

National Conference on Ecological Restoration (NCER) April 18-22, 2016

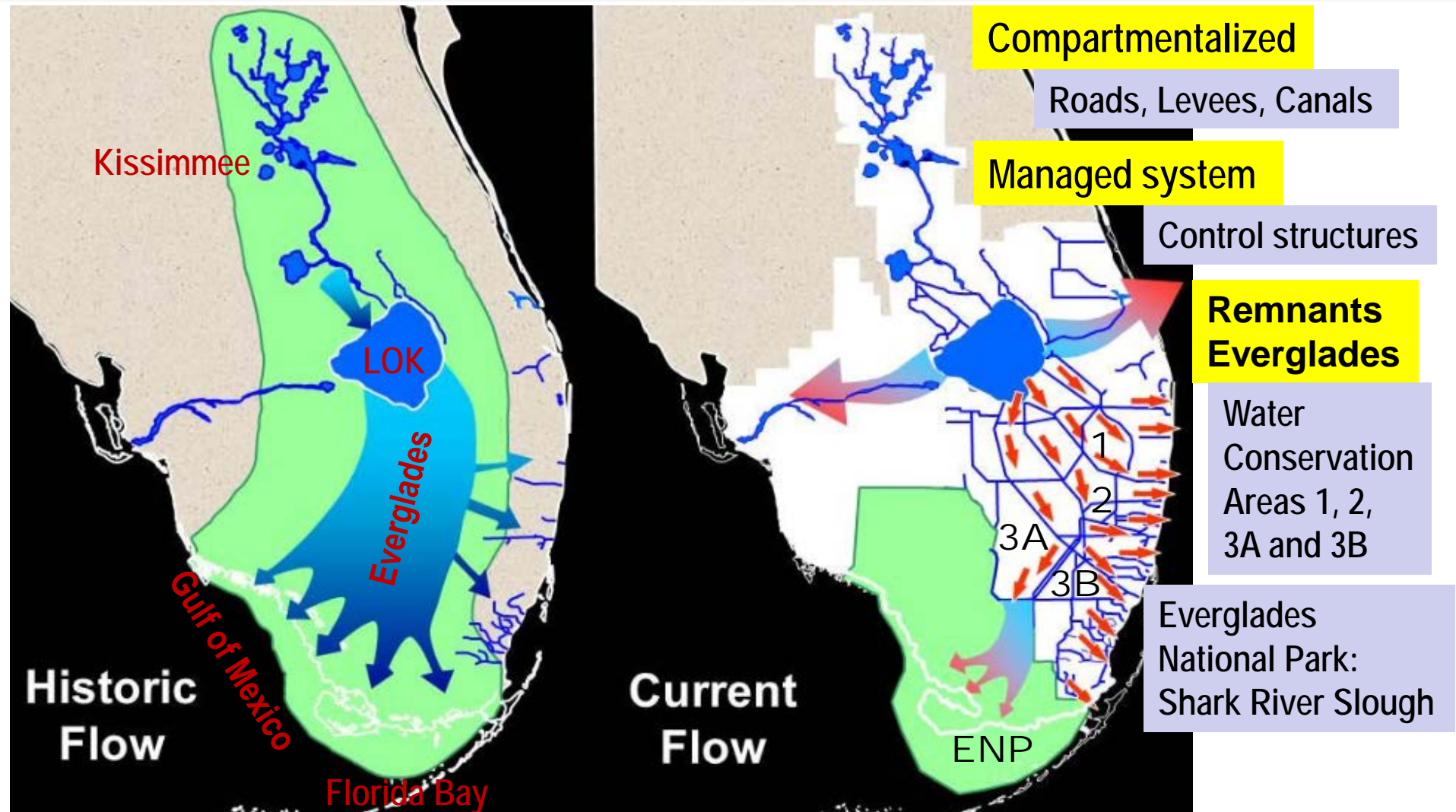


An Application of the Regional Simulation Model to the Everglades and Lower East Coast for the Modified Water Deliveries and C-111 South Dade Projects

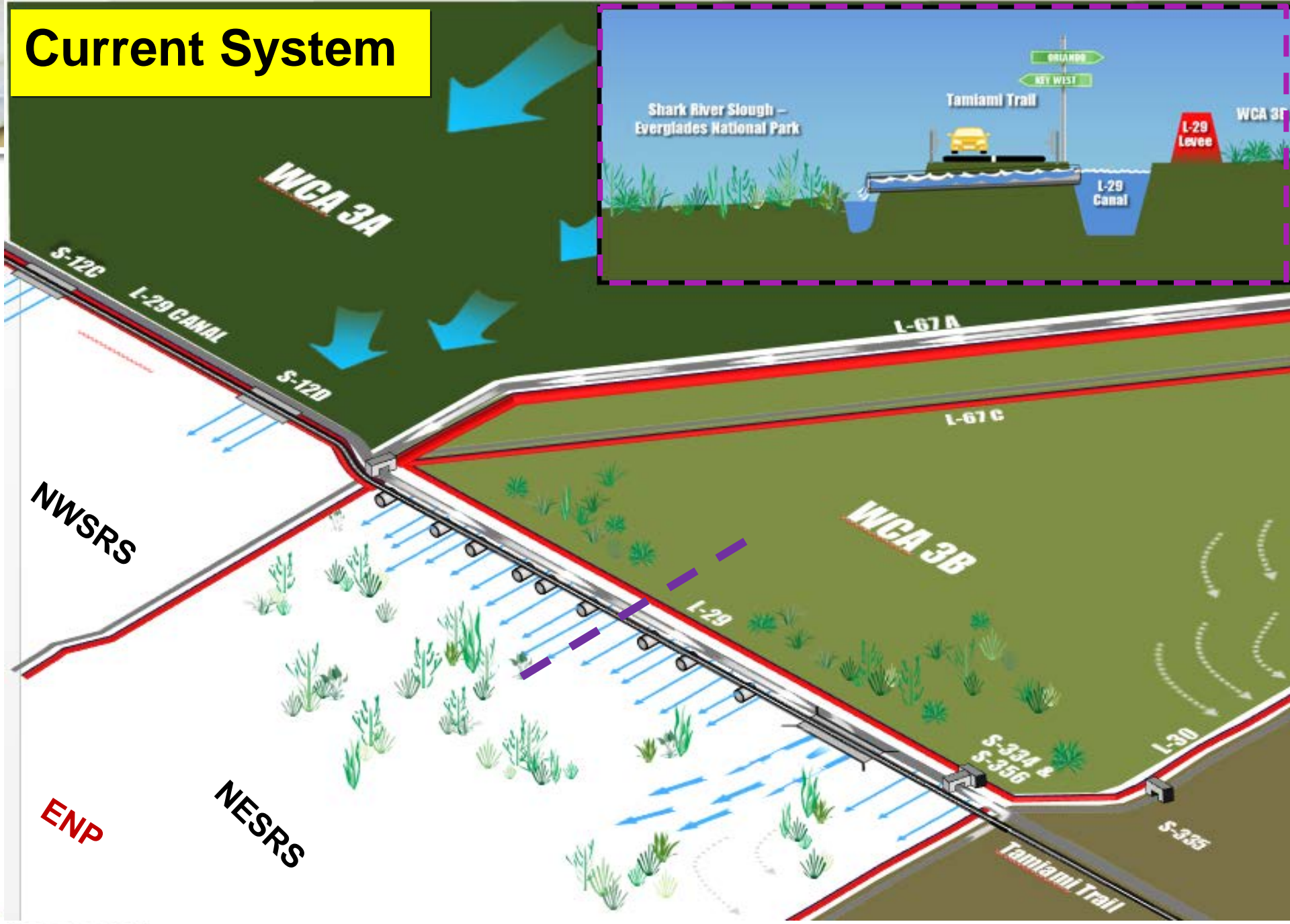
Fahmida Khatun, PE, Raul Novoa, PE and Walter Wilcox, PE



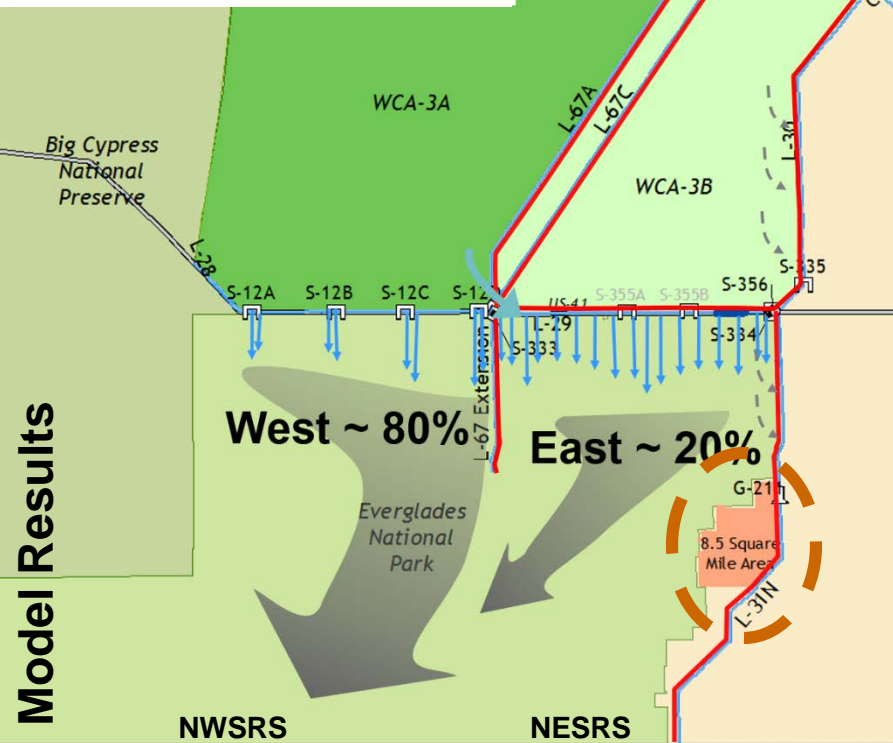
Historic VS Current System



Current System



Before MWD



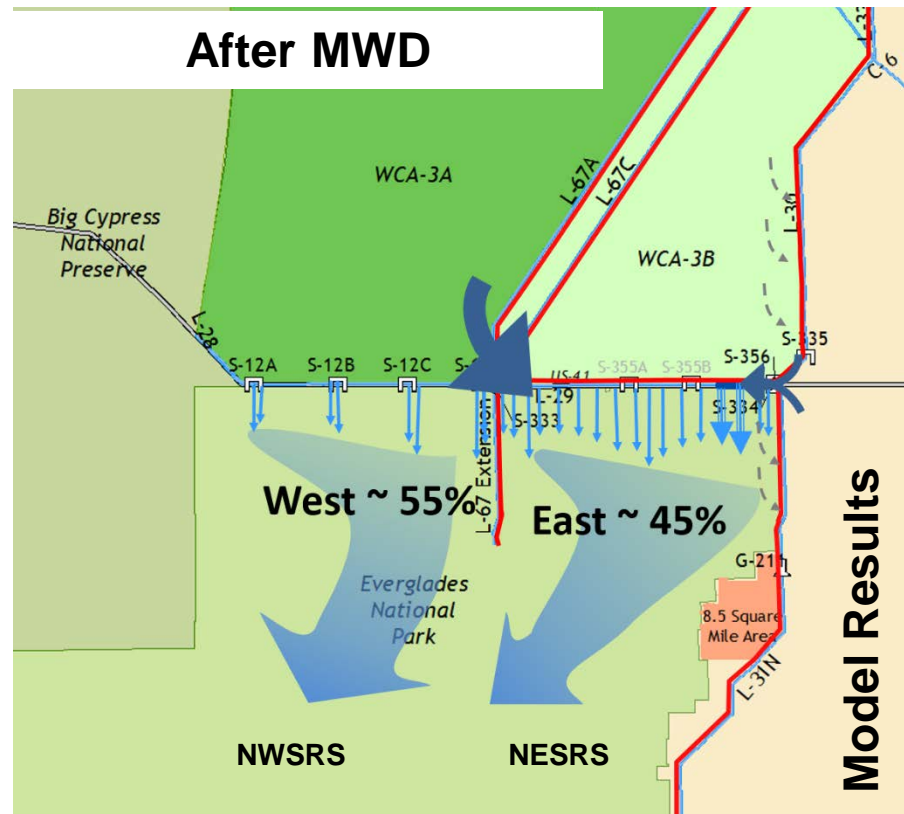
Modified Water Deliveries or Modwaters (MWD)

