Recent Progress in the MIKE Marsh Model (M3ENP) of Everglades National Park

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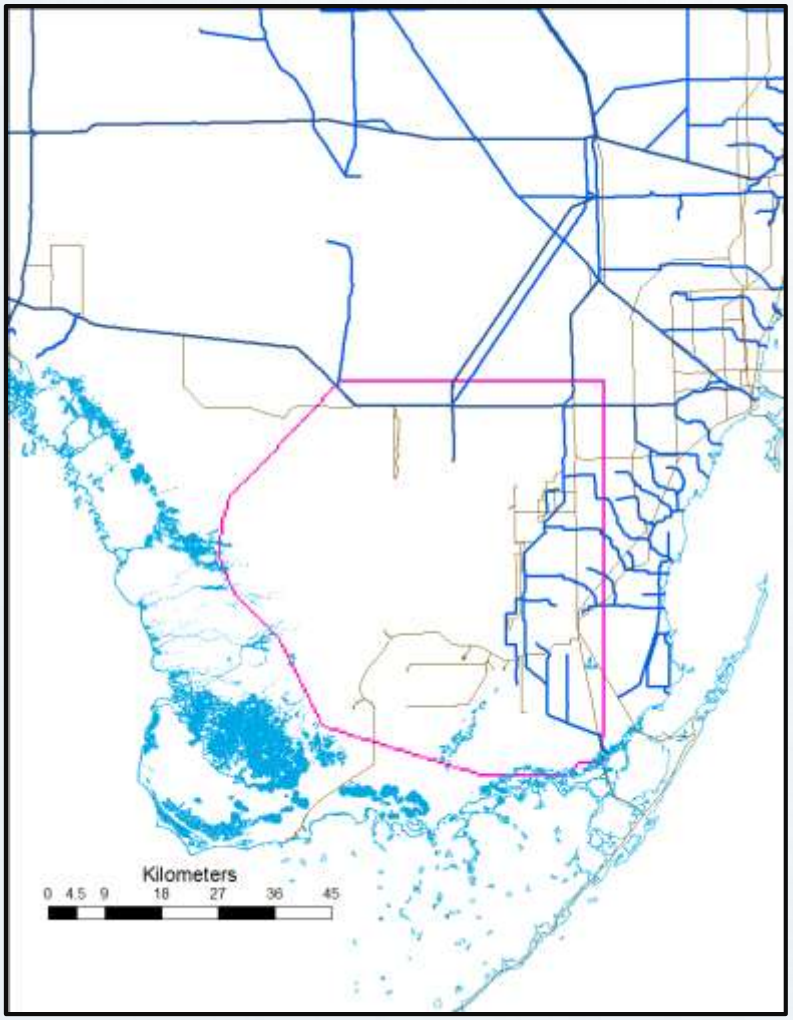
M3ENP-MIKE MARSH MODEL OF ENP



Developers:

