

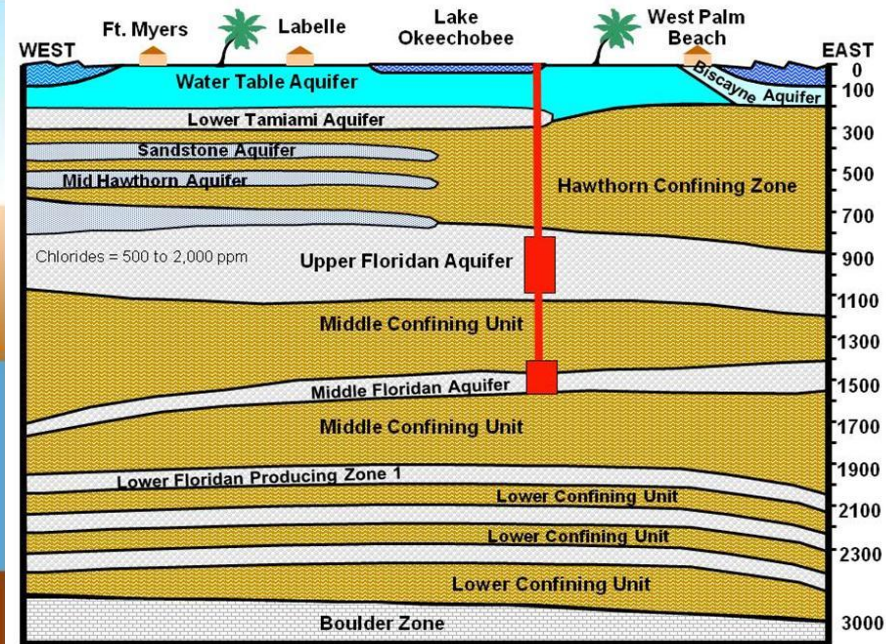
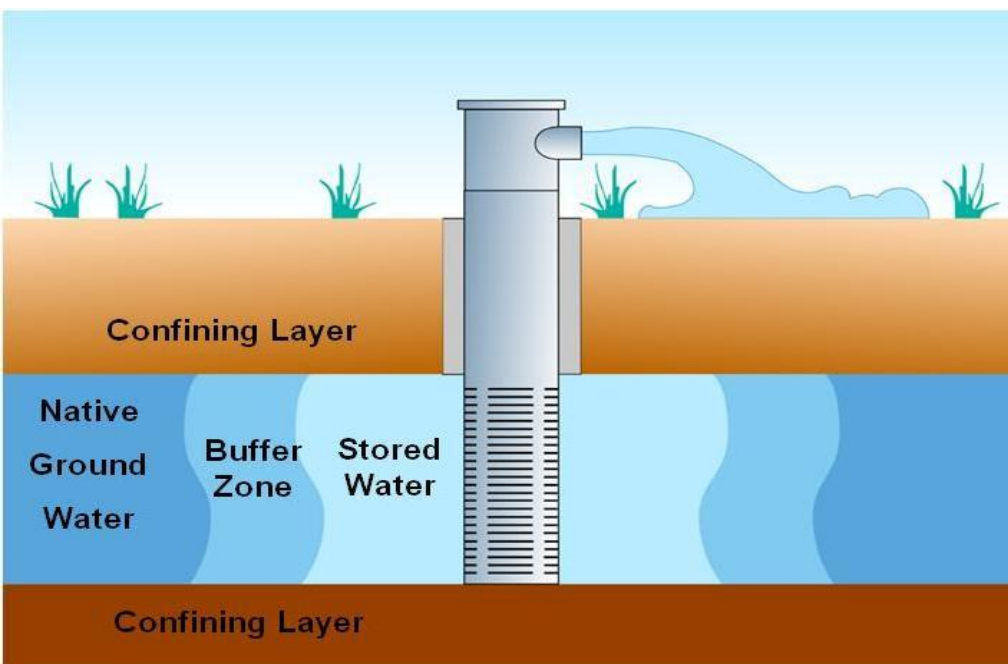
*PBC Water Resources Task Force
April 2014*

Update on ASR in the Lower East Coast and Beyond

Bob Verrastro, P.G
Lead Hydrogeologist
Water Supply Bureau

Objectives

- Discuss the basics of ASR...quickly
- Update on CERP projects
- Update on other ASR initiatives and studies



History of ASR in Florida

- Manatee County (1983)
- Peace River (1985) largest in Florida
- Several system built in 90's with AWS funding
- In 1997, arsenic found in water recovered from Tampa system
- In 2005, drinking water standard for arsenic lowered to 10 ppb
- Concern about permitting and mixed testing results, and the recession all combined to stall the technology for a decade
- Recent news is encouraging