- ❑ Restore more natural flows into Everglades National Park
- ❑ Part of South Florida Ecosystem Restoration Project

Model Results

Model Results

After MWD



❑ MWD is a multi-agency effort



MWD and C-111 South Dade Projects

Includes three incremental efforts

- Increment 1 Field Test:
 - Initiated on October 15, 2015
 - A planned deviation to the 2012 Water Control Plan
 - Deliver more water from WCA-3A to NESRS
 - Return Seepage from L-31N Canal to L-29 using S-356 pump
 - Collect and analyze hydrologic, water quality, and ecological data
- Increment 2 Field Test:
 - Allow L-29 canal maximum stage at 8.5 ft
- Increment 3 or Combined Operating Plan (COP)

The modeling effort will help to evaluate a range of potential options.





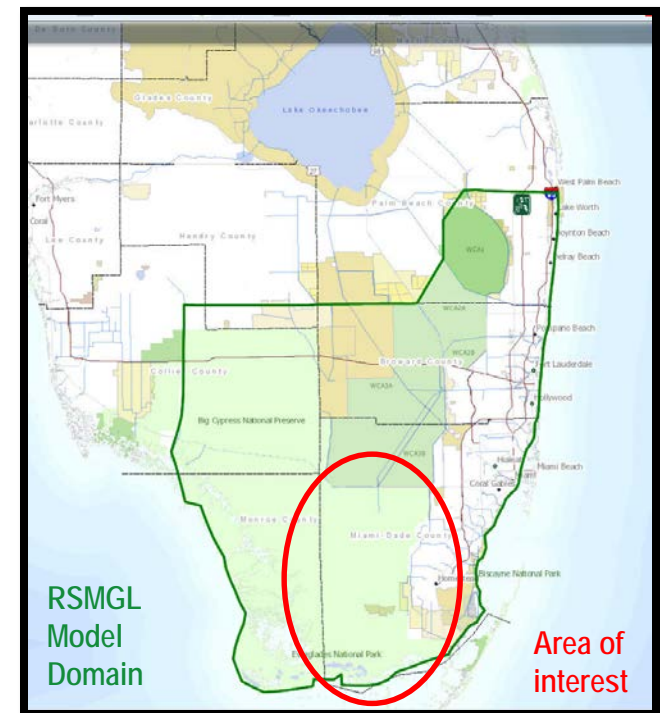
Regional Simulation Model (RSM) and RSM Glades-Lower East Coast Model (RSMGL)

Modeling Tool : RSM

- Developed by the South Florida Water Management District with South Florida's unique hydrology in mind
- Simulates canal, overland & groundwater flows and all major water budget components
- Has features to handle local scale hydrology and water management operations

Model Application: RSMGL

- A regional scale implementation of the mesh version of RSM to the Everglades and Lower East Coast Service Areas.
- Previously applied for the CERP WCA-3A DECOMP and the Central Everglades Planning projects (CEPP)





RSMGL Details

Mesh Information:

- Finite element mesh
- Number of cells: 5,794
- Average size: ~ 1 sq. mile

Canal Information:

- Total length: ~ 1,000 miles
- Number of segments: ~ 1,000
- Average length: ~ 1 mile

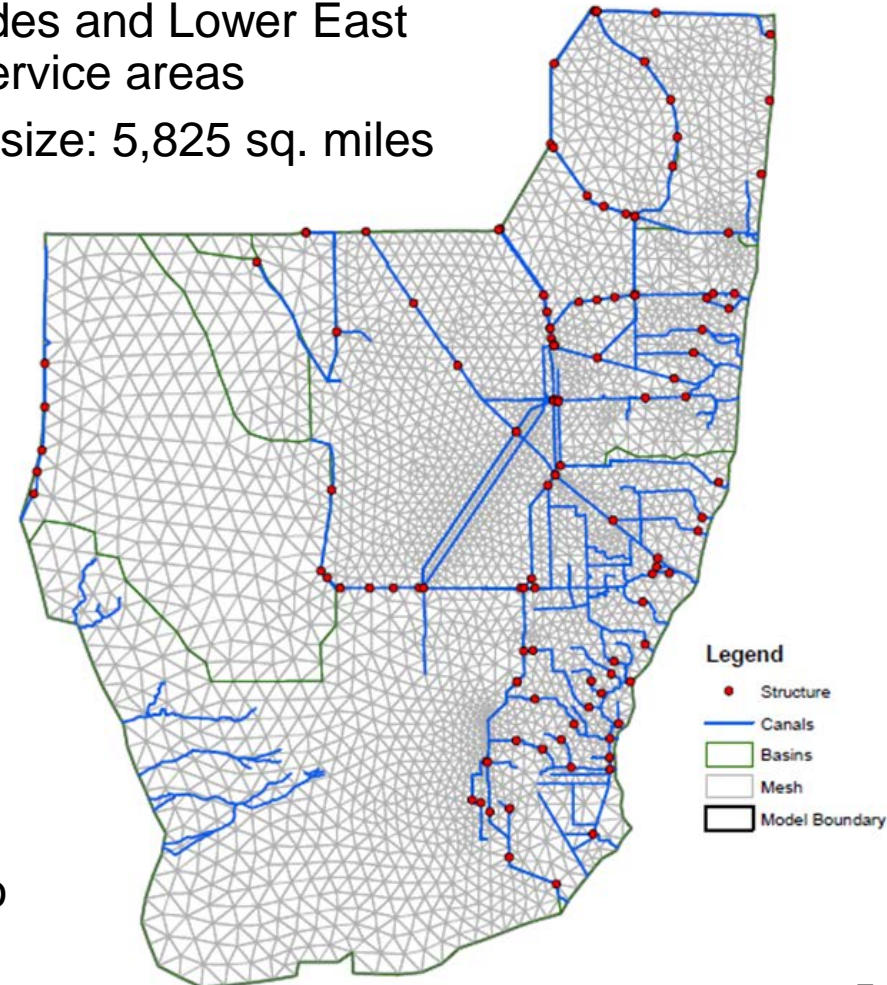
Run Time: ~ 1 day

Calibration/Validation:

- Calibrated for 336 gages to match historical data dating from 1/1/1984 to 12/31/1995.
- Validated to match historical data from 1/1/1981 to 12/31/1983 and from 1/1/1996 to 12/31/2000.

Model Domain:

- Everglades and Lower East Coast service areas
- Domain size: 5,825 sq. miles

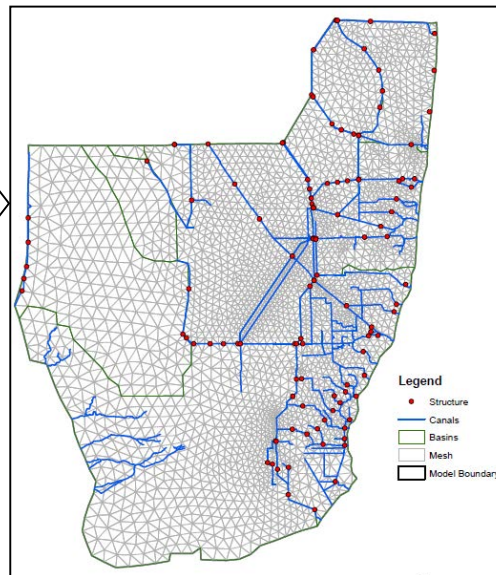


Modeling Approach using RSMGL

Scenario

Model Input

- Climatic Input
 - Rainfall
 - ET
- Boundary Conditions
- Land Use/Land Cover
- Water Demands
- Project Features
- Operating Criteria



Model Output

- Daily time series of water levels, flows
- Demands not met

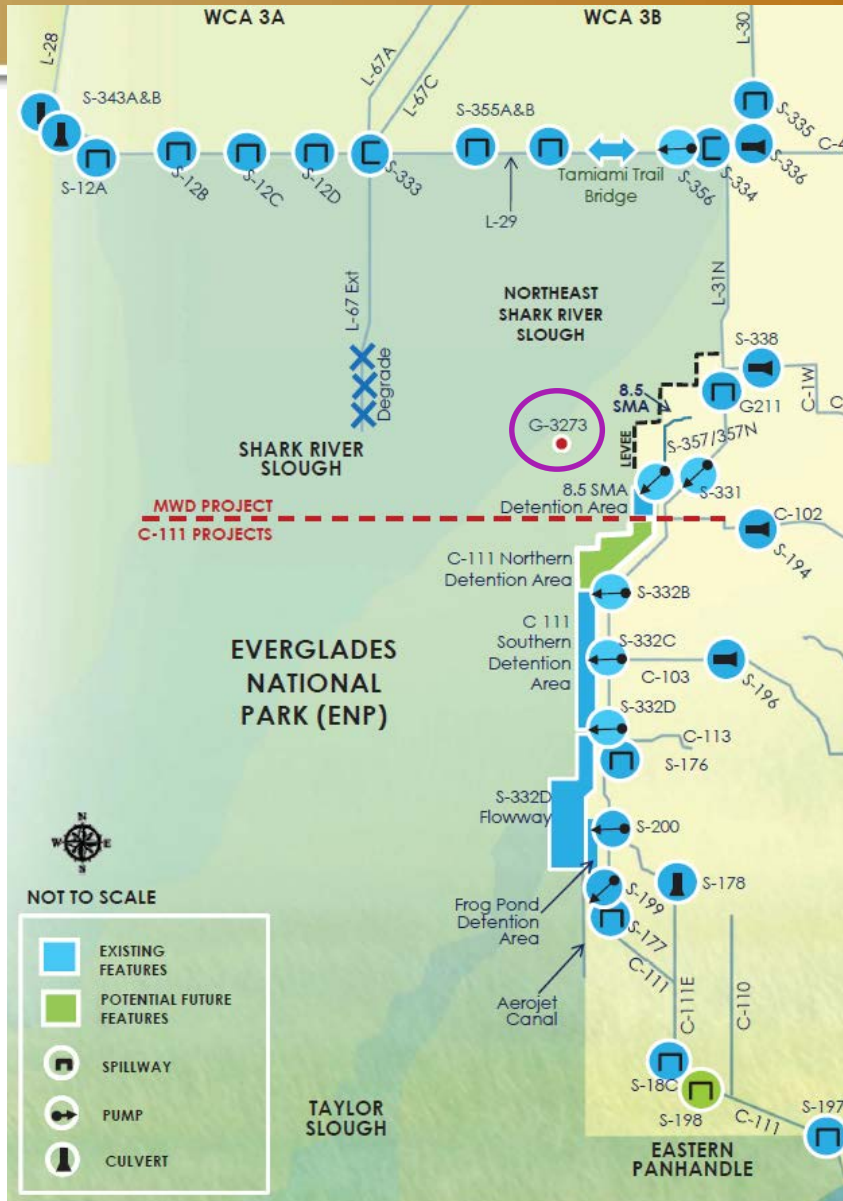
Evaluation
(Environmental,
Flood Control,
Water Supply, etc...)