- Robert Fennema, Georgio Tachiev, Amy Cook, Kiren Bahm

Funding

- NPS – CESI and Others

Commercial Software

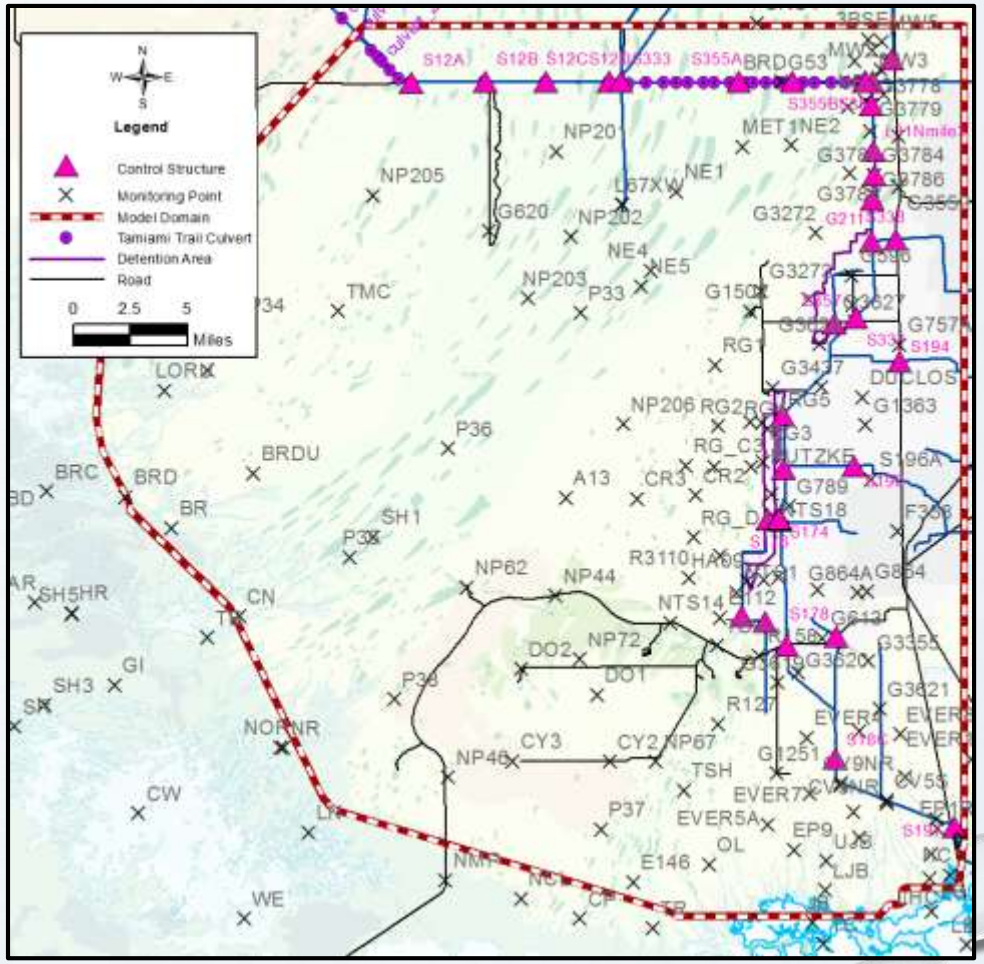
- MIKE SHE
- MIKE 11

M3ENP-MIKE MARSH MODEL OF ENP

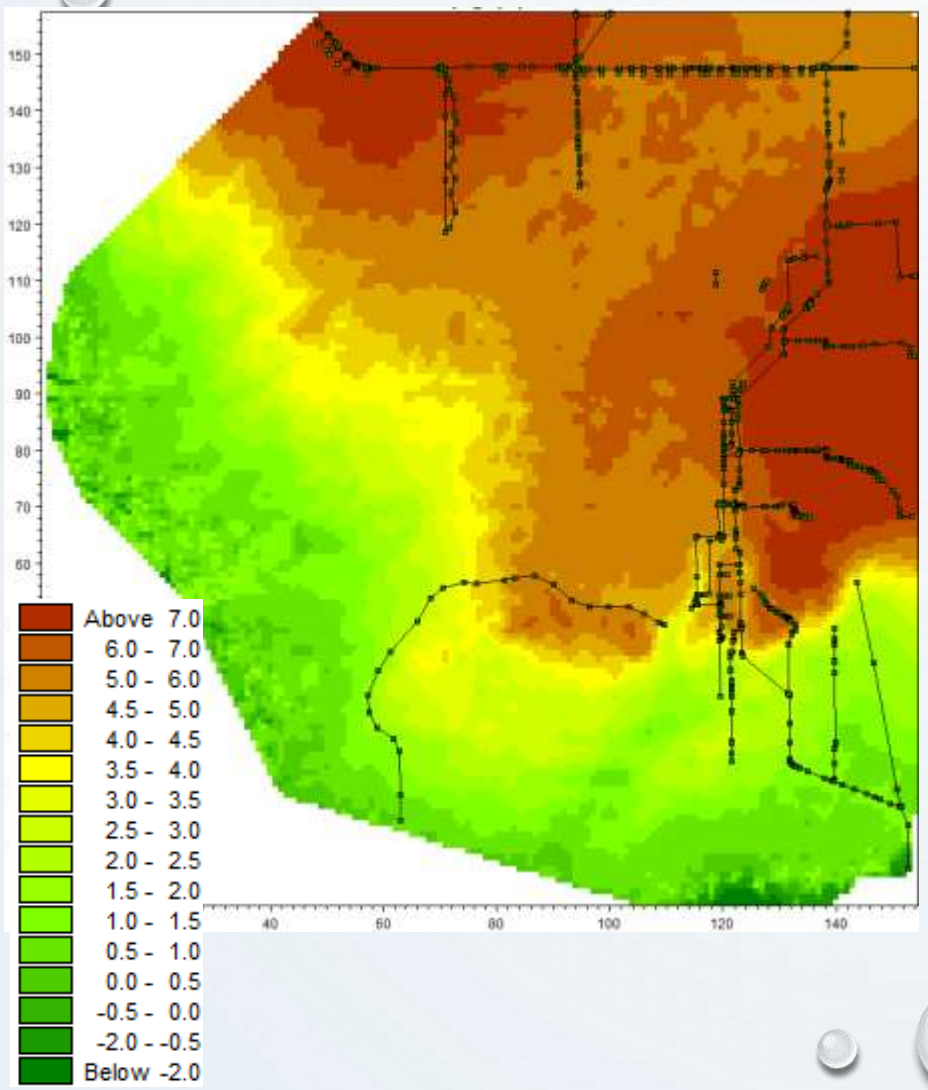
- MIKE SHE (MSHE) – 3D Saturated And Unsaturated Groundwater, 2D Overland/Sheet Flow, and 1D Unsaturated Zone Flow (Vertical)
  - Domain selection and discretization
  - Domain parameters (subsurface hydrology), vegetation, soil, overland flow, rainfall, ET, Manning's number, detention storage, imperviousness
  - Boundary conditions (rainfall, evapotranspiration, groundwater)
- MIKE 11 (M11) – 1D flow model
  - Canals, cross sections, Manning's number, structure and structure operations
  - Boundary conditions (stage and flow)

