procedures

- Pre-inversion sampling
- Surface disking to breakup roots/loosen soils
- Soil inversion with standard disk plow and moldboard plow (20-acres each)
- Rotary Harrow to breakup clumps of soil on surface
- Compaction with roller pulled by a tractor
- Post-inversion sampling

Restoration Construction Techniques
Field Tests Performed

- Trench tests to determine site-specific geology
- Collection of physical & chemical parameters to establish differences, if any, of the effect of soil composition on contaminant transport, leachability, etc. after inversion
- Physical colored bead test to determine depth and distribution of inverted soils
- Bench study of 100%, 50%-50% mixture, 66%-33% mixture and 33%-66% mixture
- Unconsolidated muck layer (peat) was sampled and results only showed detects of arsenic and copper, no or low concentrations of organochlorine pesticides

Restoration Construction Techniques
Equipment

Standard Disk Plow

Moldboard Plow

Modified Disk Plow

Restoration Construction Techniques
Equipment

Rotary Harrow

Roller

Restoration Construction Techniques
Pilot Study Observations

- The moldboard and standard disk plows used in the Pilot Study provided insignificant reduction of post-inversion surface soil concentrations
- The Modified disk plow showed an average of 33% reduction after plowing
- Reduction is limited due to the depth of soils with elevated chemical concentrations and the maximum plow depth of the pilot study equipment

Restoration Construction Techniques
Pilot Study Observations

- Field observations indicate there is a 10 – 12 inch layer of well mixed surface soils historically plowed by USSC. Underlying soils appear undisturbed and uncontaminated
- Soils from 6 – 12 inches below the surface expected to have similar concentrations to those found at surface
- A minimum of 24 inches of soil with at least 12 inches of uncontaminated soils must be present for successful inversion
- Initial contaminant concentrations were found to be a more important than muck depth in determining whether soil inversion can be successful

Restoration Construction Techniques
Pilot Study Observations

- Physical removal of some mixed surface soil layer prior to plowing expected to increase reduction efficiency
- In some areas with higher contaminant concentrations, removal of the surface layer (6 inches) followed by soil inversion is likely to be effective
- The areas with the highest contaminant concentrations are likely to require capping or removal of soils – soil inversion is not likely be effective

Restoration Construction Techniques
Pilot Study Recommendations

- For fields where <40% reduction is needed to meet corrective action goals, inversion using a plow larger than the plow used in the Pilot Study is recommended
- For fields where a greater reduction (40 – 60%) is required to meet corrective action goals, removal of maximum feasible volume of surface soils (min. 6 inches) prior to plowing is recommended
- Further investigation is required to more accurately determine effectiveness of partial removal of contaminated surface soils in conjunction with plowing

