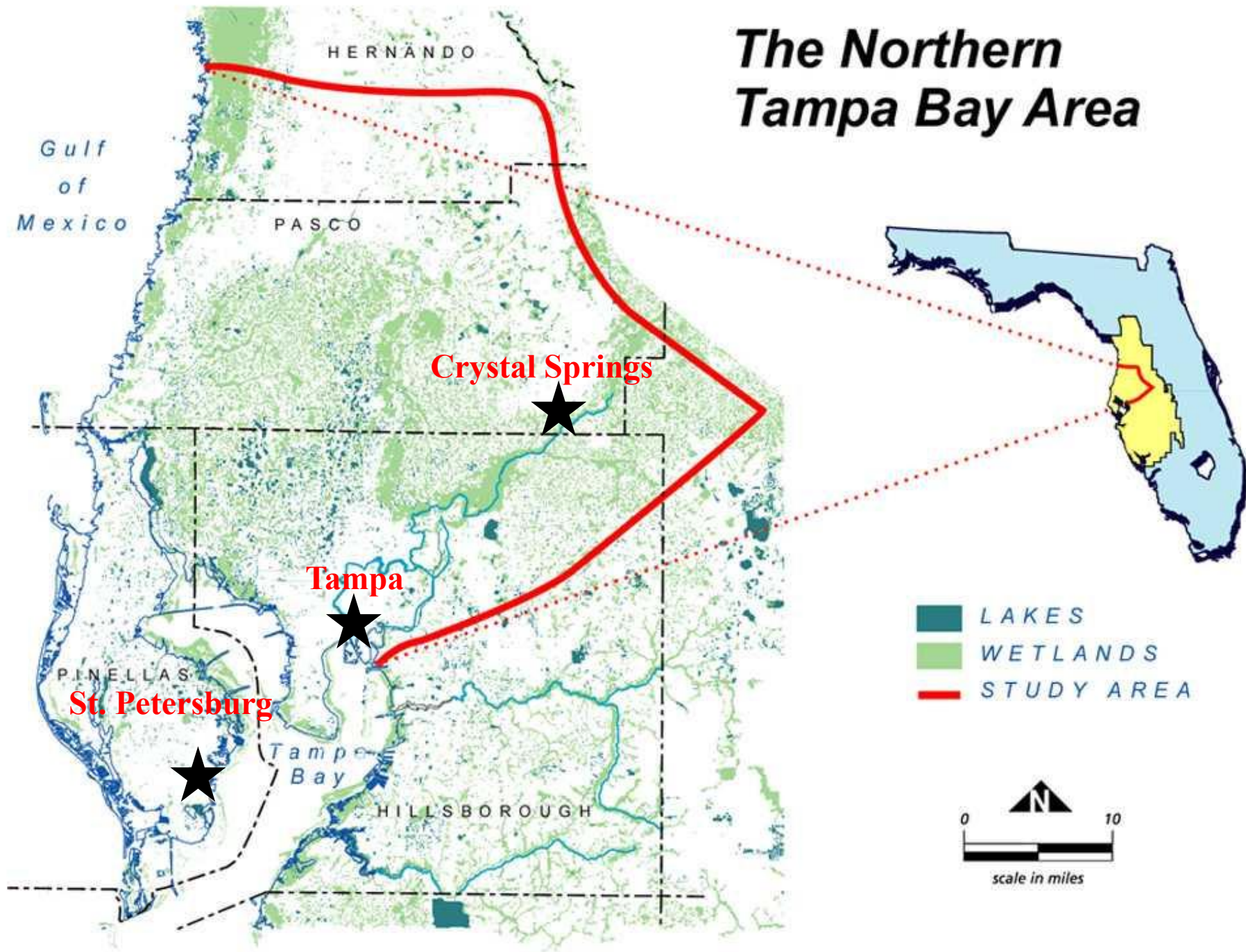


Groundwater Analysis Tools for the Northern Tampa Bay Area

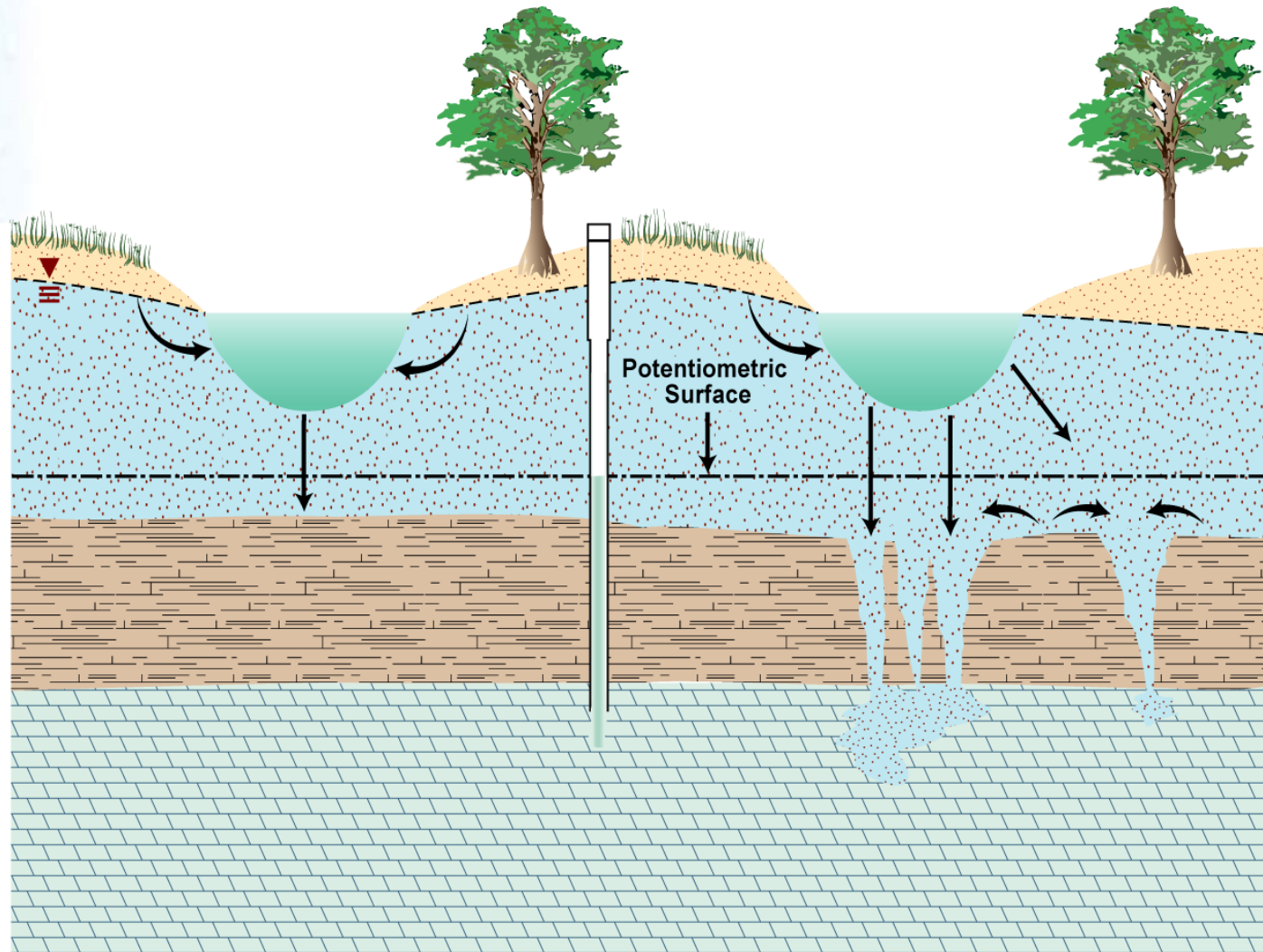
May 22, 2014



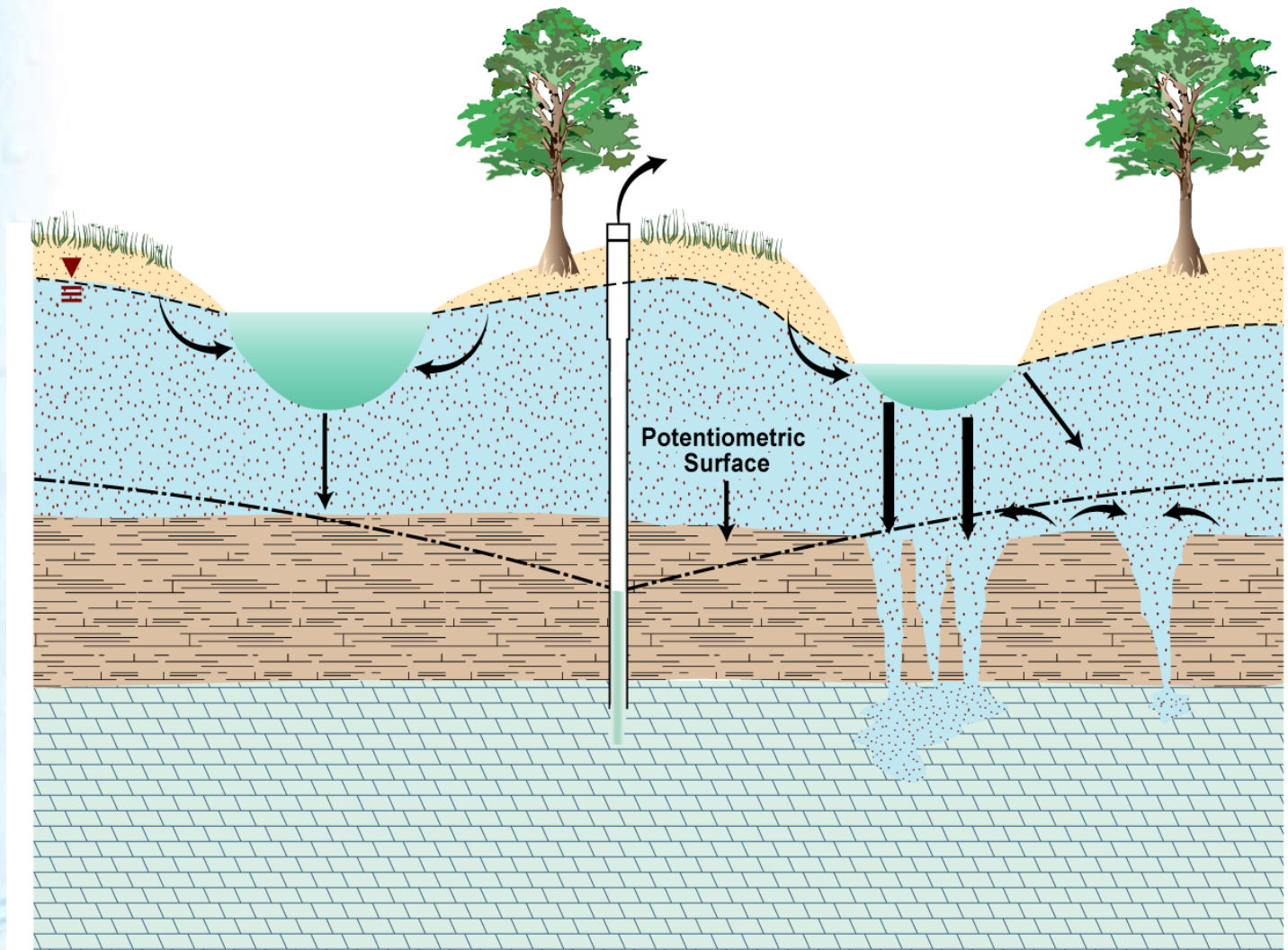
The Northern Tampa Bay Area



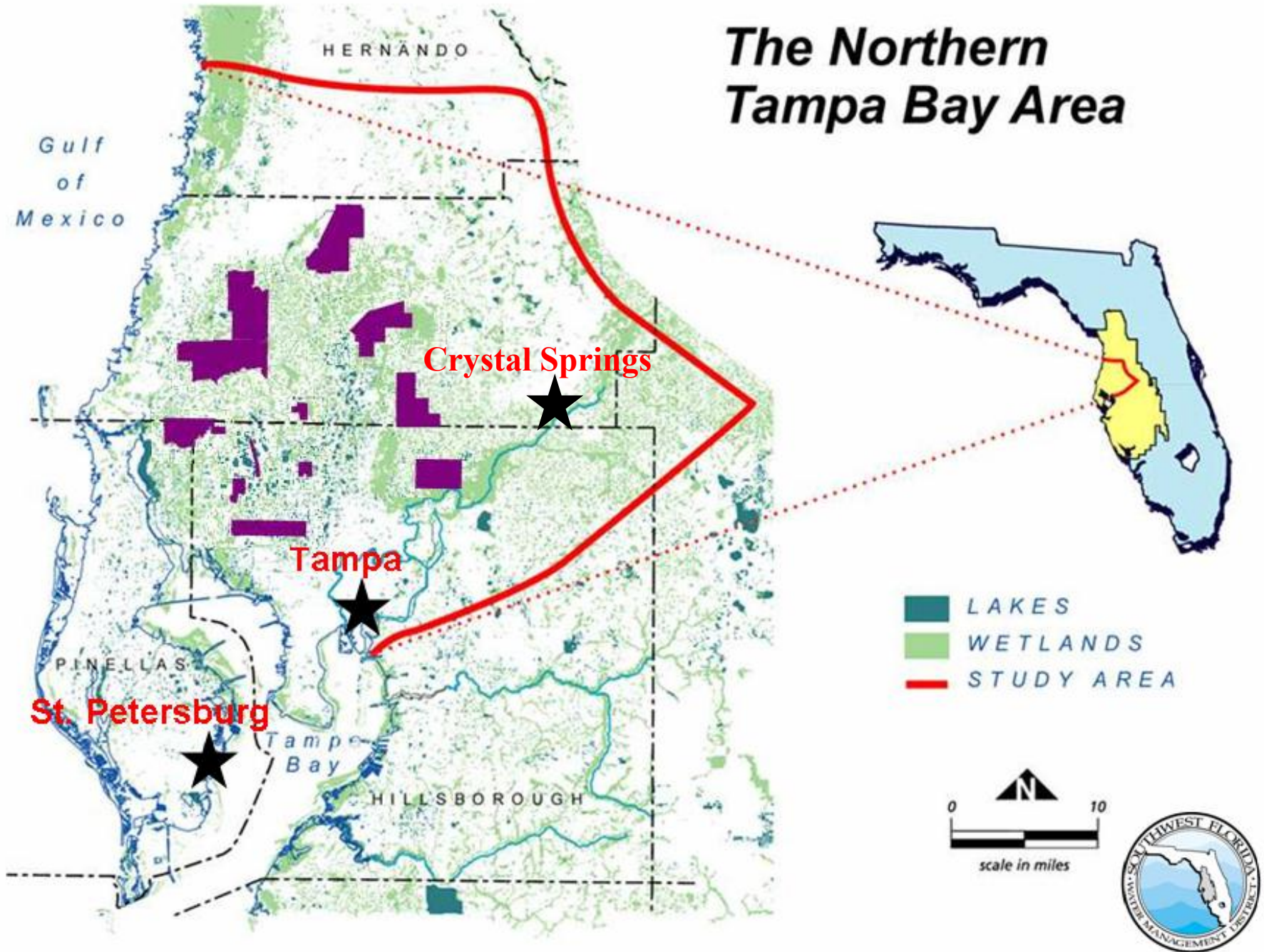
Groundwater Flow in a Karst Environment



Groundwater Flow in a Karst Environment



The Northern Tampa Bay Area



CONSOLIDATED PERMIT WELLFIELDS

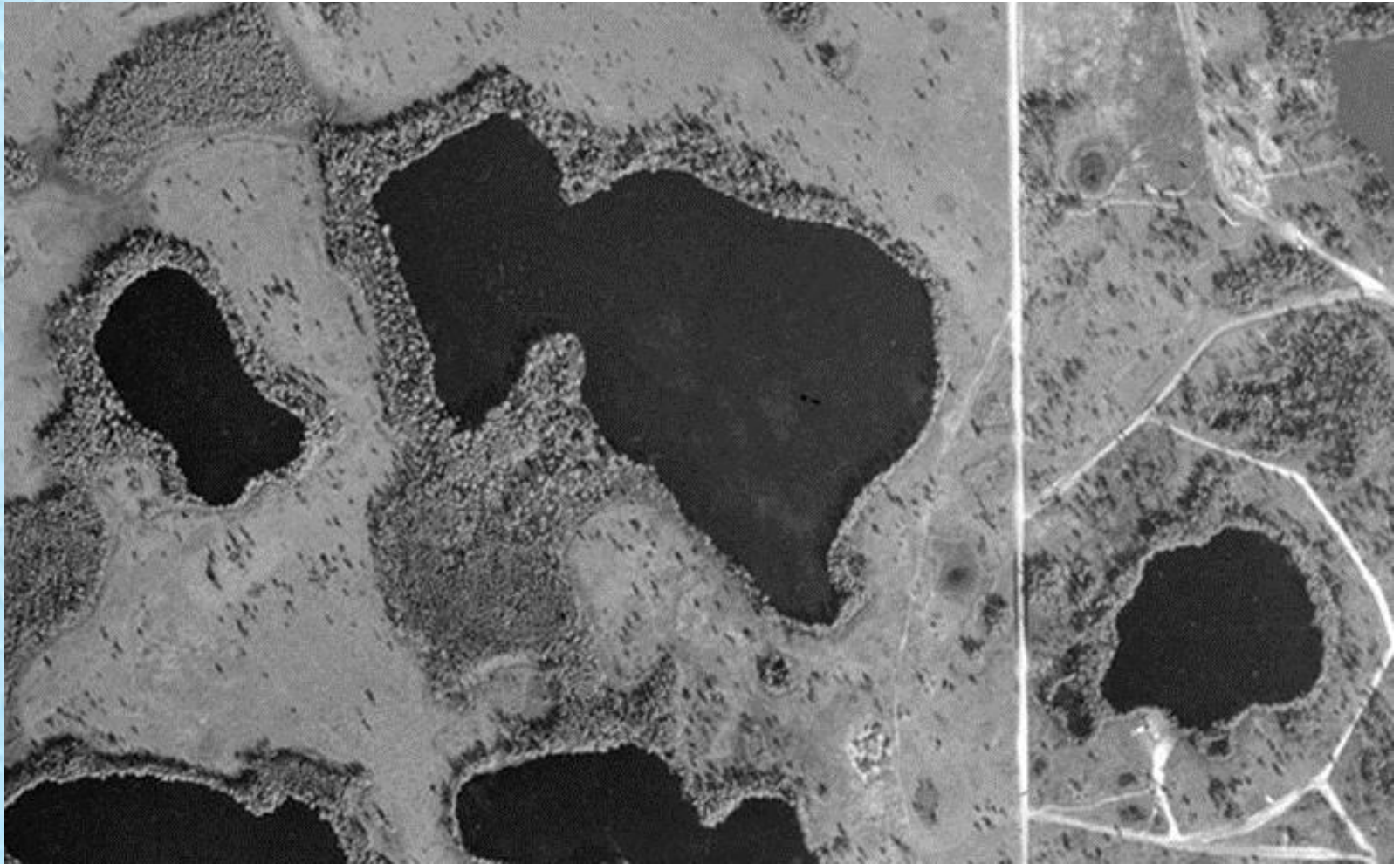


1930 1940 1950 1960 1970 1980 1990 2000

YEAR

MILLIONS OF GALLONS PER DAY

Lake Starvation - 1948



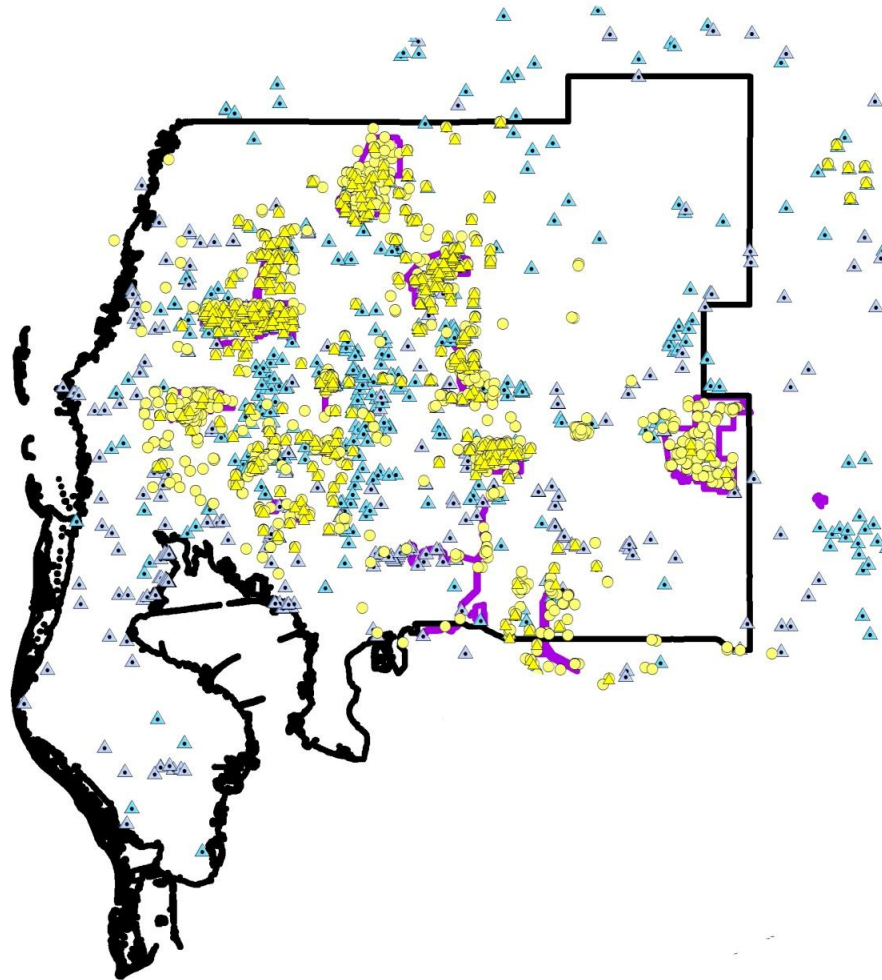
Lake Starvation - 1968





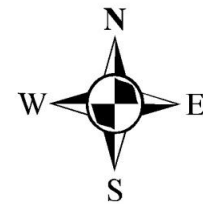