M3ENP-MIKE MARSH MODEL OF ENP

- Simulation Period
  - 1987-2010
- 1226 Square Mile Domain
- 120 Miles Of Canals
- Structures:
  - Tamiami Trail Culverts
  - Gates (Full Ops)
  - Pump Stations (Full Ops)
  - Stormwater Detention Areas



M3ENP-MIKE MARSH MODEL OF ENP



- Square Finite Difference Grid (400m discretization)
- Key Parameters: Hydraulic Conductivity, Manning n, Canal Seepage, Structure Operations
- 350 Observation Points
- Computes: Canal Water Levels, Flows, Seepage
- Spatial Plots: Flow Velocities, Water Depth

APPLICATIONS OF M3ENP

1. Feasibility Study for Proposed Biscayne Bay Ecosystem Restoration Reservoir
2. Effects of a Curtain Wall Adjacent to L31-N Canal

Reservoir

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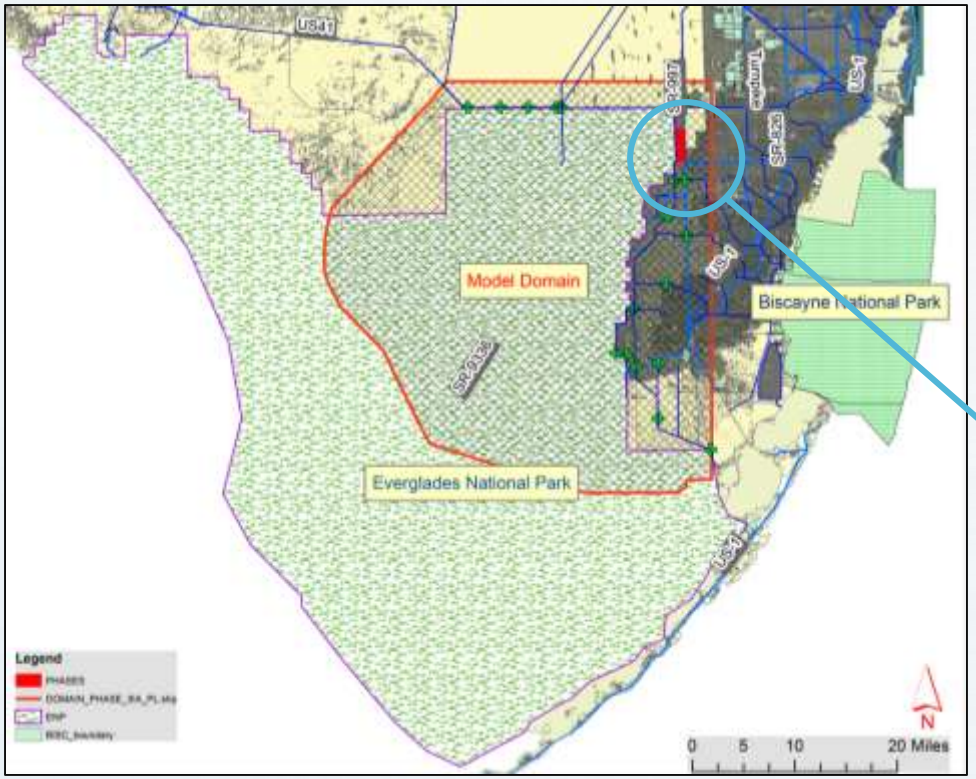
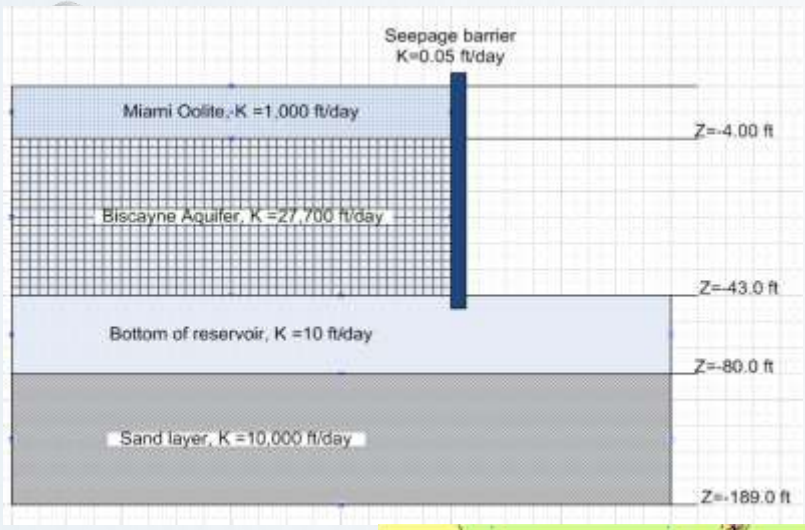
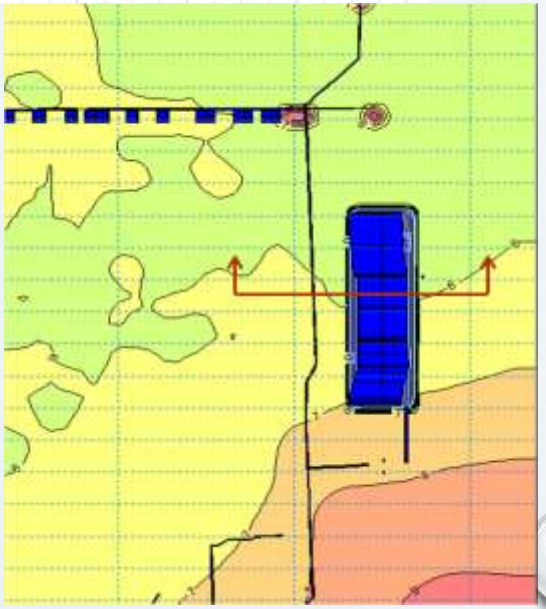