Climatic Simulation Period of record:
1965-2005

Scenarios (Base VS Increment 1)

Base (ECBRW)

- Everglades Restoration Transition Plan (ERTP) conditions with 2015 project features.
- Revised to reflect Real-World operations (within the operational flexibility)



Increment 1

= Base +

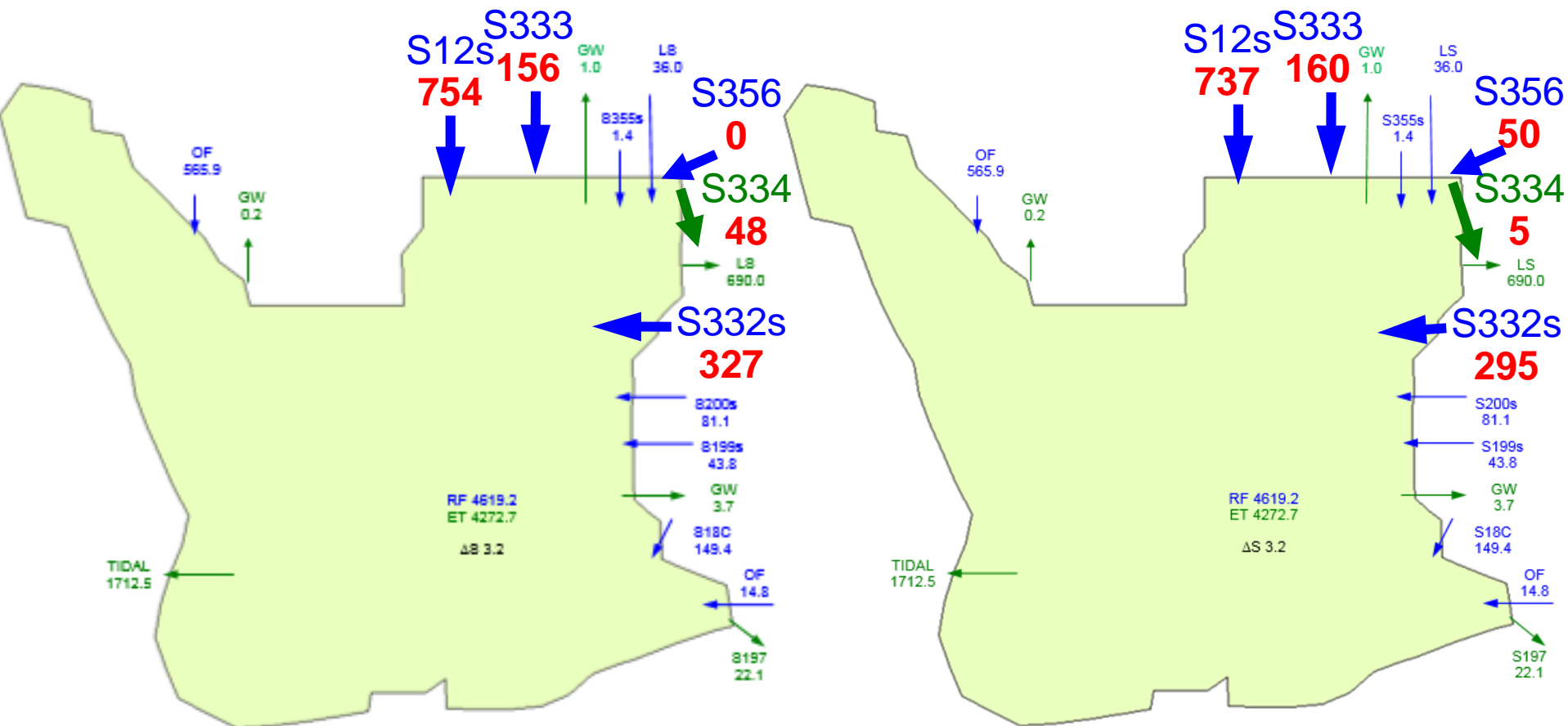
- Part of MWD projects
 - Allow more flows to NESRS (via S-333) without constraining for 8.5 SMA
 - Return seepage from L31N to NESRS via S-356 pump
- Part of South Dade Projects
 - Revised operations to SDCS based on WCA-3A stages, and available capacity at SDCS
 - Additional conditional operation for S-197



Water Budgets for Everglades National Park (ENP)

Base

Increment 1

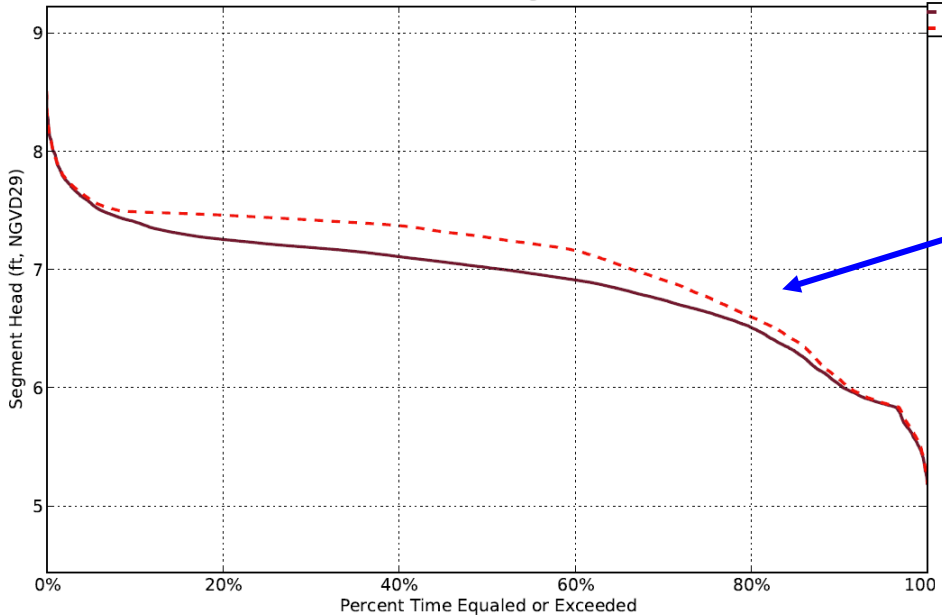


Average Annual water budget in K-AC-FT (1965-2005)

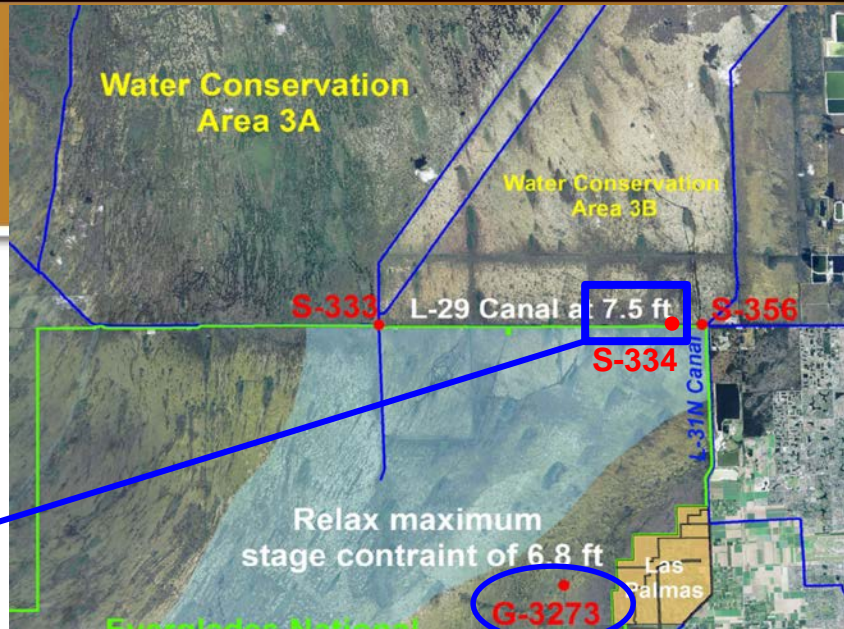


Duration Curves

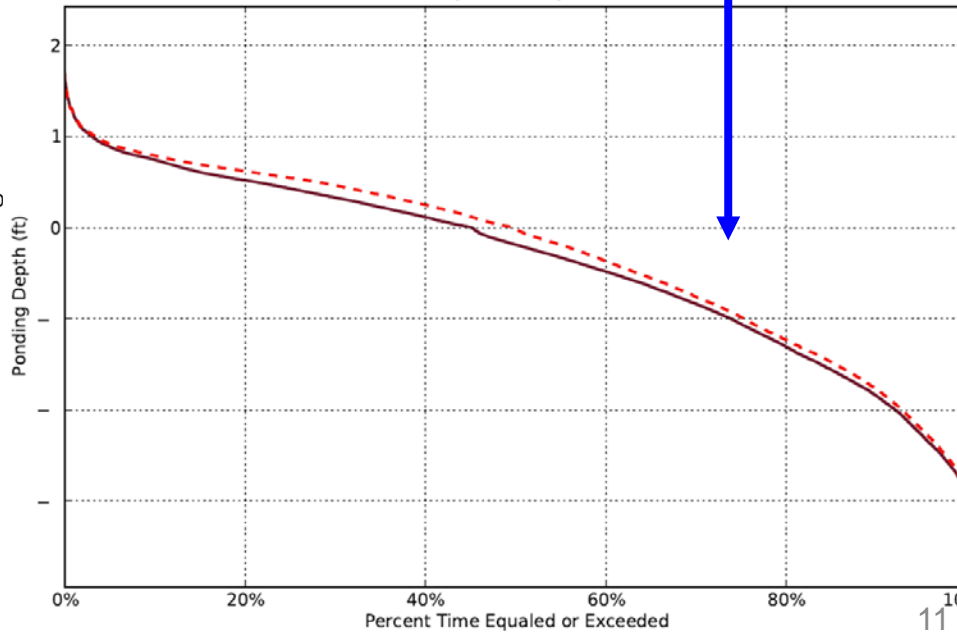
Duration Curves for L-29_at_S334
Elev: 5.47 ft, NGVD29; Segment ID: 309197