NTB Data Collection Network



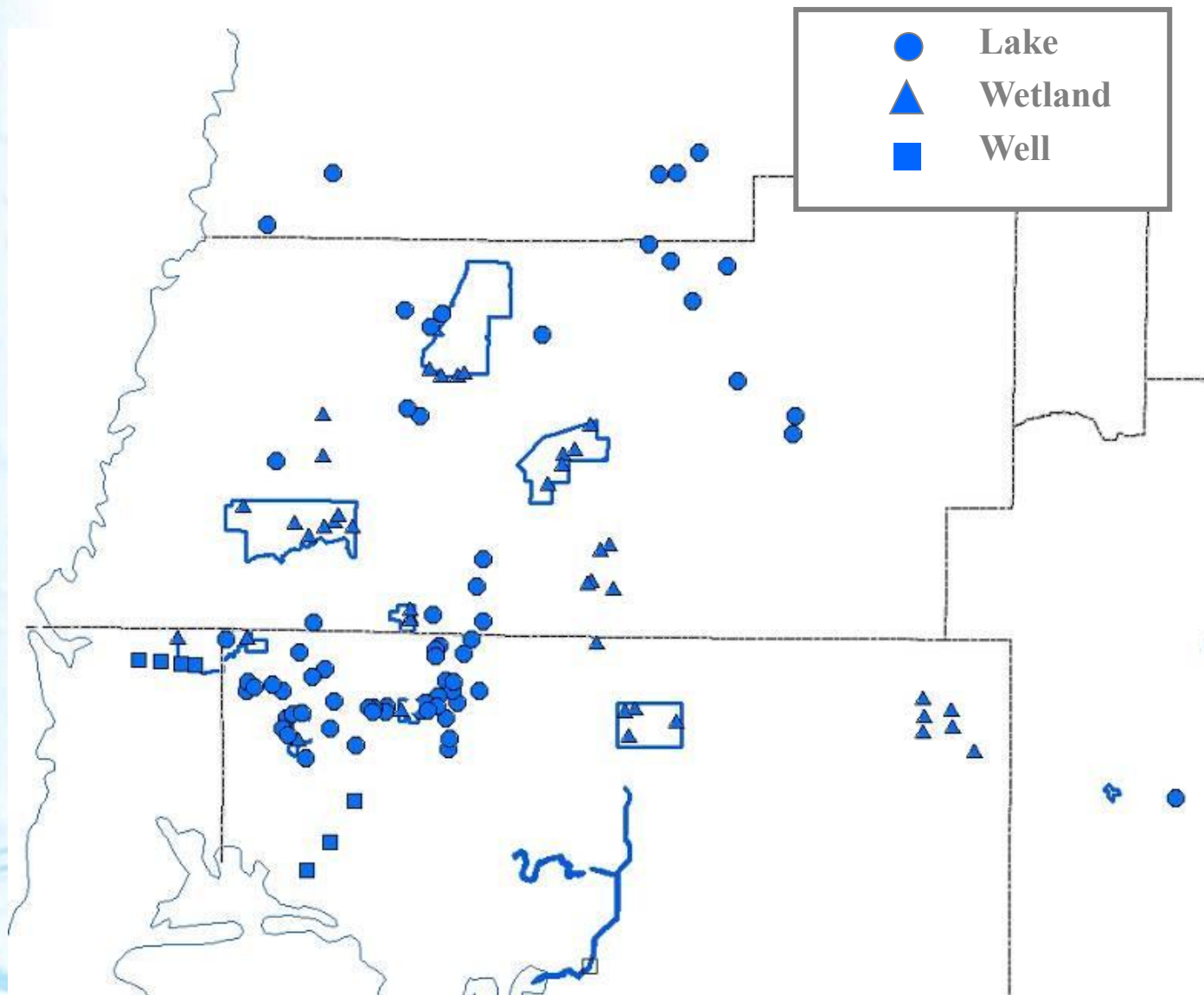
Legend

-  TBW Wetlands
-  TBW Wells
-  District Lake
-  District River/Stream
-  District Wetland
-  NORTHERN TAMPA BAY
-  Public Supply Wellfields



0 5 10 20 Miles

Minimum Levels



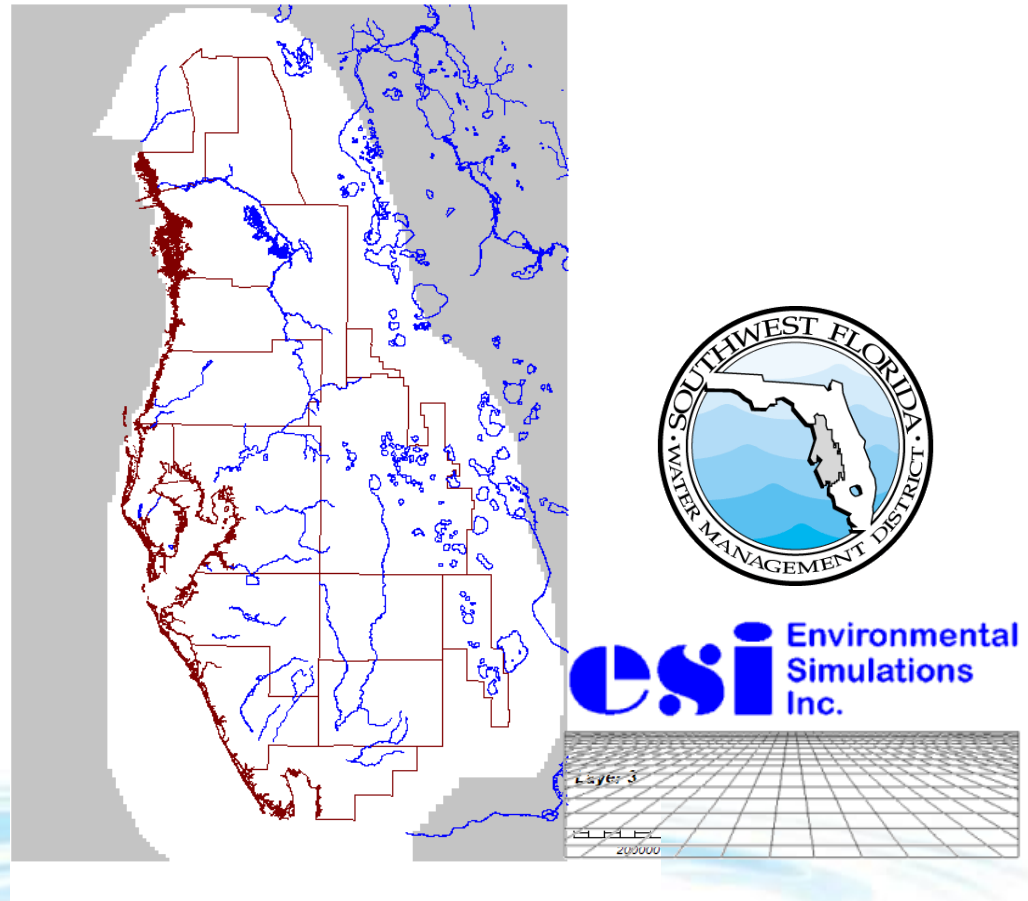
Analysis Tools – Models

Comprehensive and Consistent

- Models for permitting (DWRM)
- Integrated models (INTB)
- Models focused on detailed drainage (DHI-based)
- Site-specific water budgets

District Wide Regulation Model (DWRM)

- Regional Model for Entire District
- System for Rapid Review of Permits
 - Simple
 - Individual Permit Area
 - Cumulative Impacts
 - Incremental Impacts