- Adjacent to L31N, south of C-4
- 638 acres –1800 acres

Reservoir

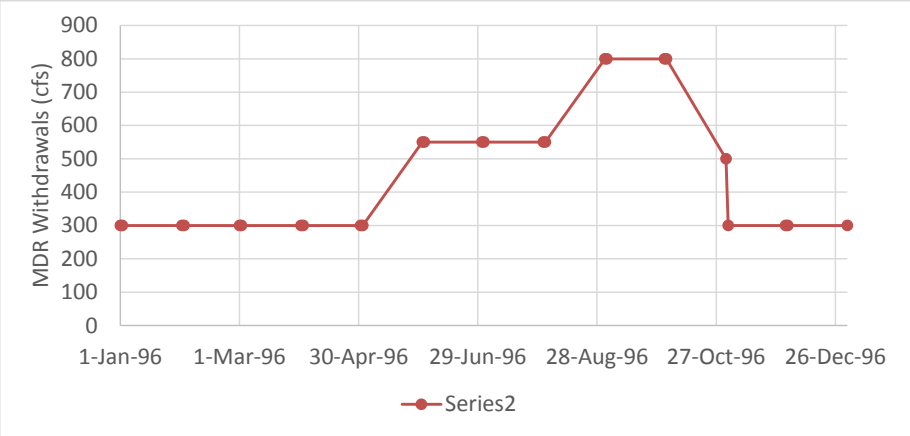




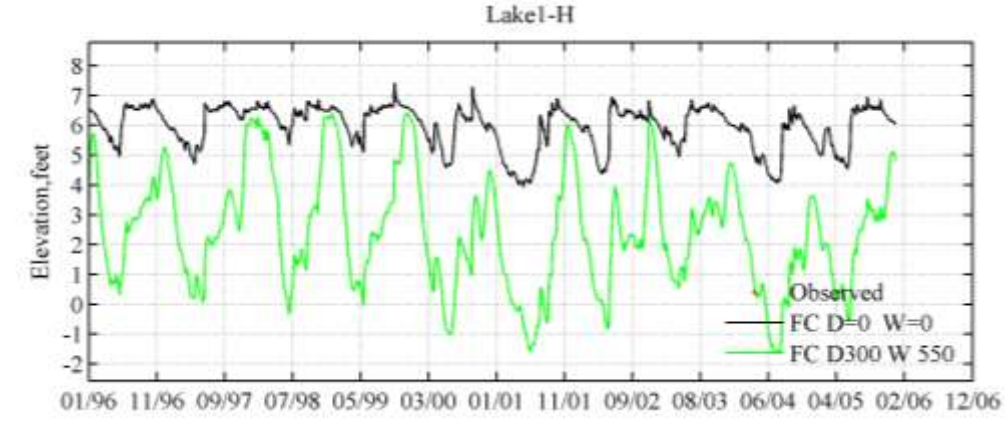
- Drawdown, volumes, seepage rates, and potential withdrawals
- Up to 800 cfs are possible and will keep the levels at -25 Ft elevation (NGVD29)

Reservoir

Simulated Withdrawl



Resulting Water Levels With Proposed Pumping Vs. No Pumping



Reservoir

Conclusions

- Capture Excess Water From L-31N During the Wet Season to Improve Year-Round Flows to The Biscayne National Park
- Regional Water Supply
- Wellfield Recharge
- Stormwater Management