— Base
- - - Increment1

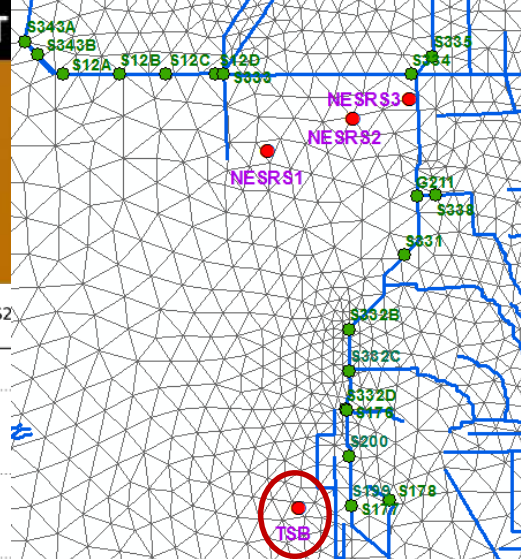


Normalized Duration Curves for G3273
Elev: 6.65 ft, NGVD29; Cell ID: 2364

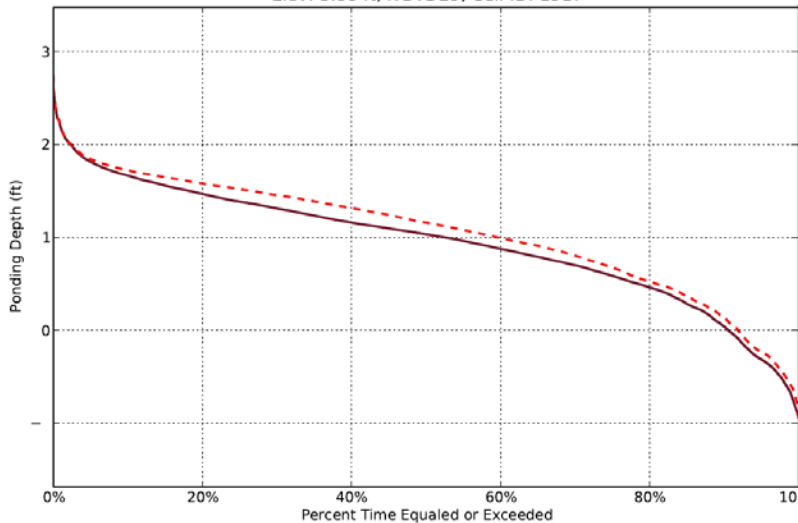




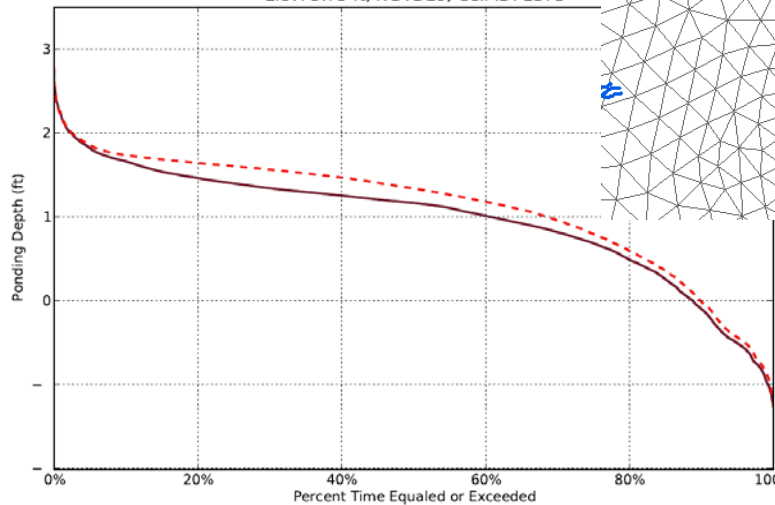
Duration Curves at Key Slough Gages



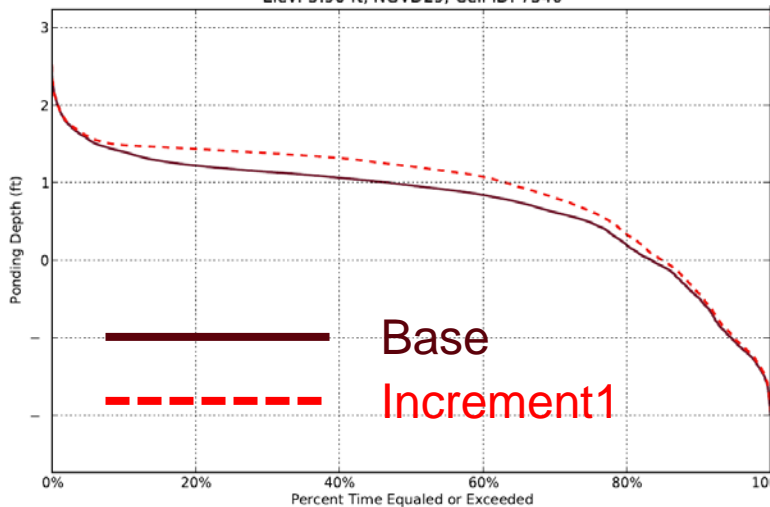
Normalized Duration Curves for ENP_NESRS1
Elev: 5.86 ft, NGVD29; Cell ID: 1917



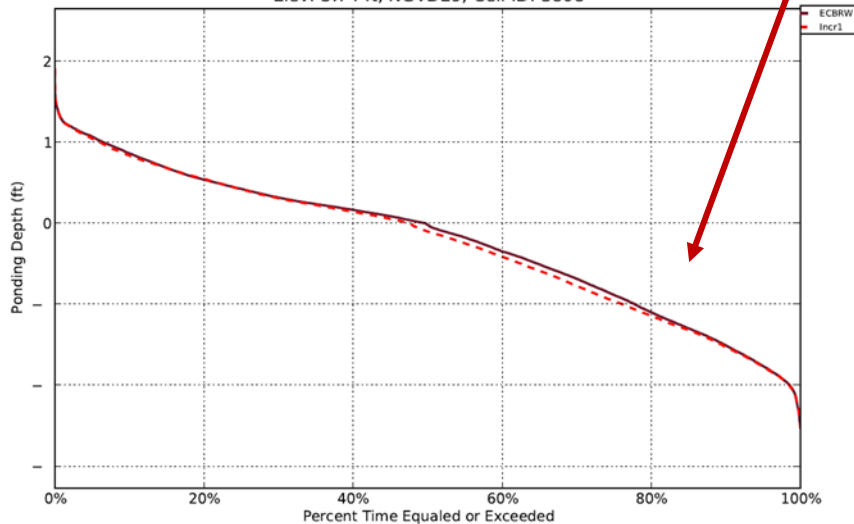
Normalized Duration Curves for ENP_NESRS2
Elev: 5.75 ft, NGVD29; Cell ID: 2373



Normalized Duration Curves for ENP_NESRS3
Elev: 5.96 ft, NGVD29; Cell ID: 7540



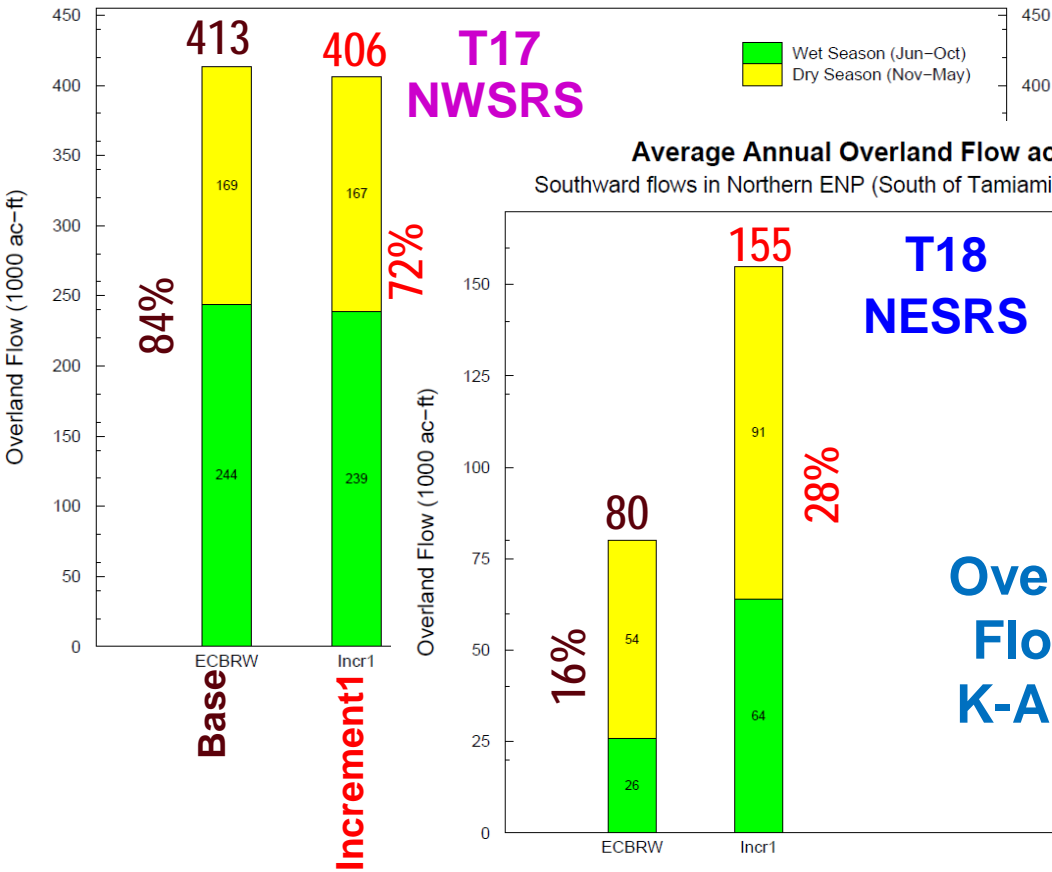
Normalized Duration Curves for ENP_NP-TSB
Elev: 3.74 ft, NGVD29; Cell ID: 3808