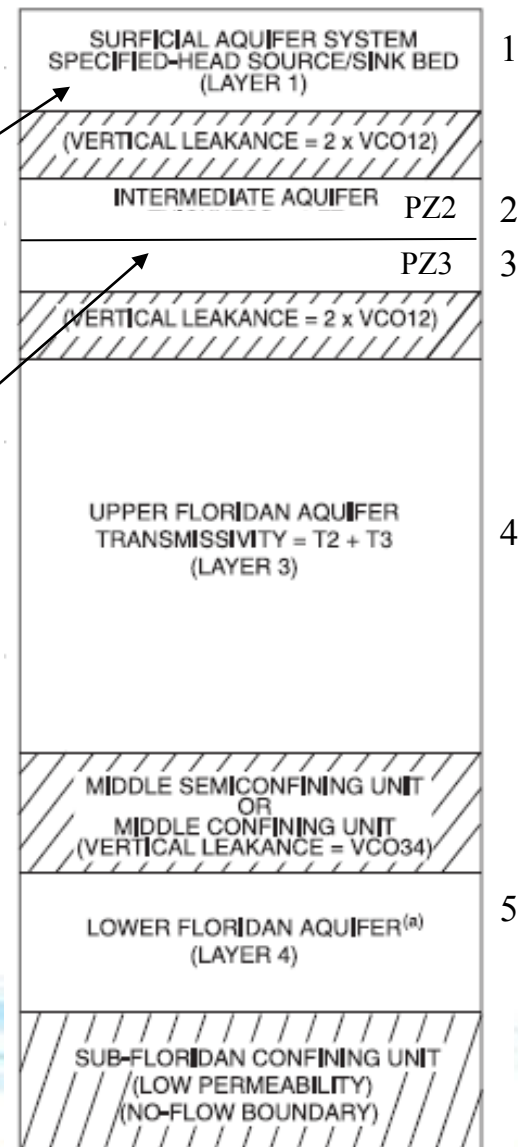


DWRM2 Layering

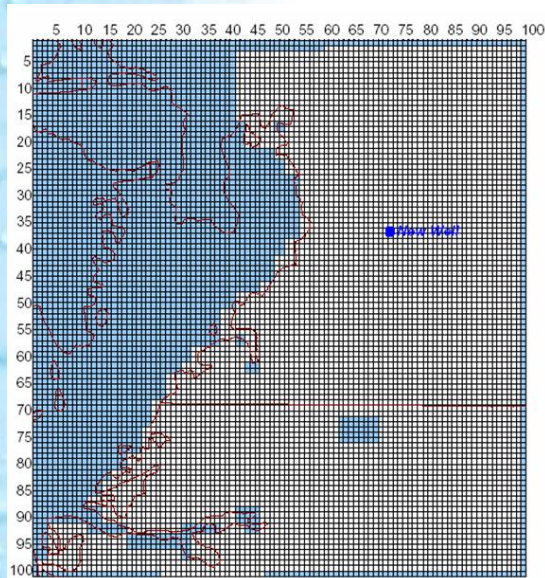
Surficial Layer is Active

Intermediate layer split in two

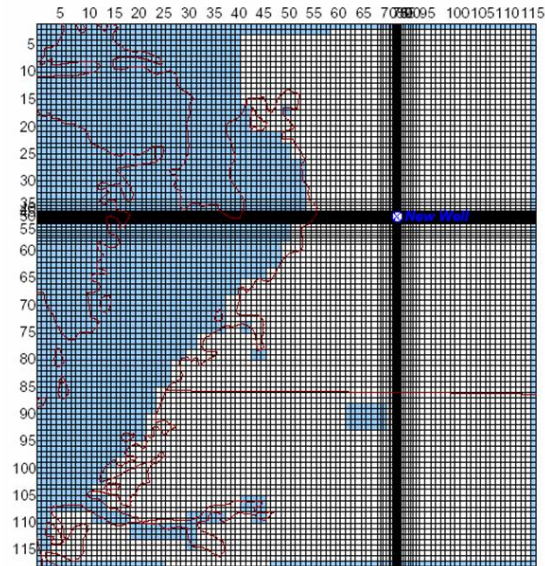
PRINCIPAL HYDROGEOLOGIC UNITS AND EQUIVALENT LAYERS IN REGIONAL MODEL



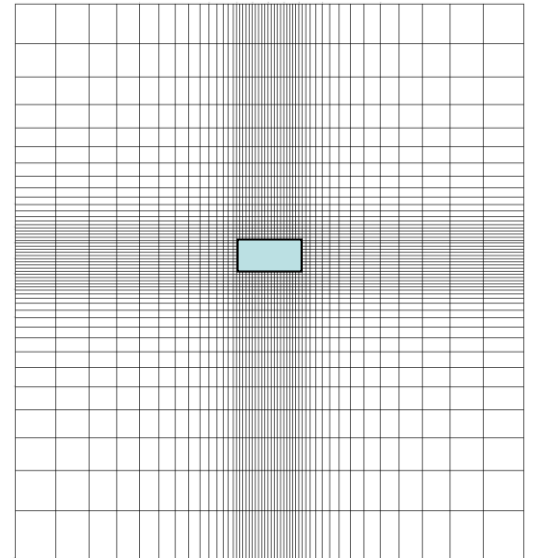
Focus Telescopic Mesh Refinement (FTMR) with GIS link