Curtain Wall

Curtain Wall

Effects on the hydrology in NE Shark River Slough

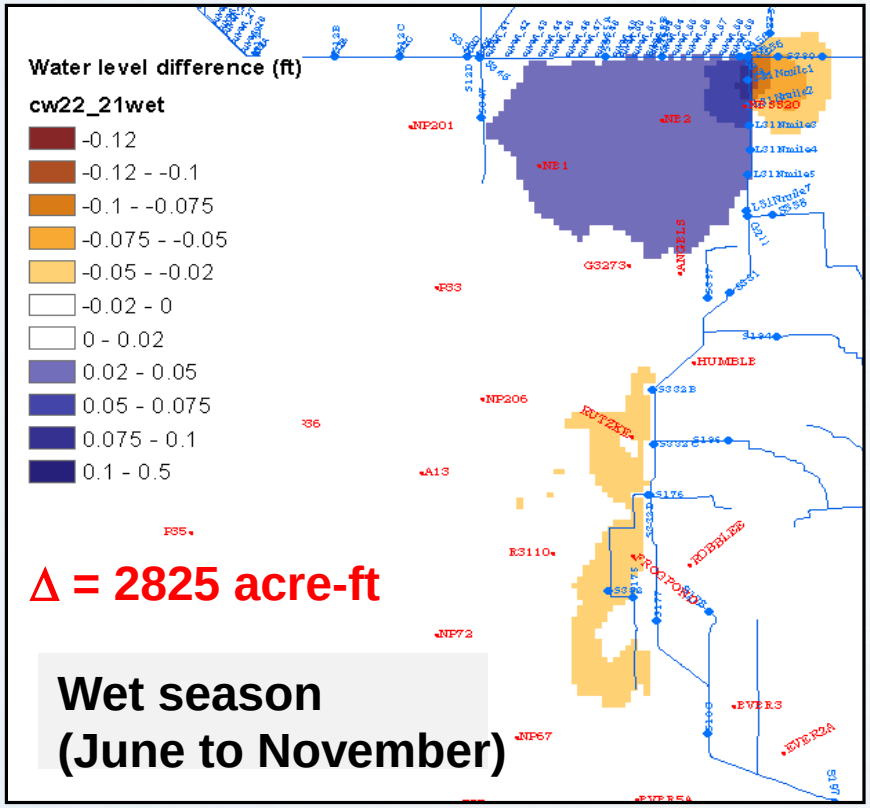
Three Models:

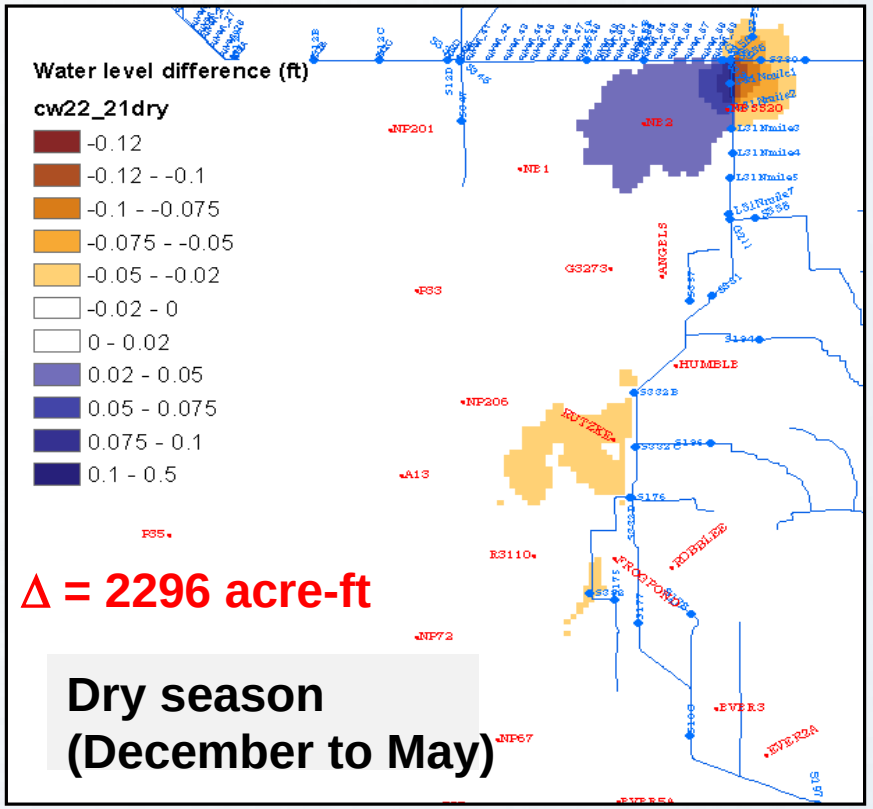
'v21' – No curtain wall implemented

'v22' – Same as 'v21' but with a 2-mi long curtain wall added along L31N

'v23' – Same as 'v21' but with a 5-mi long curtain wall added along L31N

Curtain Wall

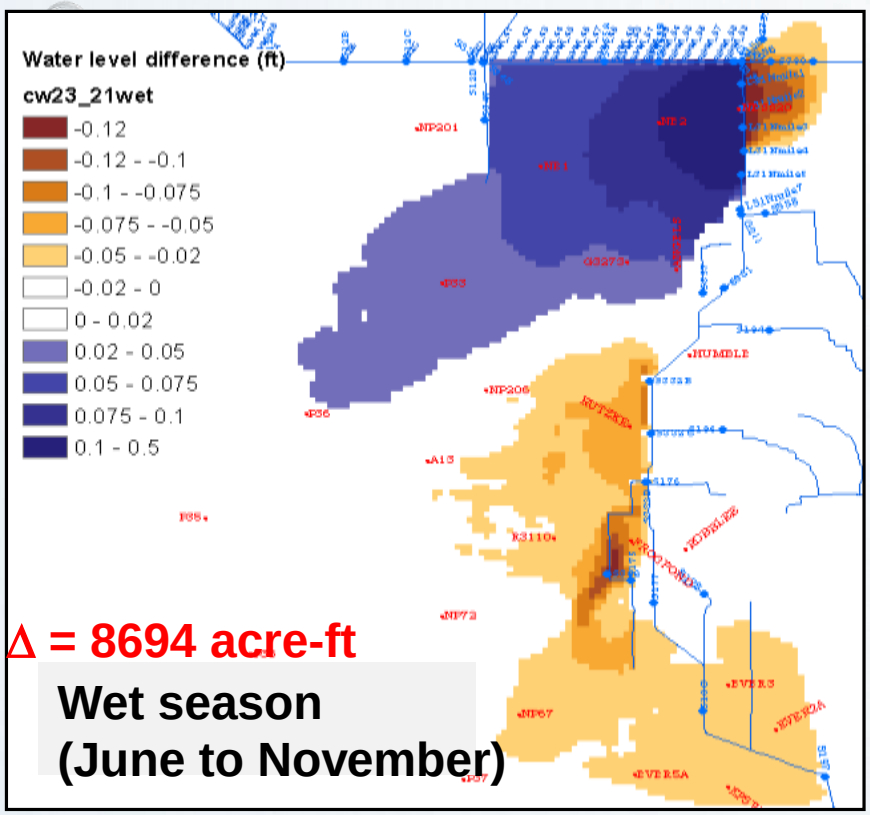




Curtain wall - 2-mile vs no wall

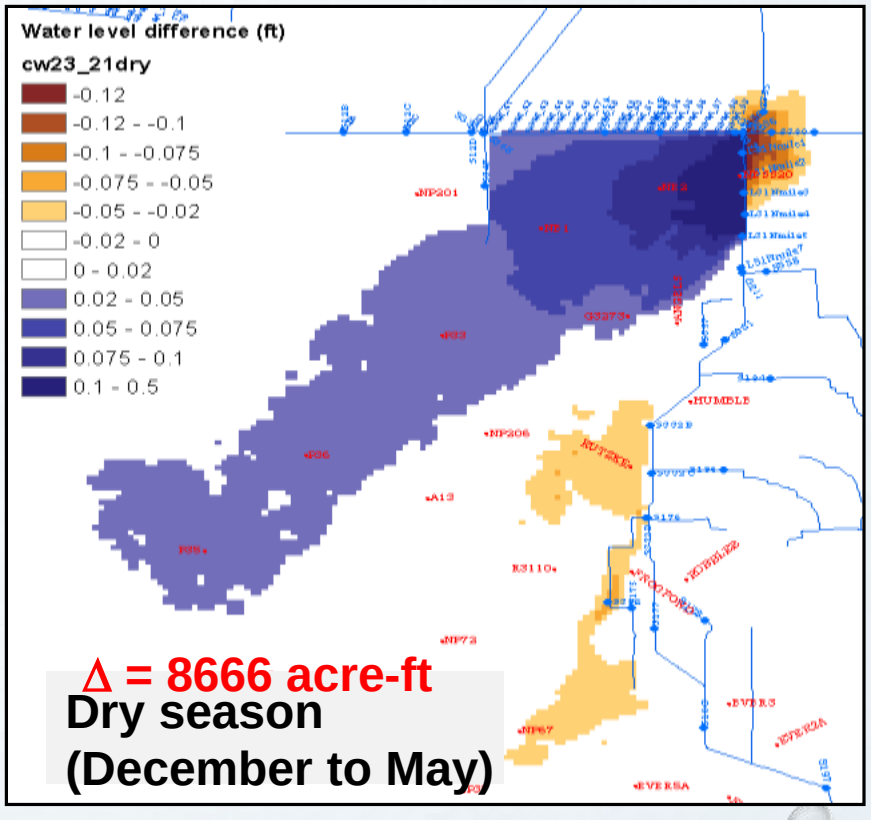
Differences in surface water level

Curtain Wall



Δ = 8694 acre-ft

Wet season (June to November)