Transects: Shark River Slough

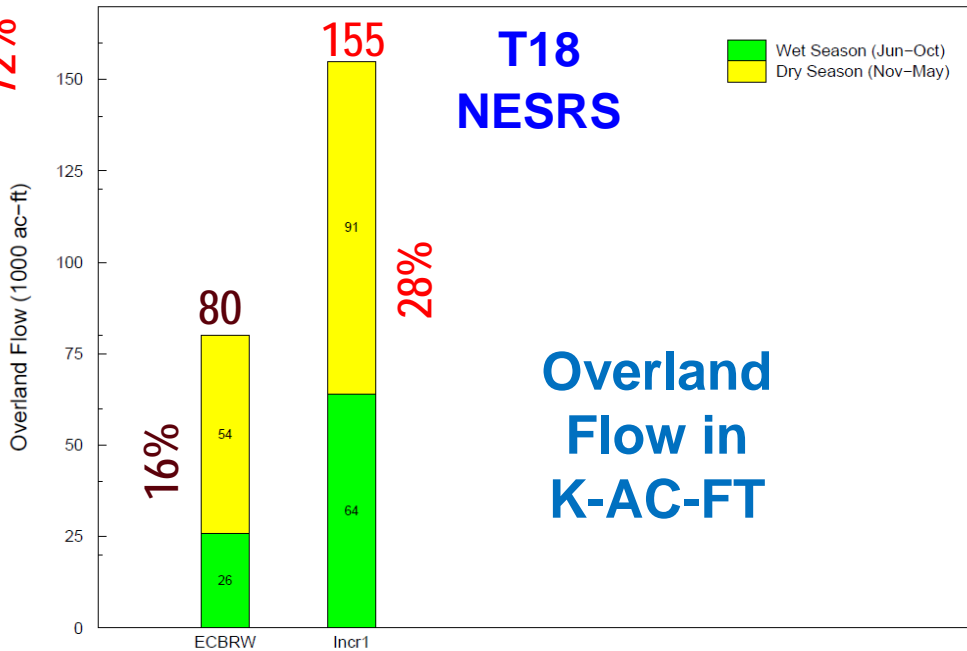
Average Annual Overland Flow across Transect 17

Southward flows in Northern ENP (South of Tamiami Trail & West of L-67 extension)

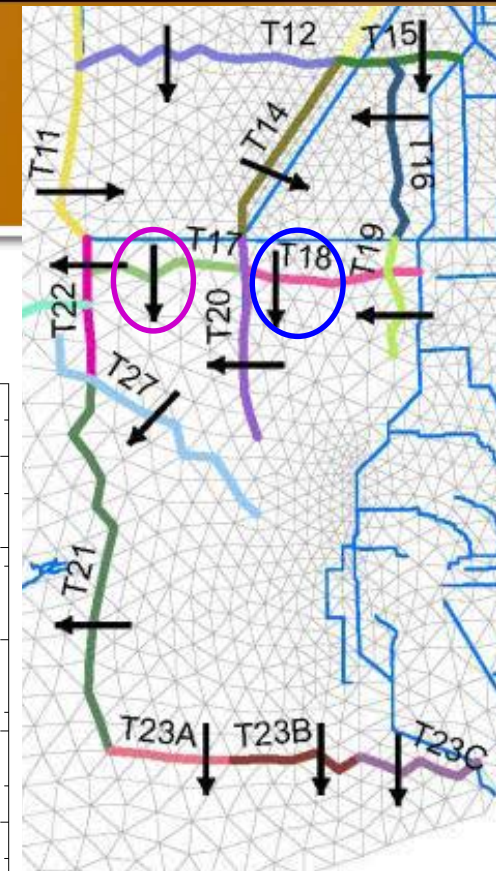


Average Annual Overland Flow across Transect 18

Southward flows in Northern ENP (South of Tamiami Trail & East of L-67 extension)



Overland Flow in K-AC-FT

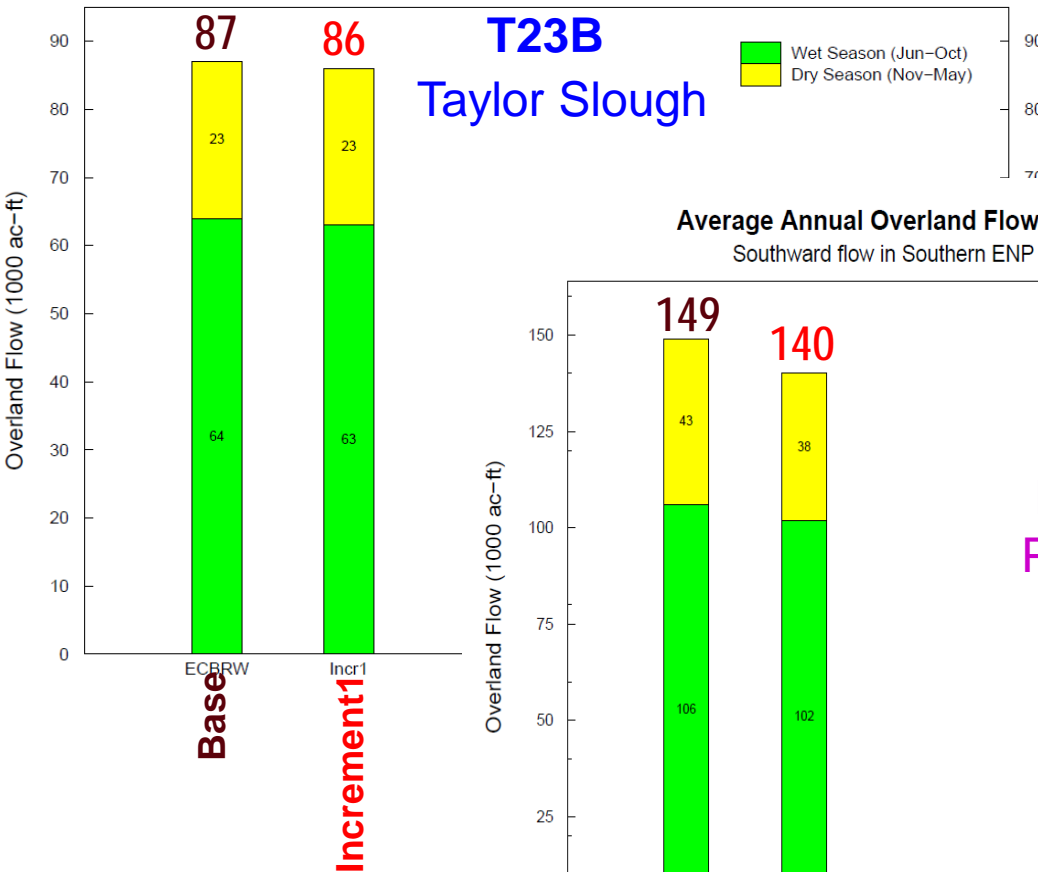


- ❑ Additional flows into NESRS could help a variety of habitats:
 - plants like sawgrass,
 - wildlife like fishes, alligators, otters, wading birds and endangered snail kites & wood storks

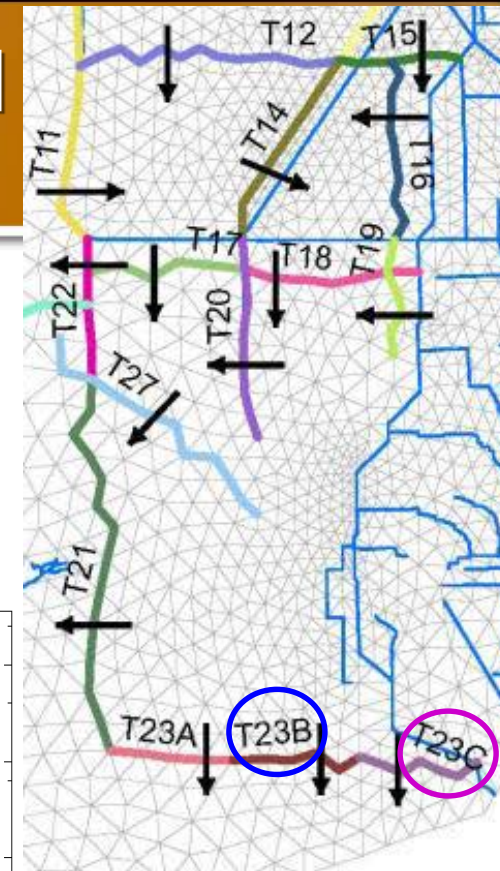
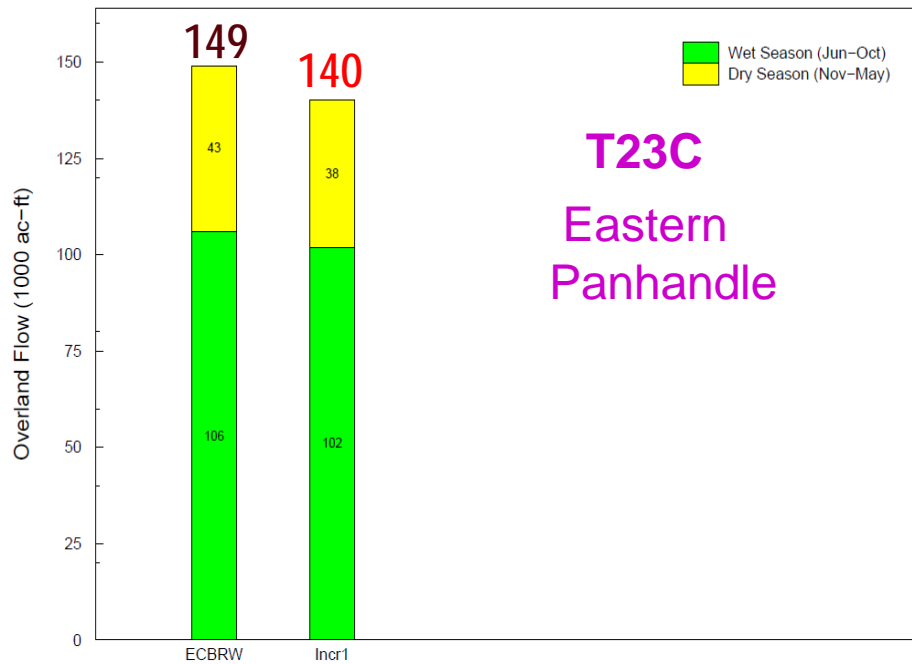


Transects: Taylor Slough and Eastern Panhandle

Average Annual Overland Flow across Transect 23B
Southward flow in Southern ENP (Taylor Slough)



Average Annual Overland Flow across Transect 23C
Southward flow in Southern ENP (Eastern Panhandle)