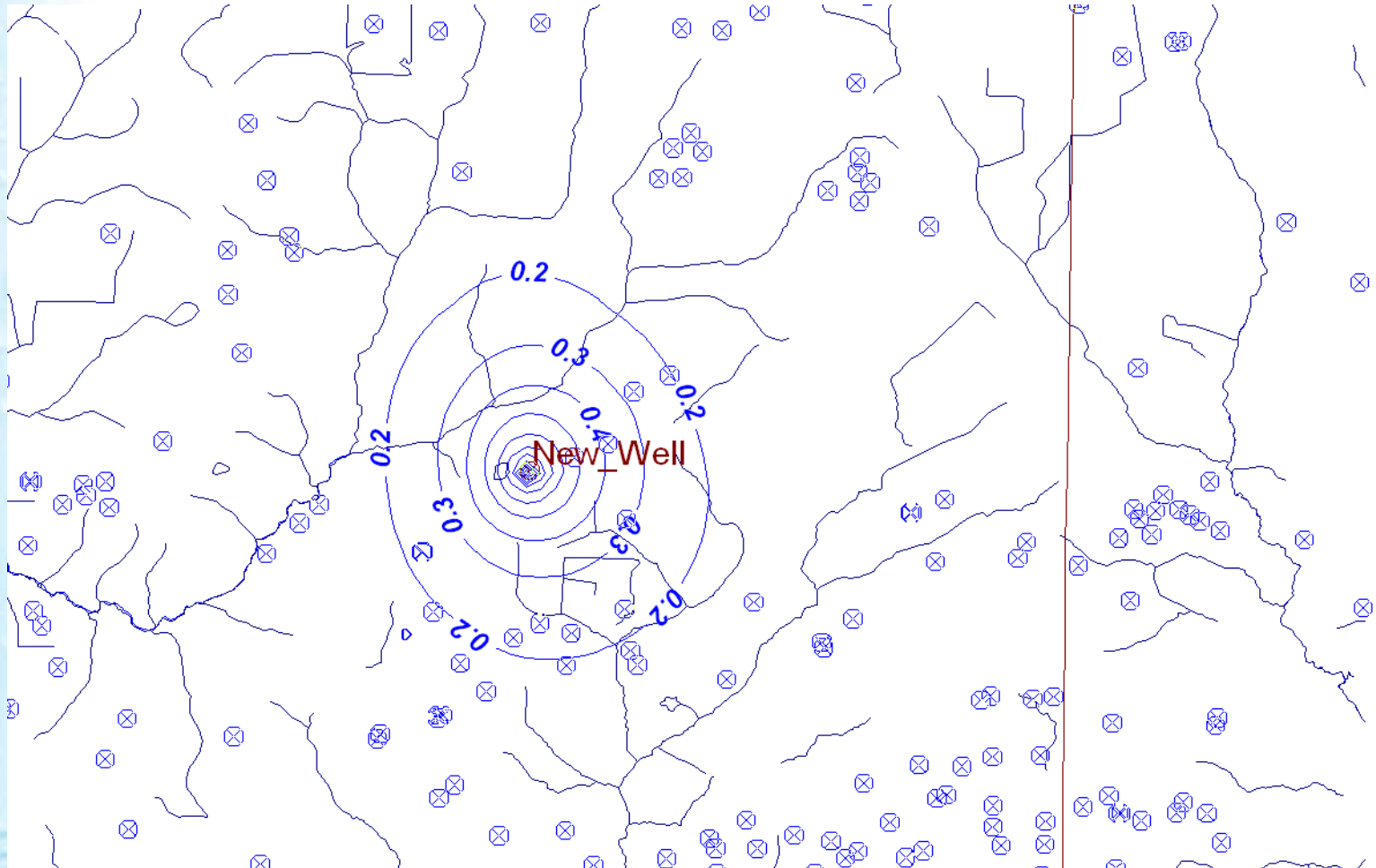
Standard TMR Finite-Difference Grid



Focus TMR Finite-Difference Grid

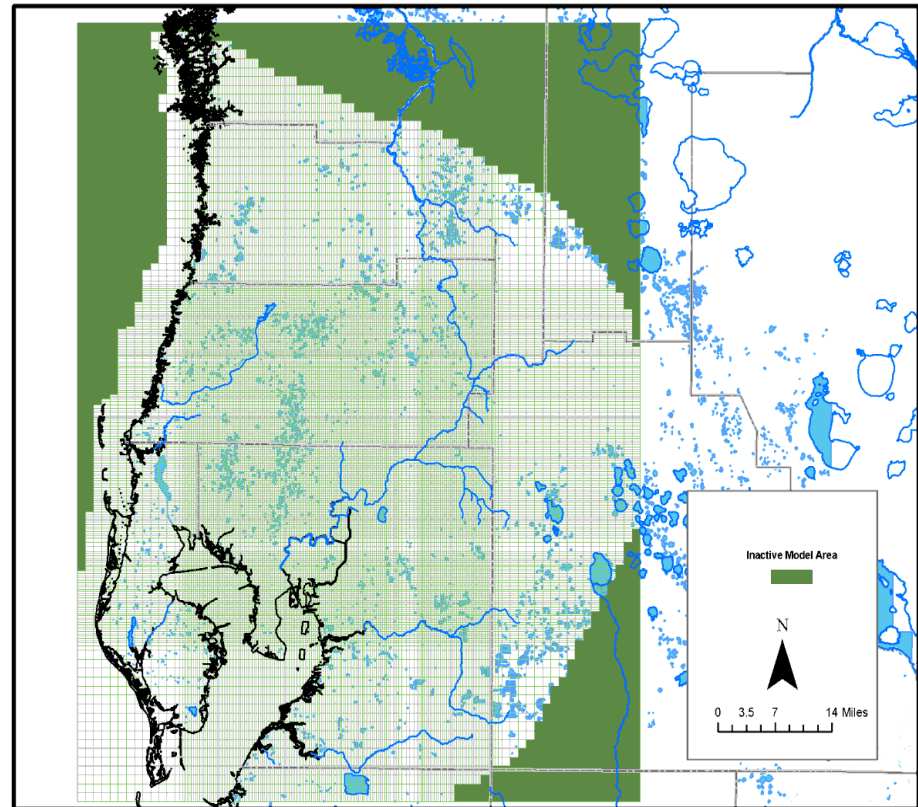


Impact Assessment

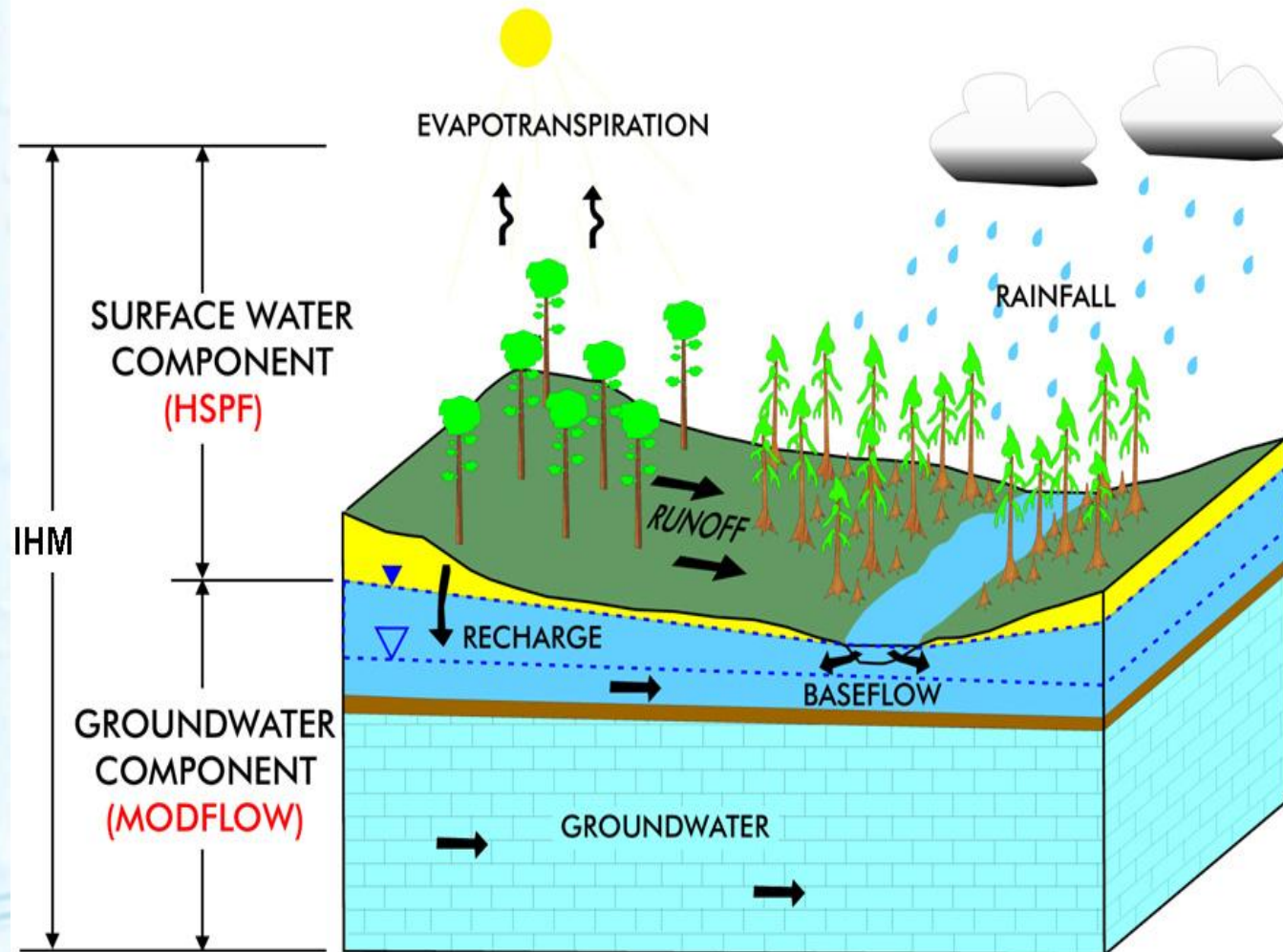


Integrated Northern Tampa Bay Model (INTB)

- State of the art computer model
- Simulates surface water and groundwater flow systems
- Covers 4,000 square miles