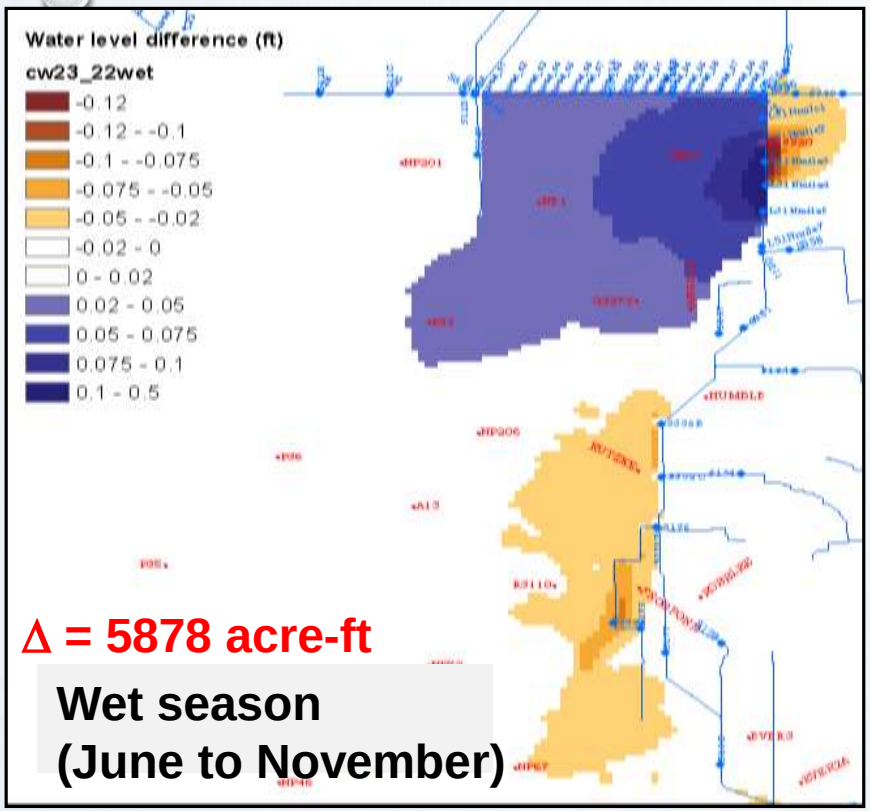
Δ = 8666 acre-ft

Dry season (December to May)

Curtain wall - 5-mile vs no wall

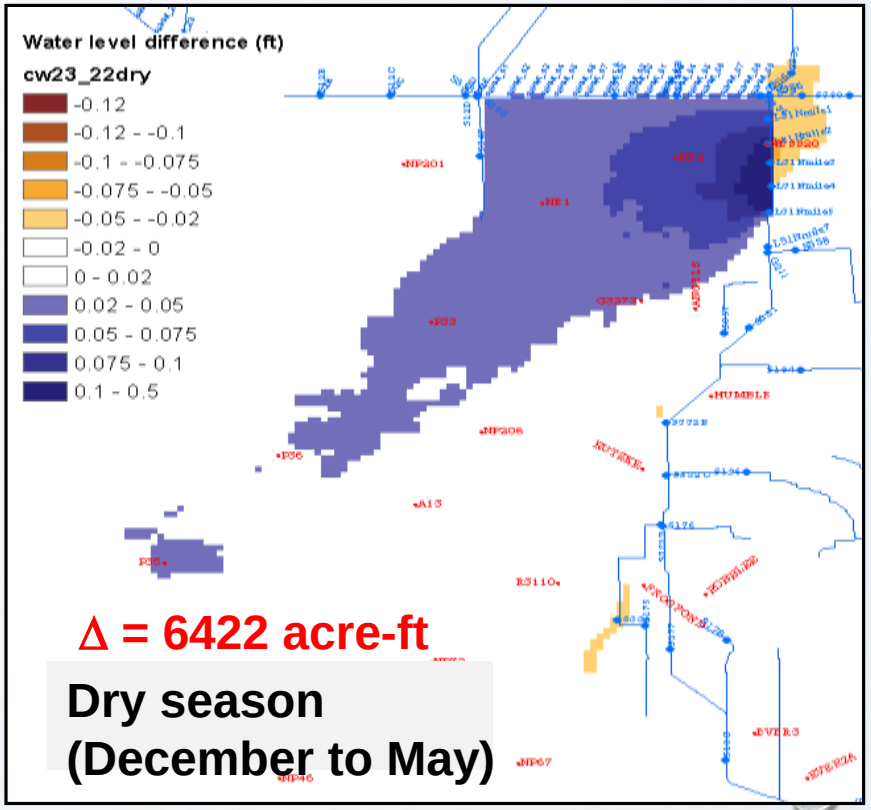
Differences in surface water level

Curtain Wall



Δ = 5878 acre-ft

Wet season (June to November)



Δ = 6422 acre-ft

Dry season (December to May)

Curtain wall - 5-mile vs 2-mile wall

Differences in surface water level

Curtain Wall

What are the potential benefits of a curtain wall?