Overland Flow in K-AC-FT

- Dry Season
- Wet Season



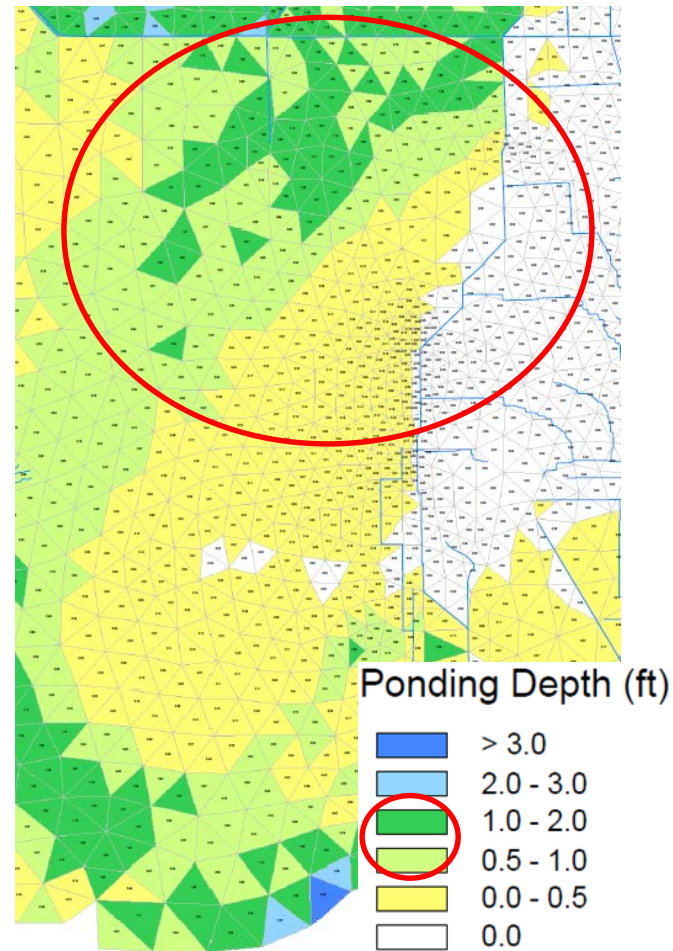
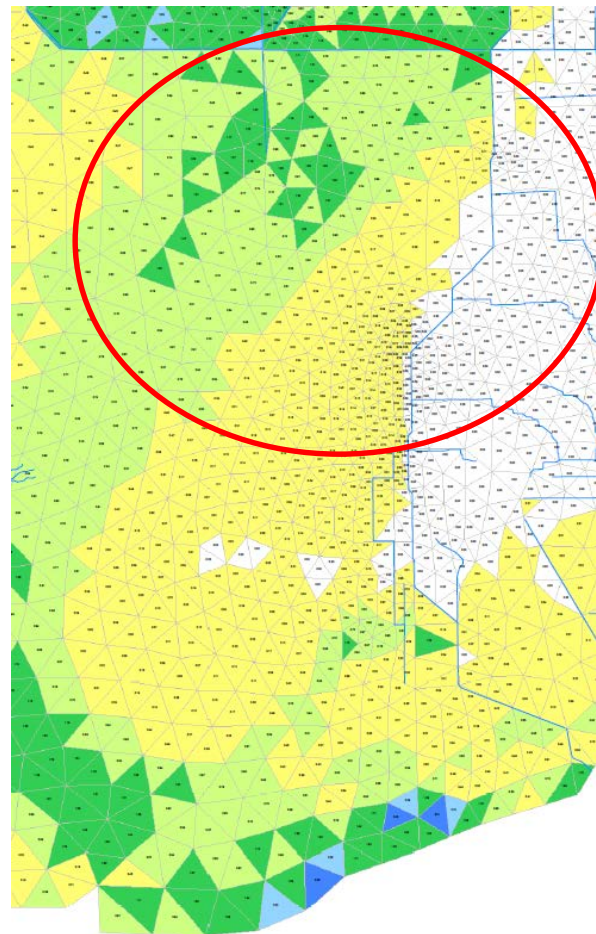
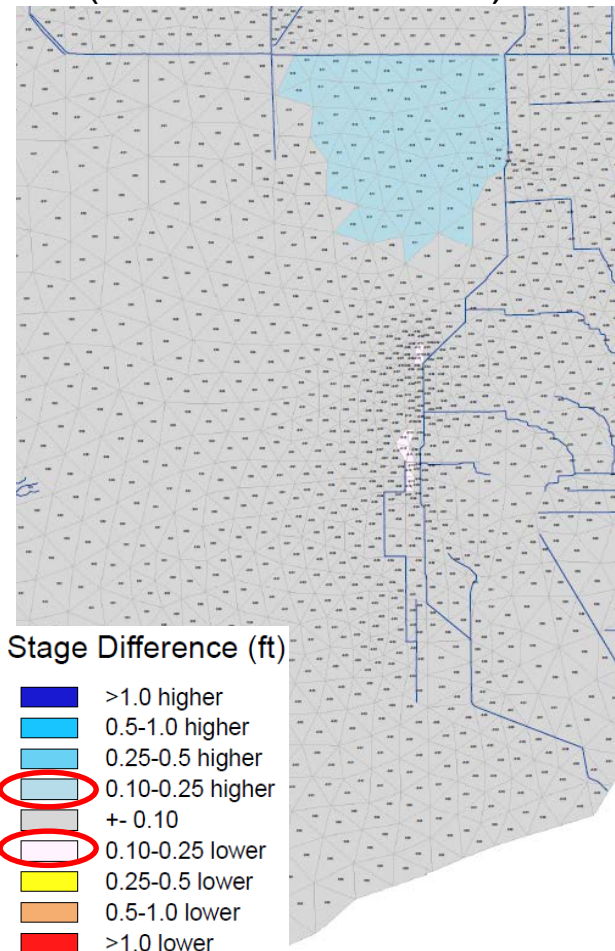
Stage Difference and Ponding Depth Map (41 year Annual Average)

Higher Ponding depth helps a variety of habitats

Stage difference:
(Increment 1- Base)

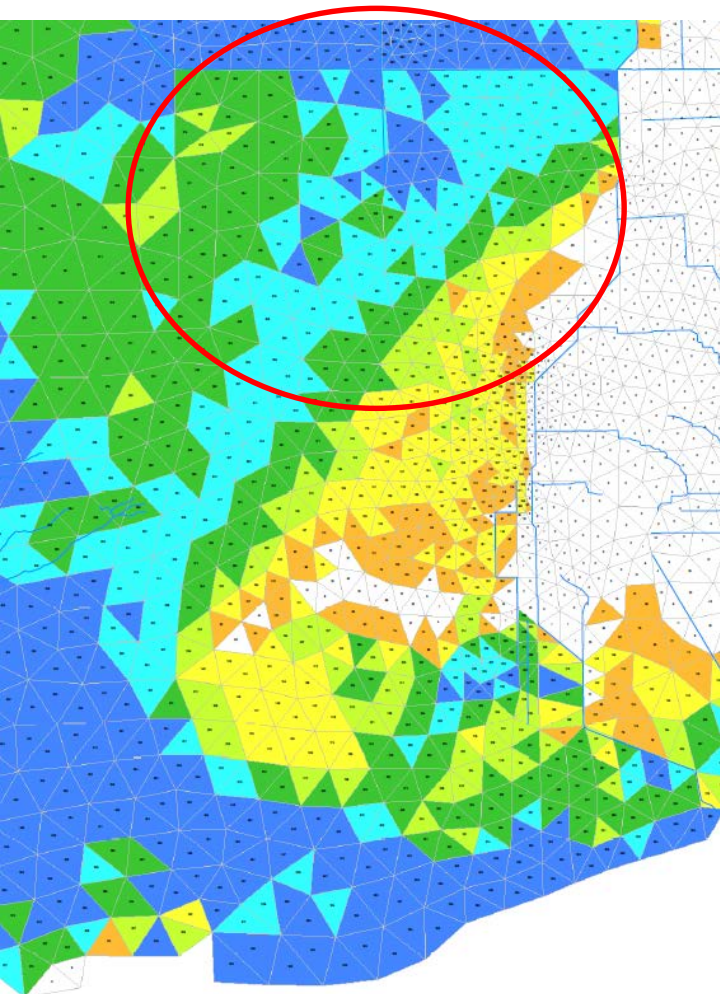
Ponding Depth:
Base

Ponding Depth:
Increment 1

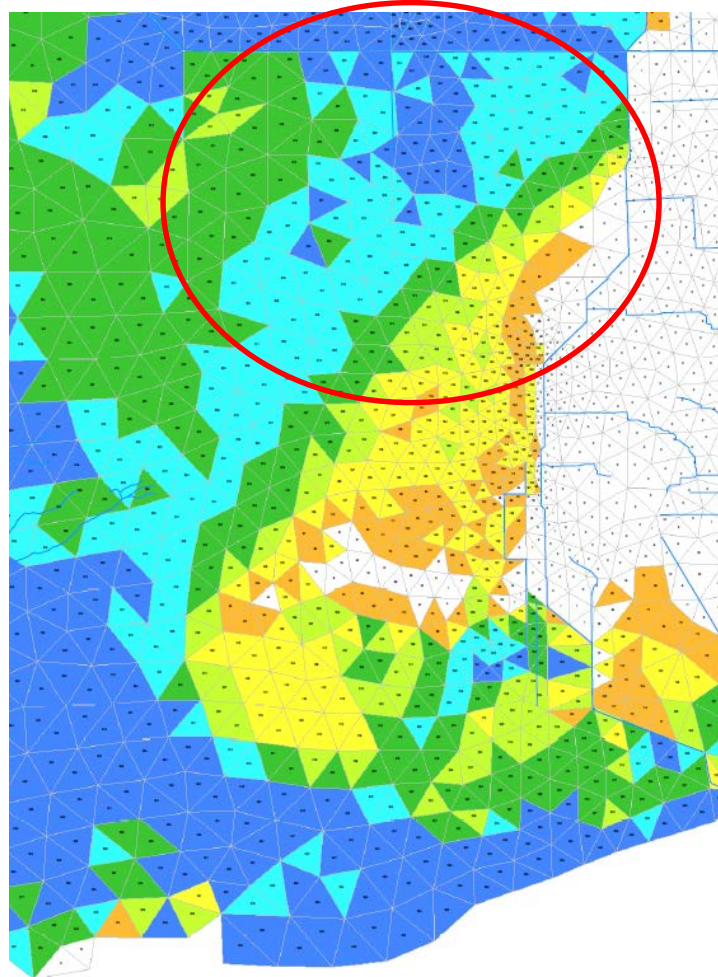




Hydroperiod Maps (41 year Annual Average)



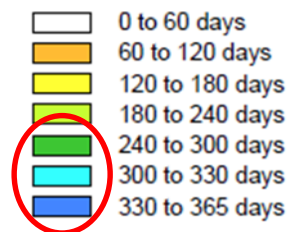
Base



Increment 1

- Hydroperiod means the length of time that water is present over the surface of a wetland
- Longer hydroperiods helps a variety of habitats