- Peer Review completed in March 2013

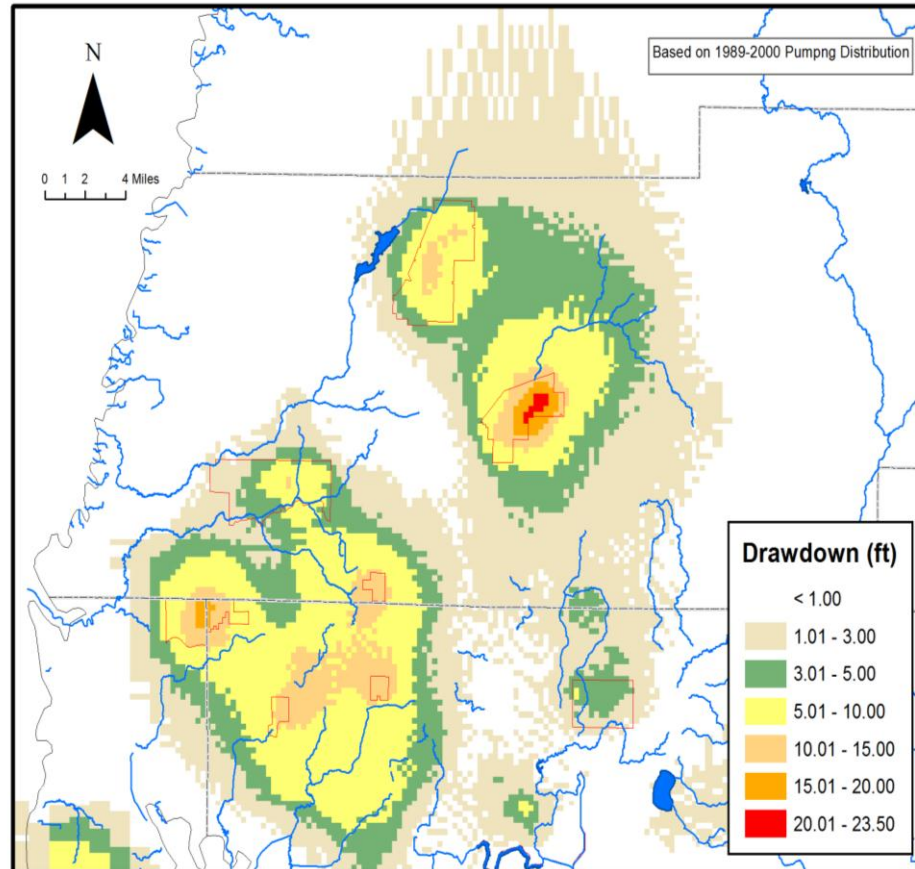


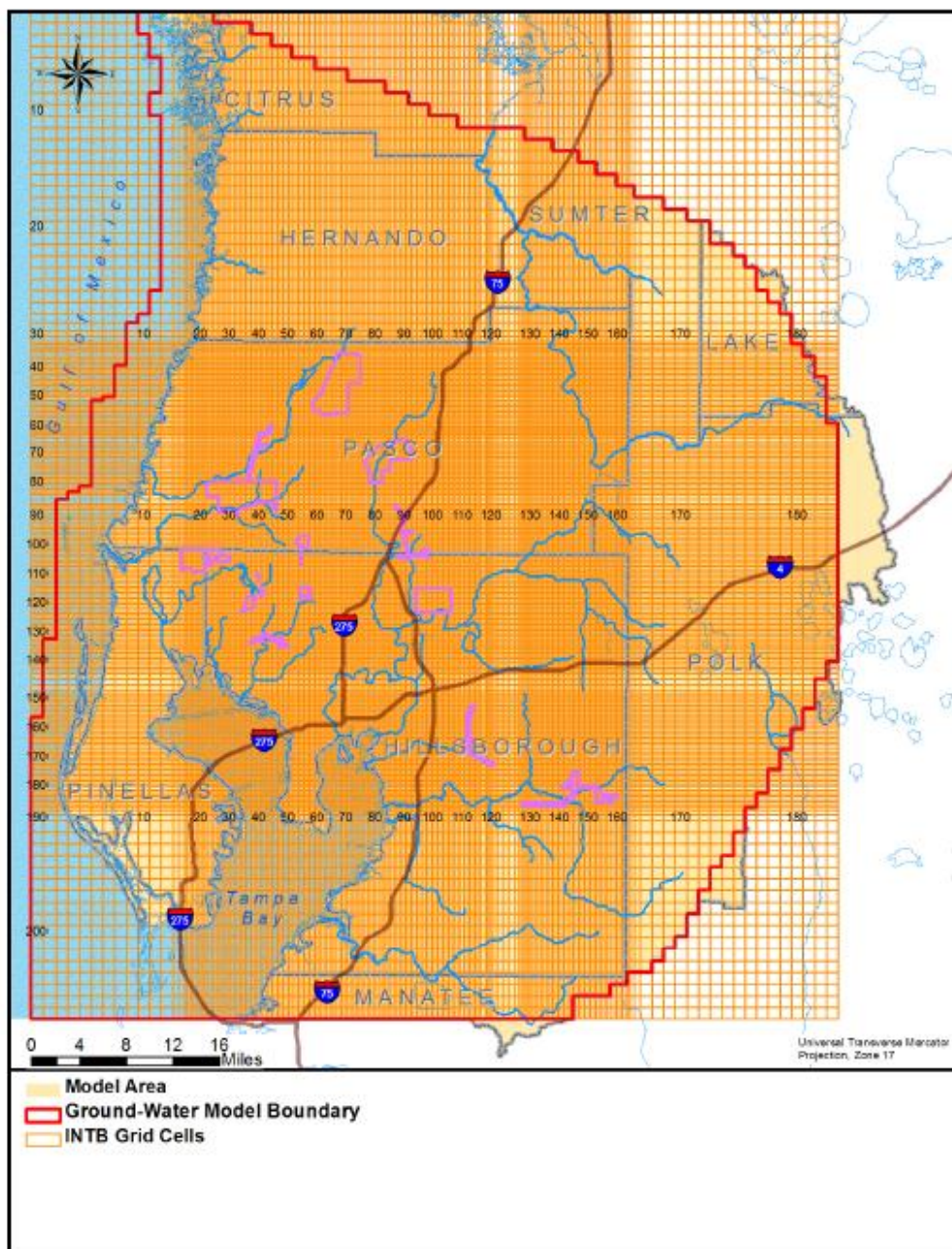
INTB Conceptualization



INTB Model – What is it used for?

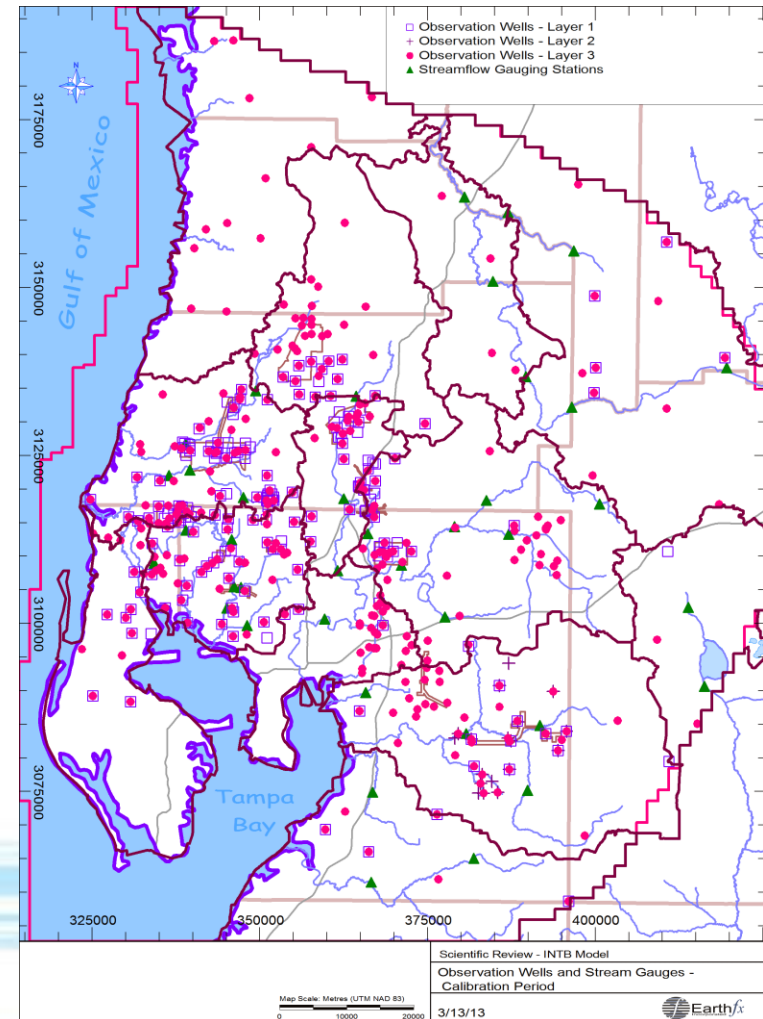
- Large permit evaluations
- Well mitigation evaluations
- Minimum flow studies
- NTB Recovery Analysis
- Hillsborough River impacts