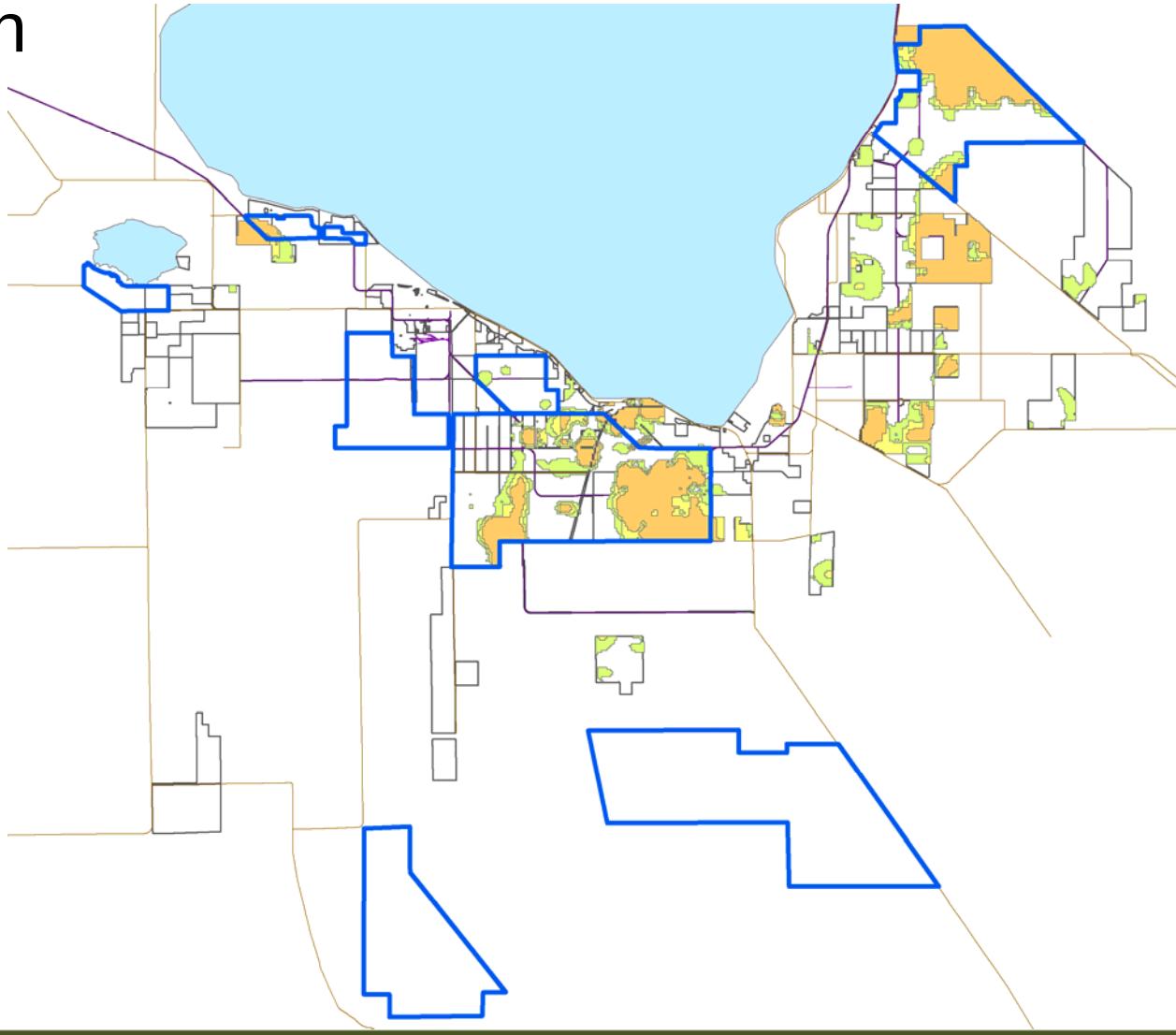
Restoration Construction Techniques
Pilot Study Recommendations

- For fields requiring more than 60% reduction in surface soil concentration to meet corrective action goals, avoidance, capping or complete removal of contaminated surface layer is recommended
- The District should work in consultation with USFWS and FDEP to develop a comprehensive set of corrective action goals and benchmarks based on expanded ecological risk assessment tasks prior to initiation of any corrective action measures