Hydroperiod Class

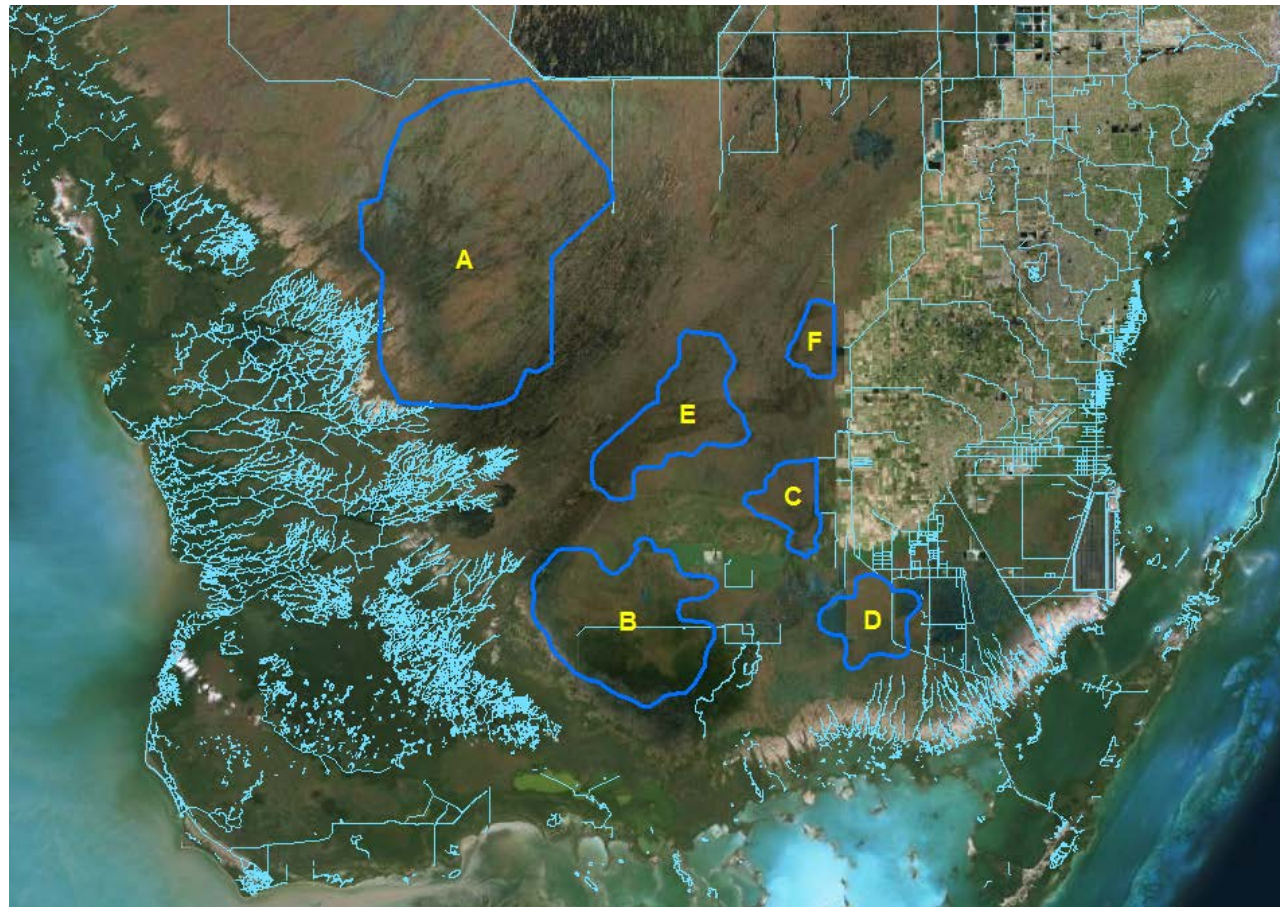




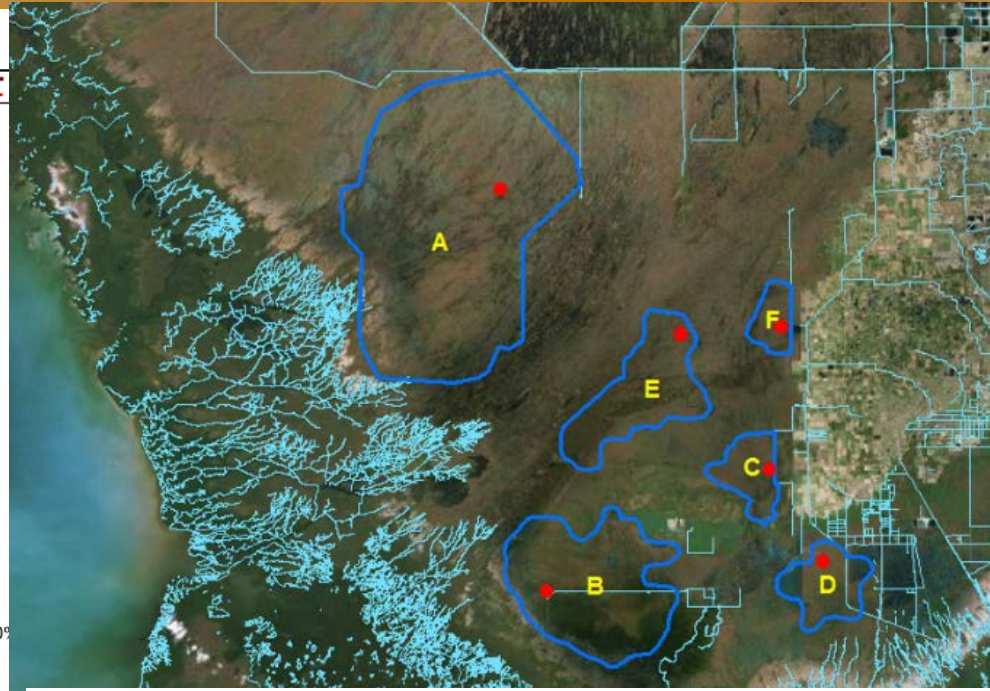
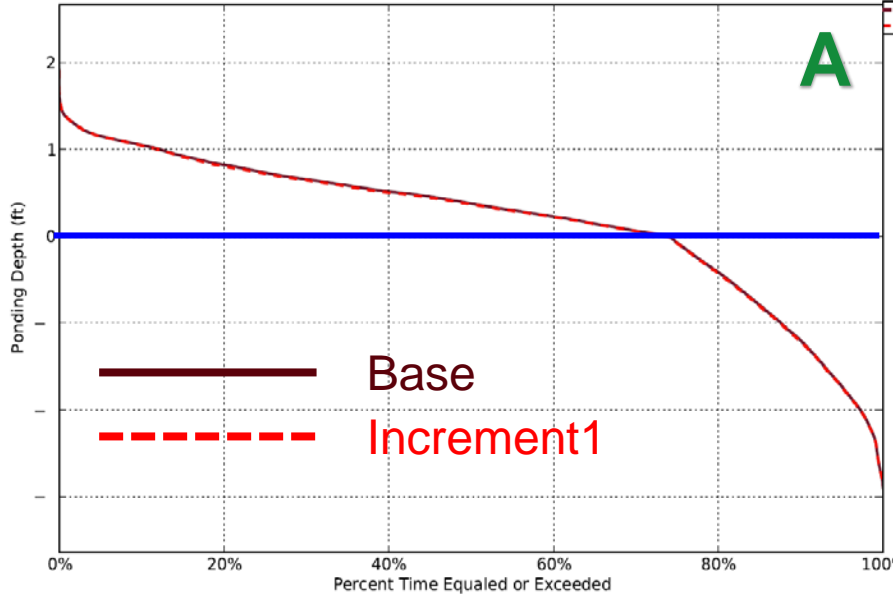
Cape Sable Seaside Sparrow (CSSS) Populations



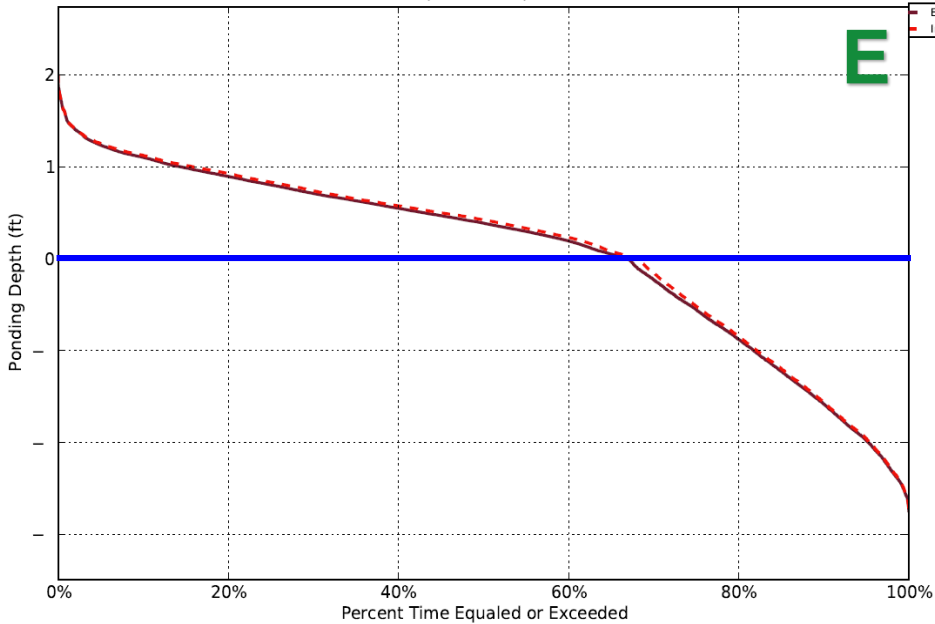
- ❑ ENP is a home of Cape Sable Seaside Sparrows
- ❑ A non-migratory endangered sparrow species.
- ❑ Marl prairies
- ❑ Sparrows are distributed in 6 areas : **A-F**.
- ❑ Nest on the ground
- ❑ **Short-hydroperiod**



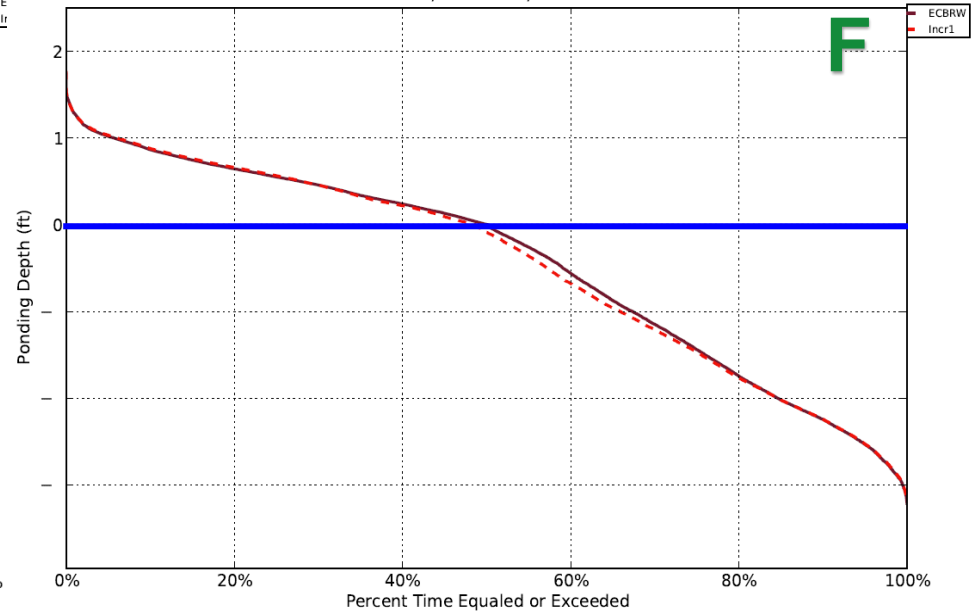
Normalized Duration Curves for CSSS-A at NP205
Elev: 6.01 ft, NGVD29; Cell ID: 1219