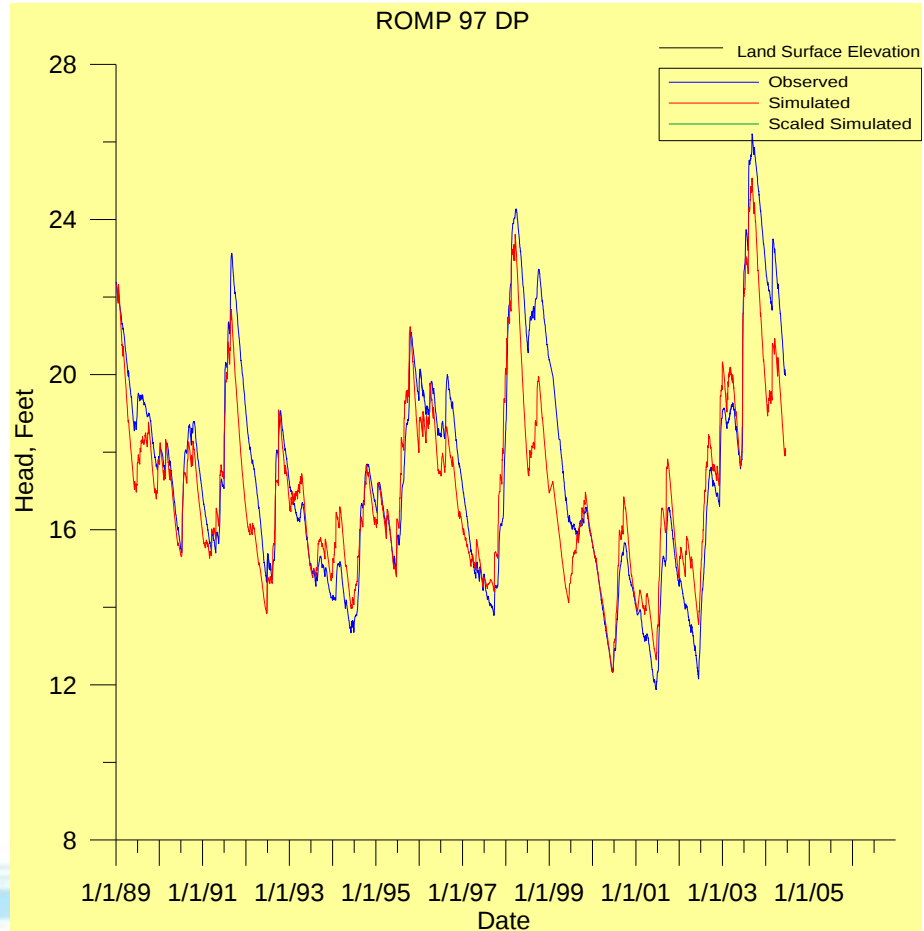
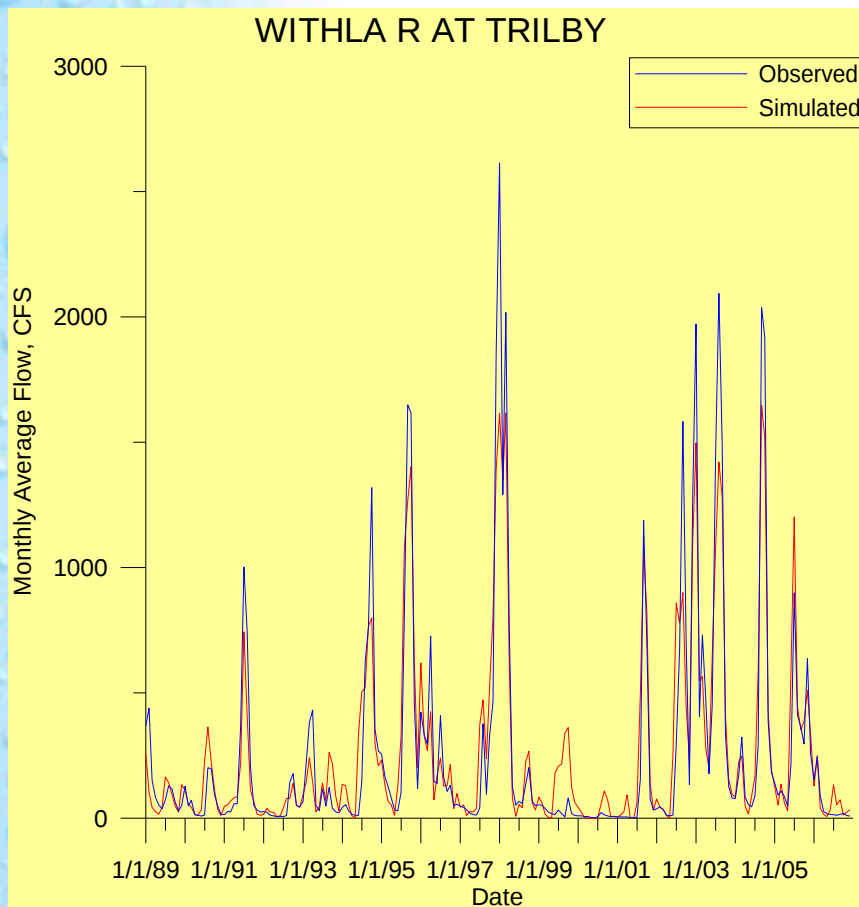
Calibration Targets and Metrics

- Estimated ET, by land-use type and depth to water table
- Streamflows
- Groundwater heads
- Spring flows
- Weekly, monthly, seasonal
- Dry and wet conditions
- Compare times series of model and observations