- Increased Surface Water Storage
  - Averaged during 2000-2010 for dry (Jan-May, Dec) and wet (Jun-Nov) season periods. Summed across entire model domain, but main effect is in NE Shark Slough.
- Potential Reduction of Flow from West to East
  - North to South transect.
  - Several transects were tested including:

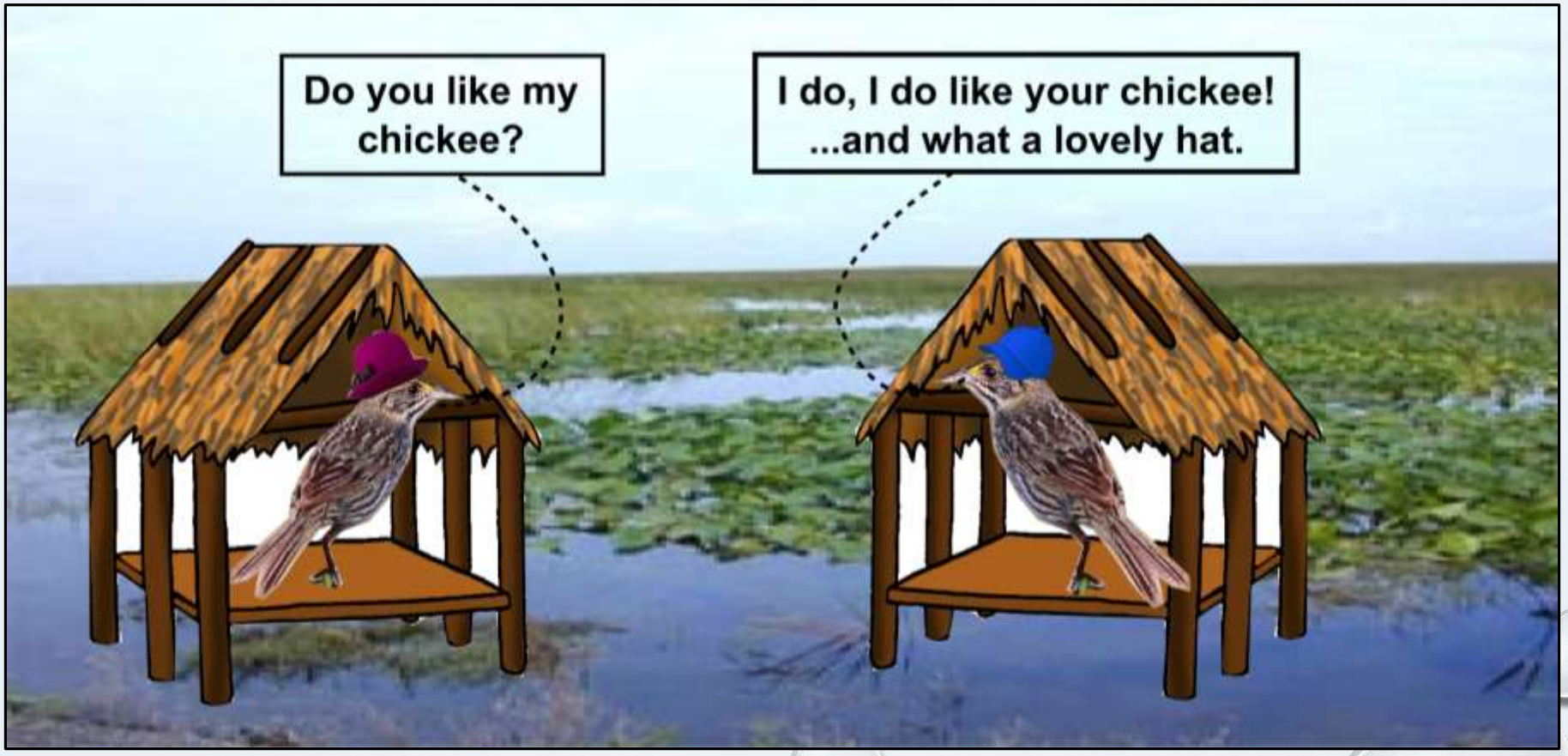
    a) 5-mile transect parallel and adjacent to the 5-mi curtain wall, and

    b) 7+ mi transect that extends ~0.5 mi south of G211.

FUTURE APPLICATIONS

- Cape Sable Seaside Sparrows
- Water Quality Analysis
- Quantification Of Canal Seepage
- Evaluation of Tamiami Trail Bridge Construction
- Stormwater Detention Area Effectiveness

THANK YOU!


Do you like my chickee?
I do, I do like your chickee! ...and what a lovely hat.