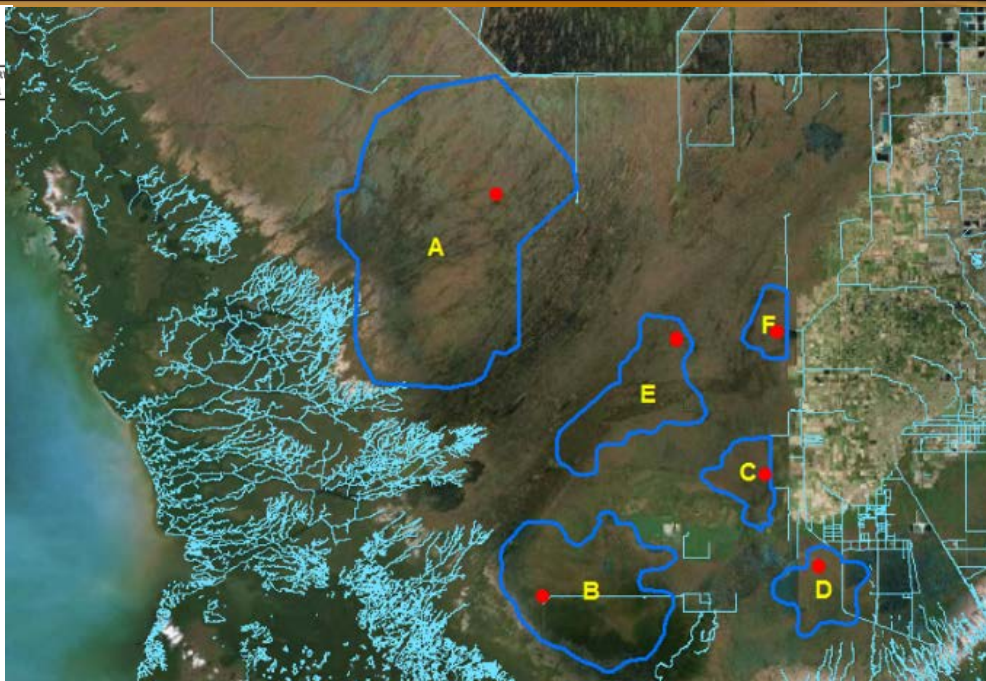
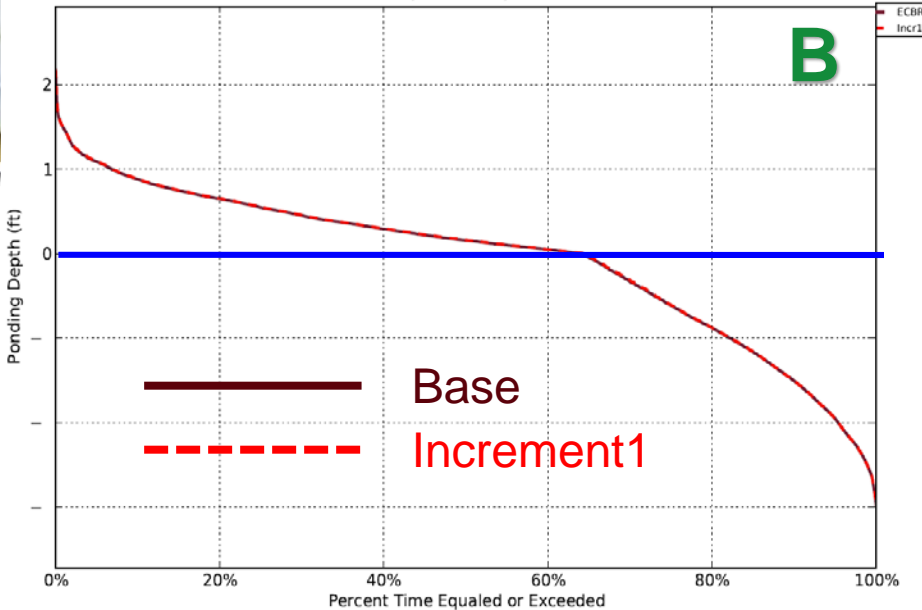
Normalized Duration Curves for CSSS-E at NP206
Elev: 5.55 ft, NGVD29; Cell ID: 2189



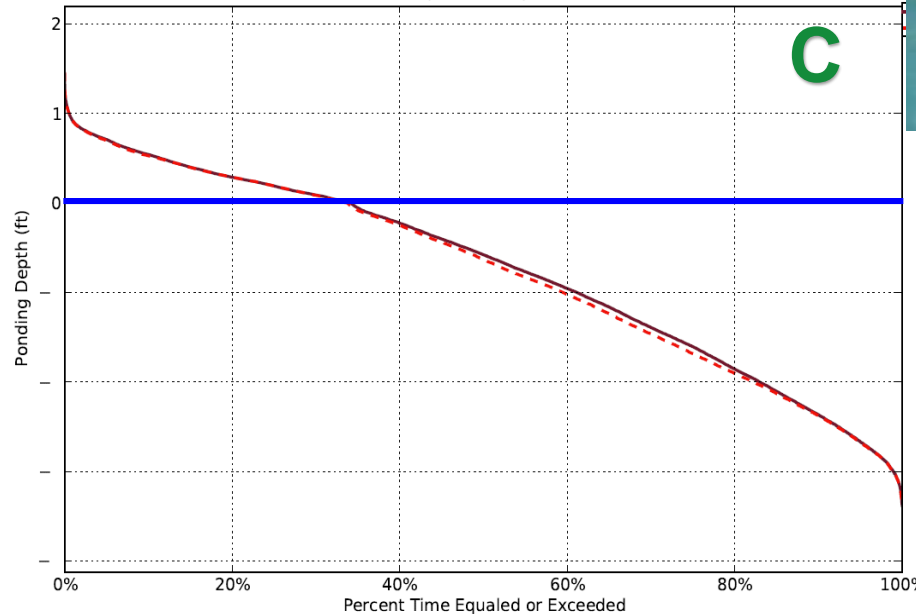
Normalized Duration Curves for CSSS-F at RG-2
Elev: 5.99 ft, NGVD29; Cell ID: 2735



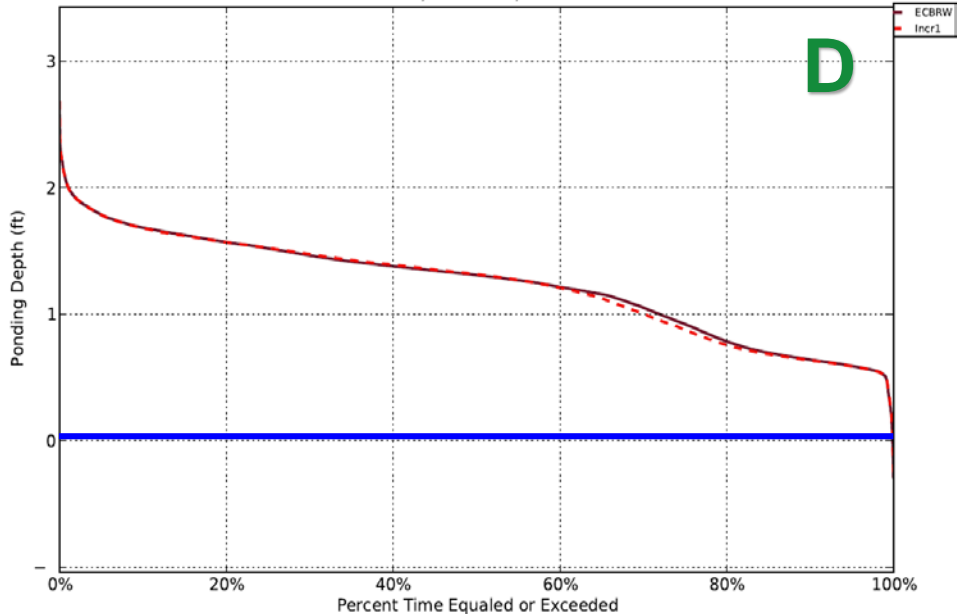
Normalized Duration Curves for CSSS-B at NP46
Elev: 1.43 ft, NGVD29; Cell ID: 2700



Normalized Duration Curves for CSSS-C
Elev: 5.00 ft, NGVD29; Cell ID: 3358



Normalized Duration Curves for CSSS-D
Elev: 1.08 ft, NGVD29; Cell ID: 4778





Benefits of Increment 1

Increment 1 produce small but important benefits:

- ❑ **Hydrologic benefit** → increased flow through NESRS
- ❑ **Water quality benefit** → will be maintained
- ❑ **Ecological benefit** → Improve
 - ❖ habitat function
 - ❖ species composition
 - ❖ abundance
- ❑ **Geological benefit** →
 - ❖ promoting the build-up of soil
 - ❖ inhibiting soil loss



Current Status of Increment 1

- ❑ Increment 1 planned for
 - minimum of one year
 - maximum of two years
- ❑ **El Niño** year with extremely wet “dry season”
- ❑ Florida’s Governor declared **WCA-3 High Water Emergency Condition**
- ❑ USACE approved a deviation on Feb. 15, 2016 which allows L-29 canal stage to rise 8.5 feet maximum instead of current limit at 7.5 feet





Path Forward

❑ Increment 2 (2017-2019):

Officially allowing the L-29 canal to reach a maximum stage of 8.5 ft

Benefits: provide additional hydrologic and ecological benefits to NESRS

Other MWD projects:

- **Tamiami Trail Bridge:** 1 mile bridge completed in 2012;
2.6 mile bridge will be constructed soon

Other South Dade projects:

- **Contract 8 and 8A:** Full build out of Northern Detention Areas (NDA) and hydraulic connection from 8.5 SMA to NDA – currently under construction

Other projects:

- **Rock Miner's Seepage Barrier at L31N canal:** 2 mile completed in 2012, additional 3 mile is almost complete

❑ Increment 3 (2018-2021):

Combined Operating Plan will guide operation of the MWD and

C-111 South Dade project features.



Questions and Answers

Team Members

ENP:

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