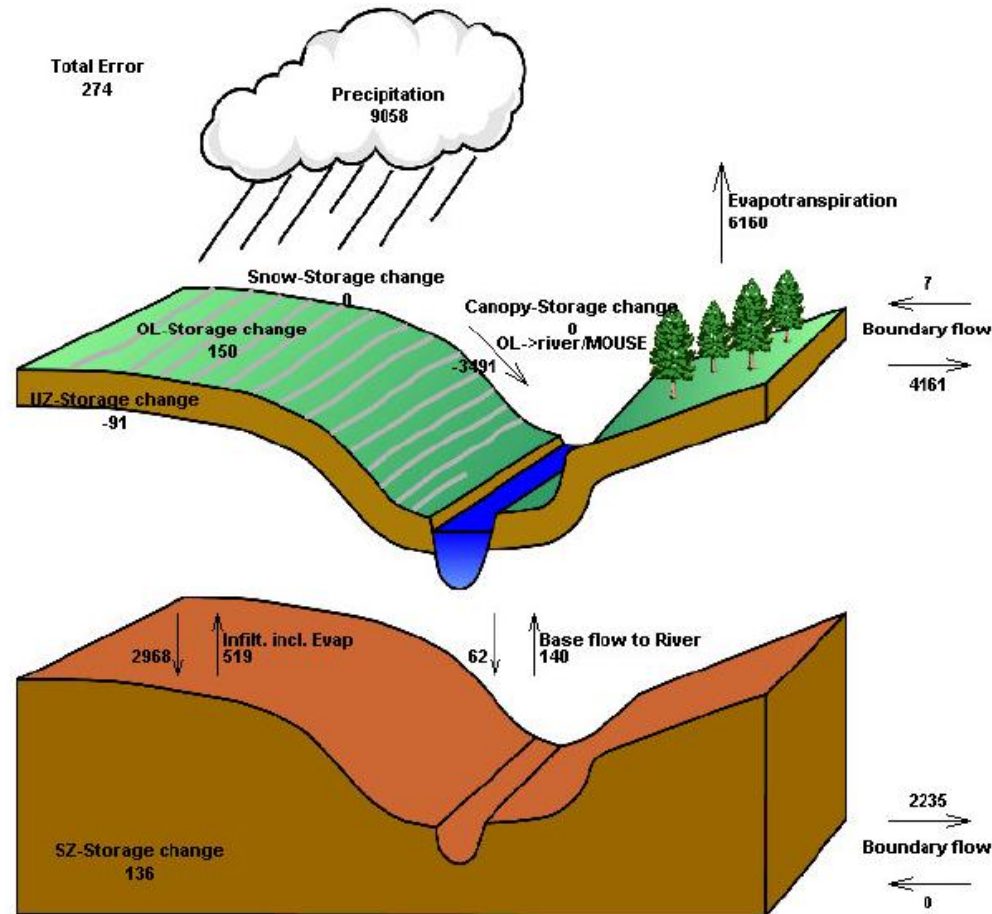


Integrated Northern Tampa Bay Model

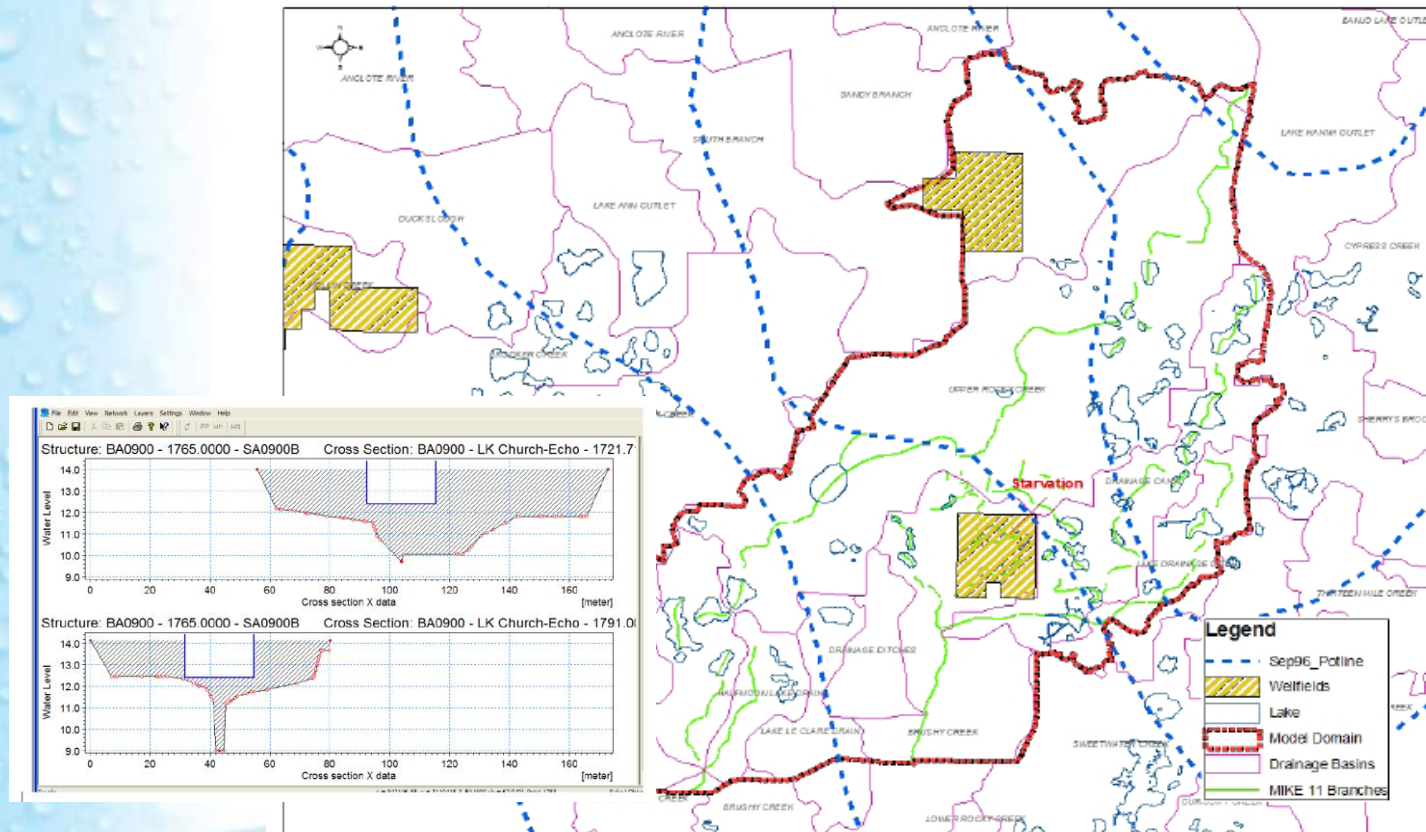
Accurate Calibration



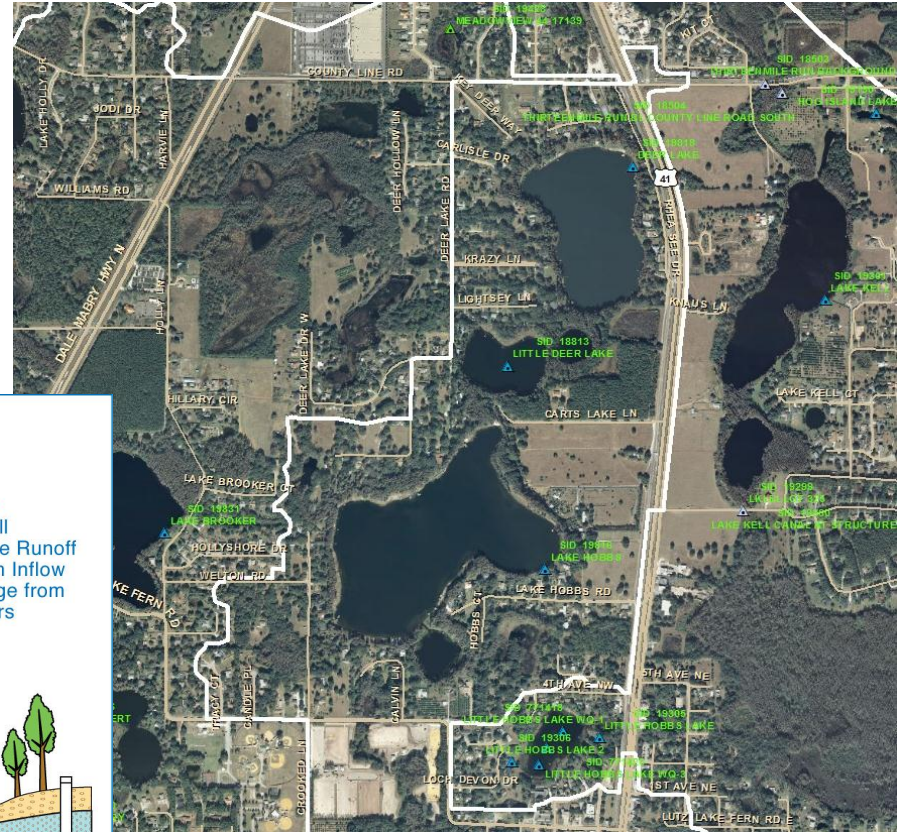
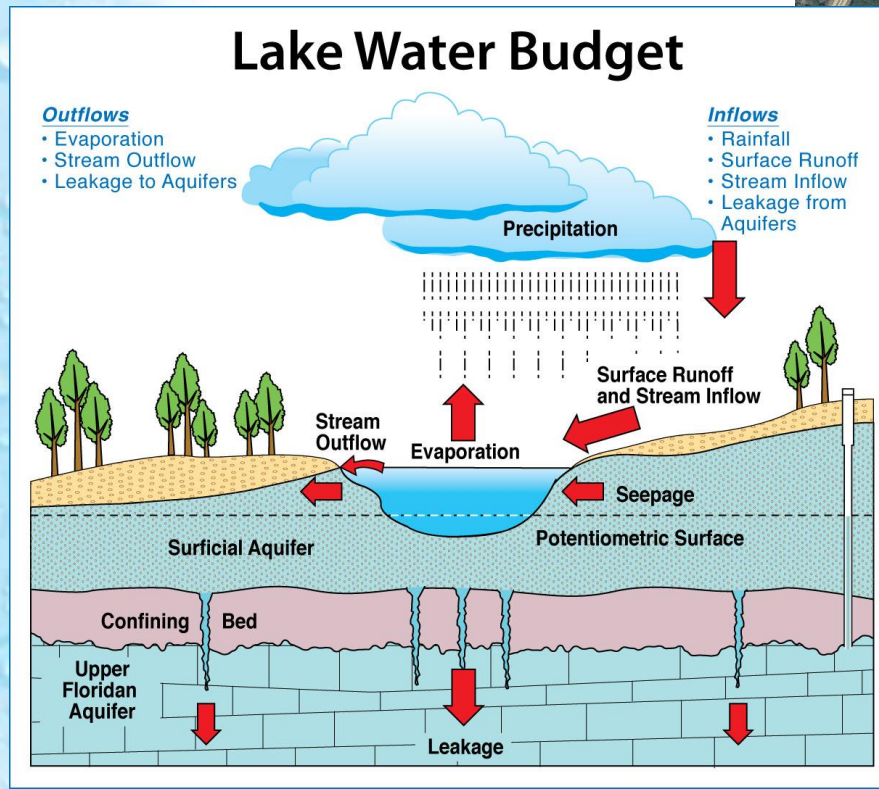
DHI, Inc. - MIKE 11 and MIKE SHE



Watershed-Scale Assessments involving Groundwater and Drainage Issues



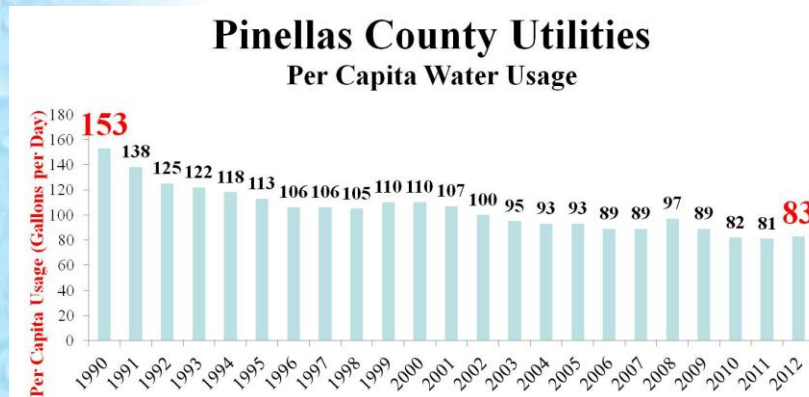
Individual Waterbody Scale Models



Northern Tampa Bay Recovery Strategy (40D-80)

Phase 1 (1998-2009)

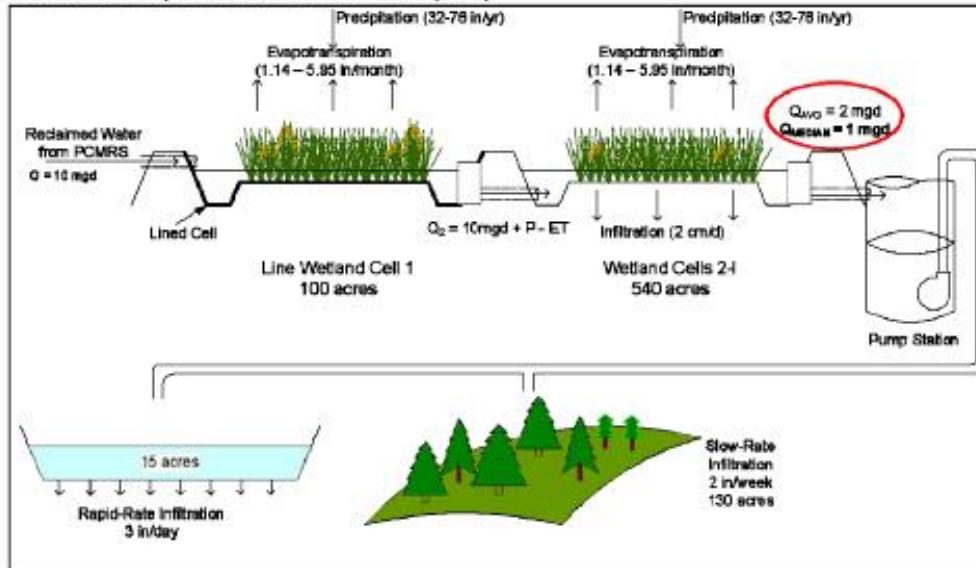
- Partnership Agreement
 - 25 mgd Desalination Plant
 - 15.5 BG off-line reservoir
 - Enhanced SW System
 - Conservation and Reuse
- Alternative Management Strategies
- Addressing other water withdrawals