Restoration Construction Techniques
Approximate Area Suitable for Inversion

USSC Configuration

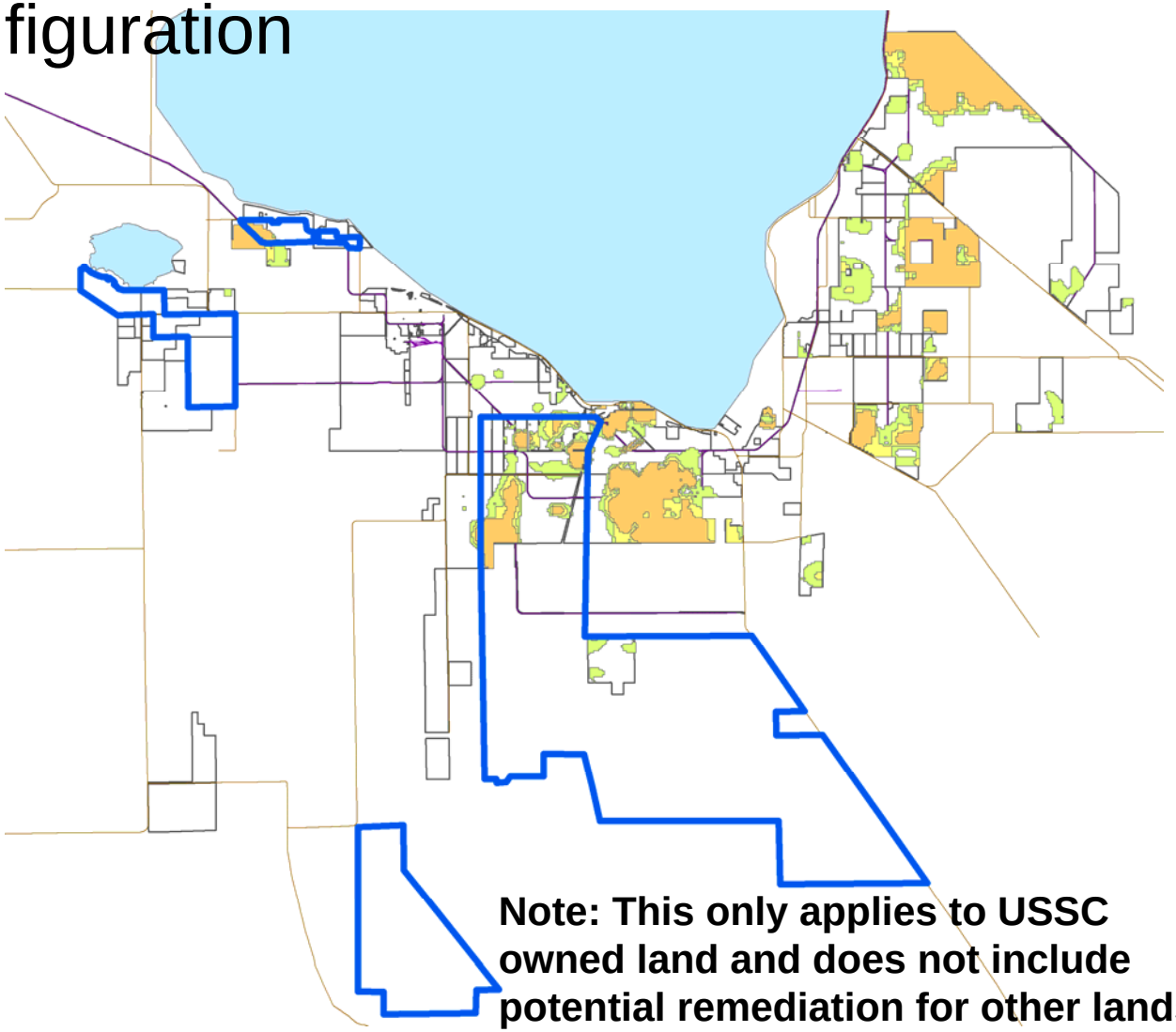
- Potentially 28,200 acres requiring corrective action.
- 6,550 acres suitable for inversion.
- 4,050 acres may require partial soil removal prior to inversion
- 17,600 acres are not expected to be suitable for inversion without removal of most of the surface soils



Restoration Construction Techniques
Approximate Area Suitable for Inversion

Rocking Chair Configuration

- Potentially 7,850 acres requiring corrective action.
- 3,150 acres suitable for inversion.
- 1,450 acres may require partial soil removal prior to inversion
- 3,250 acres are not expected to be suitable for inversion without removal of most of the surface soils



Note: This only applies to USSC owned land and does not include potential remediation for other lands

Environmental Assessments
Summary of Conclusions

- Based on the Environmental Assessment areas of impairment were identified that will need to be addressed before a reservoir is constructed.
- Impaired areas are almost exclusively located in muck soils (south and east of lake)
- Further studies may eliminate the need for corrective action in marginal areas, so current cost estimates should be conservative

Environmental Assessments
Summary of Conclusions

- The identified contaminants at this site (e.g., arsenic, copper, pesticides) have been detected on the large majority of the previous acquisitions
- Results are very similar to previous experience on other agricultural properties that have been acquired under CERP
- The identified concerns can all be addressed through additional studies or using remedial techniques that have been demonstrated as effective.
- Costs can also be controlled through manipulating the project footprint and construction characteristics.

Questions, Comments, Suggestions?

Future Meeting Topics/Next Steps

Tommy Strowd, P.E., Assistant Deputy Executive Director, ERRA, SFWMD

Phase I Planning
Future Meeting Topics

- Identification and discussion on problems, opportunities/ objectives and constraints
- Discussion on results of Hydrologic Restoration Targets Workshop
- Identification and discussion of alternative configurations
- Evaluation of alternative configurations
- Presentations and topics as identified by participants

Phase I Planning
Next Steps

- WRAC and Governing Board briefings to continue
- Initial draft alternatives scheduled for June completion
- Final draft alternatives presented to August Governing Board to support decision making
- More detailed future planning phases will continue after August Governing Board

Next WRAC Issues Workshop: February 3, 2009
SFWMD Auditorium, West Palm Beach
10:00 a.m. – 4:00 p.m.

Questions?

Website:
www.sfwmd.gov
Reviving the River of Grass
Restoration Project Planning