Creation of Recharge

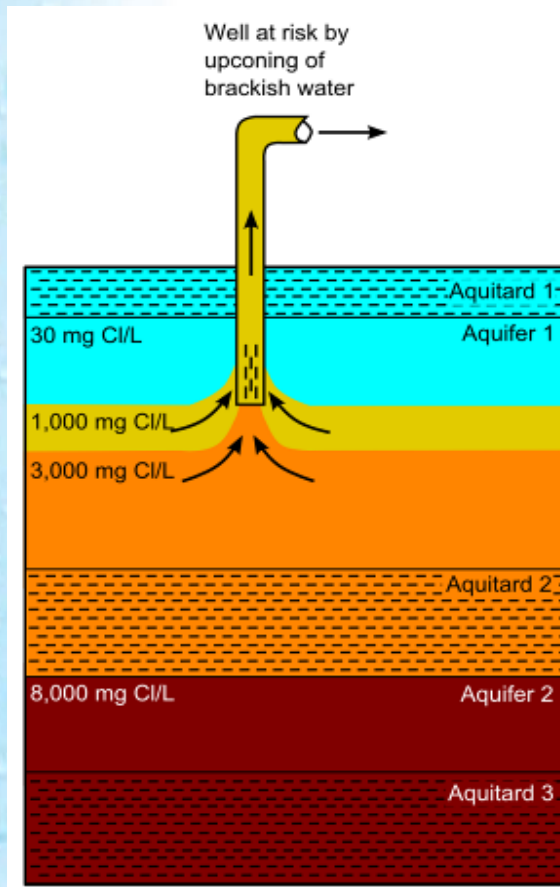
EXHIBIT 5-15

Alternative 1c: Constructed Wetland to Hybrid RRIBS and SRIBS or Spray Field
Central Pasco County Beneficial Water Reuse Feasibility Study

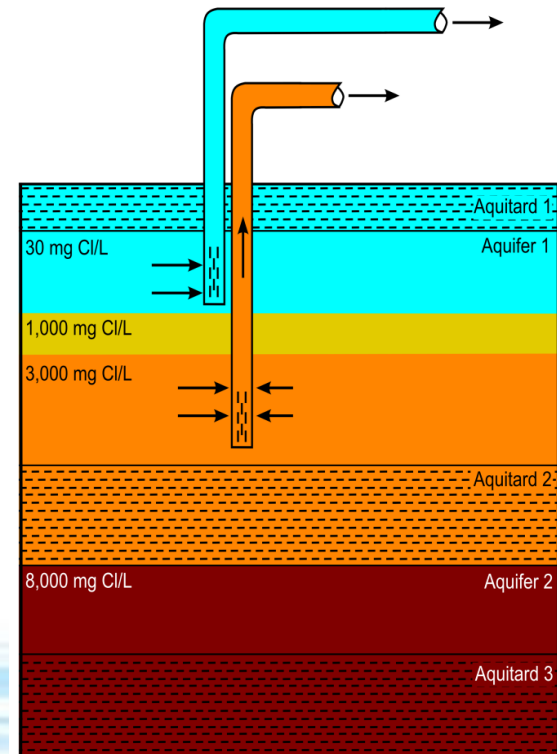


Minimizing Impact on Resources

The problem: limited resources & salinization



Innovative Approach: Fresh Keeper concept



Project partners

Dutch
Funding:



Research:



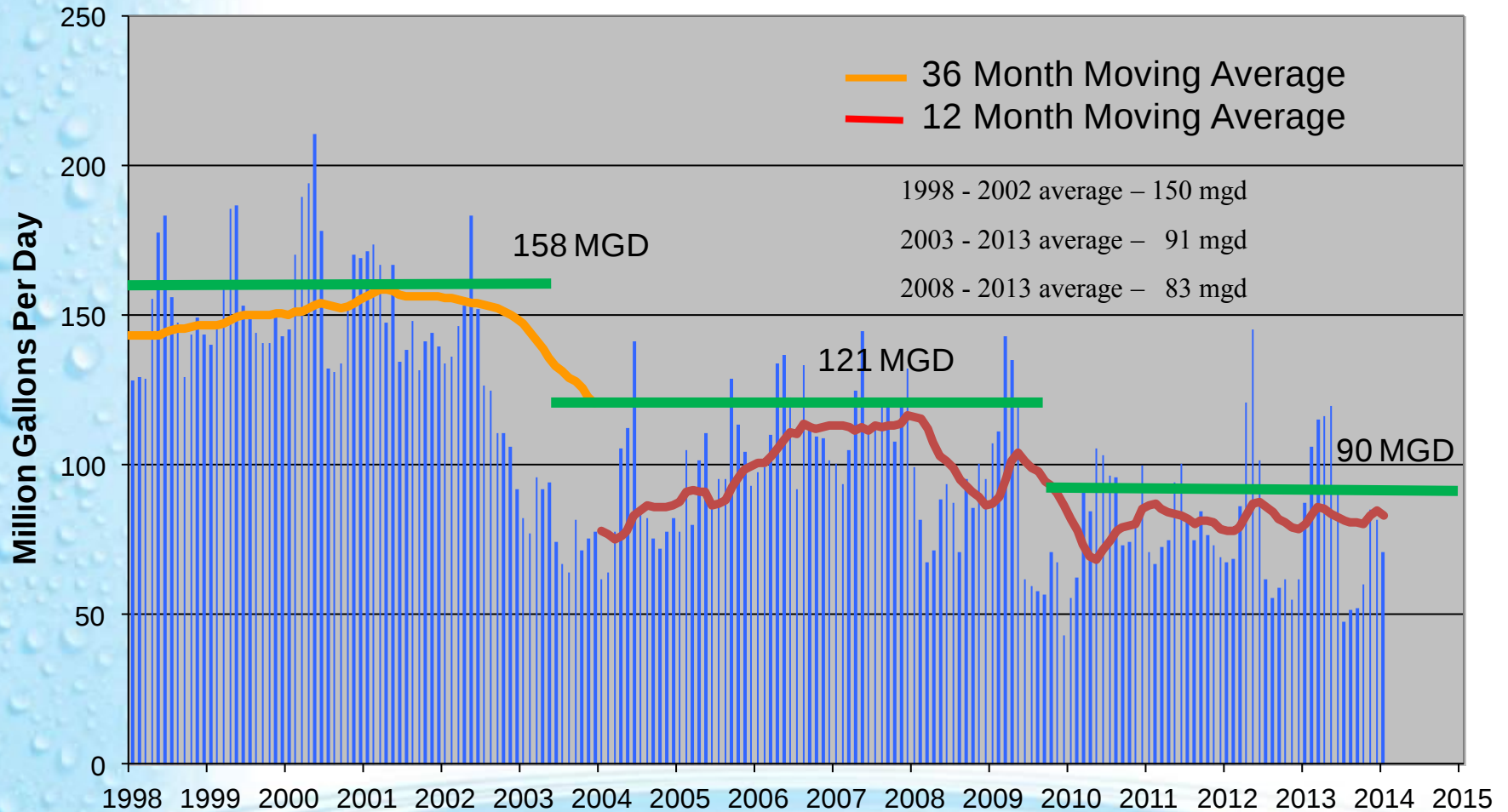
End-users:



TOWN OF BELLEAIR



Consolidated Permit Wellfield Water Use

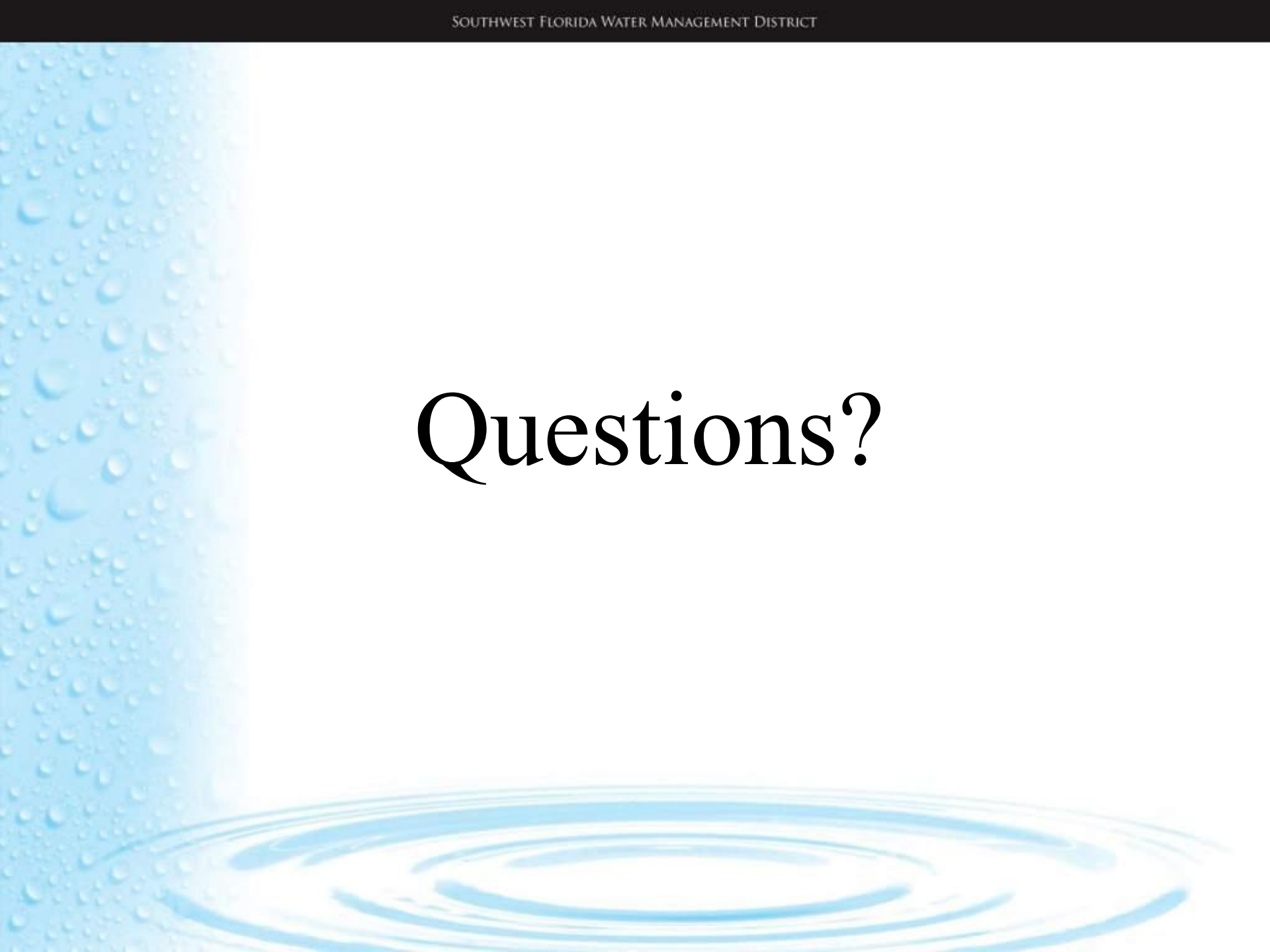


Hillsborough County – Lake Merrywater 1990s



Hillsborough County – Lake Merrywater 2013



The background features a vertical column of water droplets on the left side, transitioning into concentric ripples at the bottom, suggesting a drop of water hitting a surface.

Questions?