Lake Manatee ASR System



Manatee County, FL

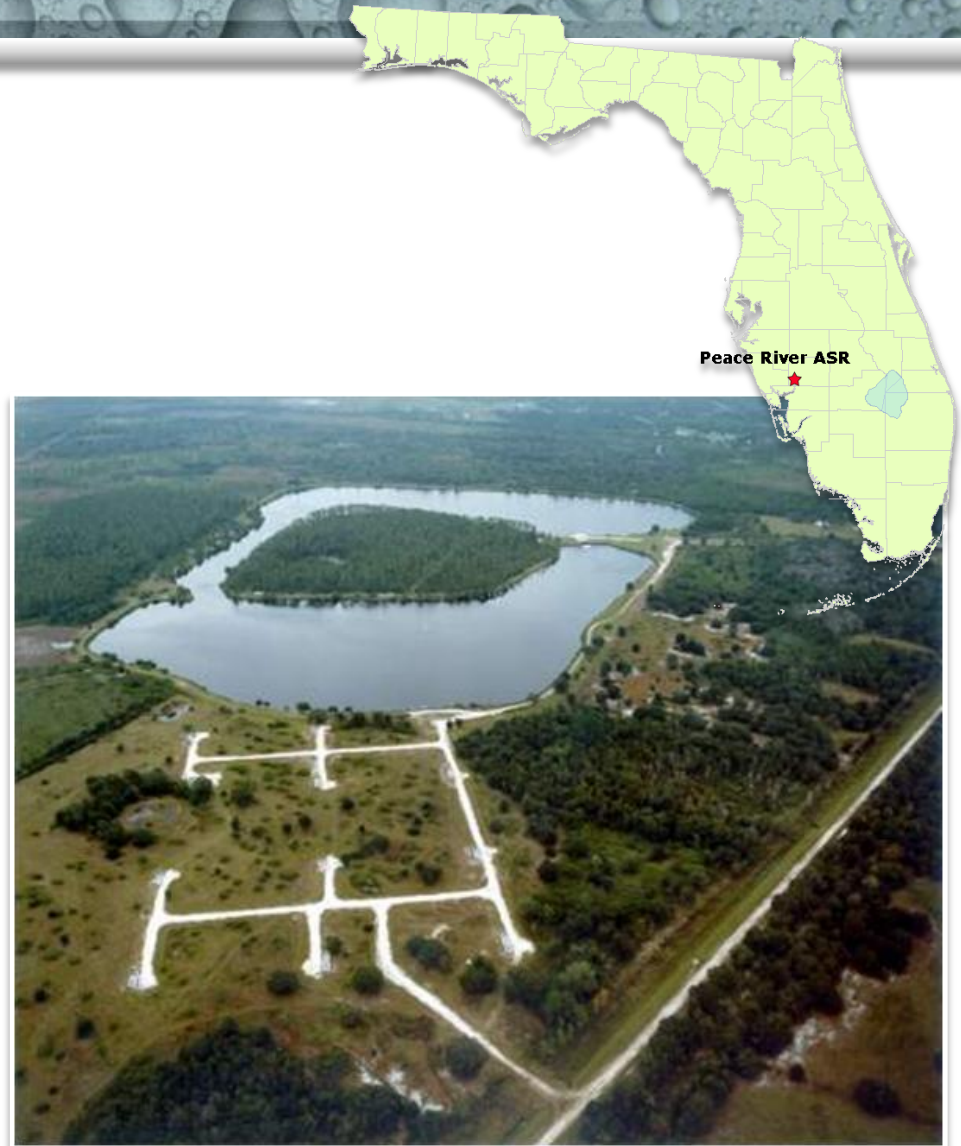
**Florida's First
ASR Well**

**Currently up
to 6 wells**



Peace River System

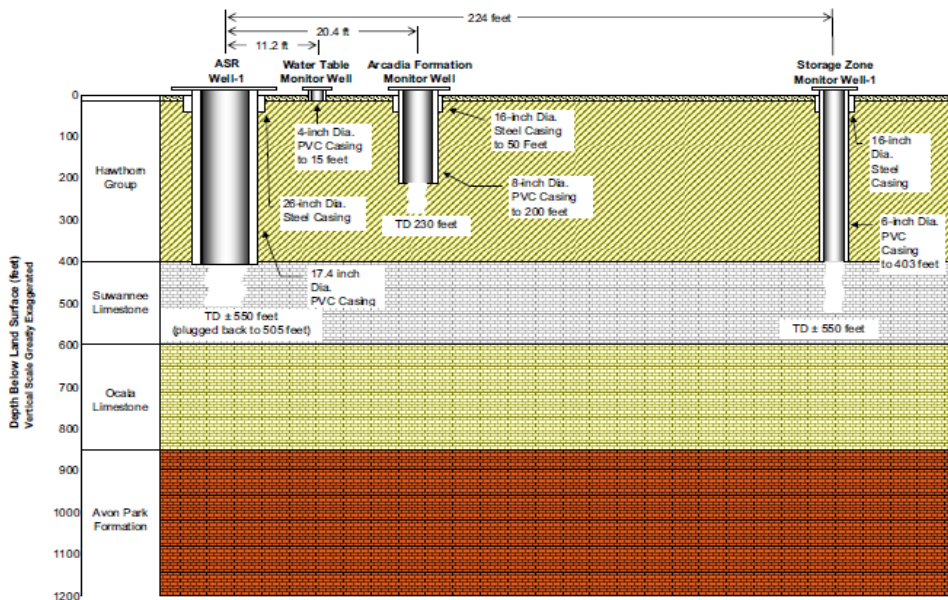
- The largest system in Florida
- Treated surface water
- 21 wells, 20 mgd capacity
- ASR integrated with reservoir
- Arsenic has been an issue
- Recently issued an operating permit



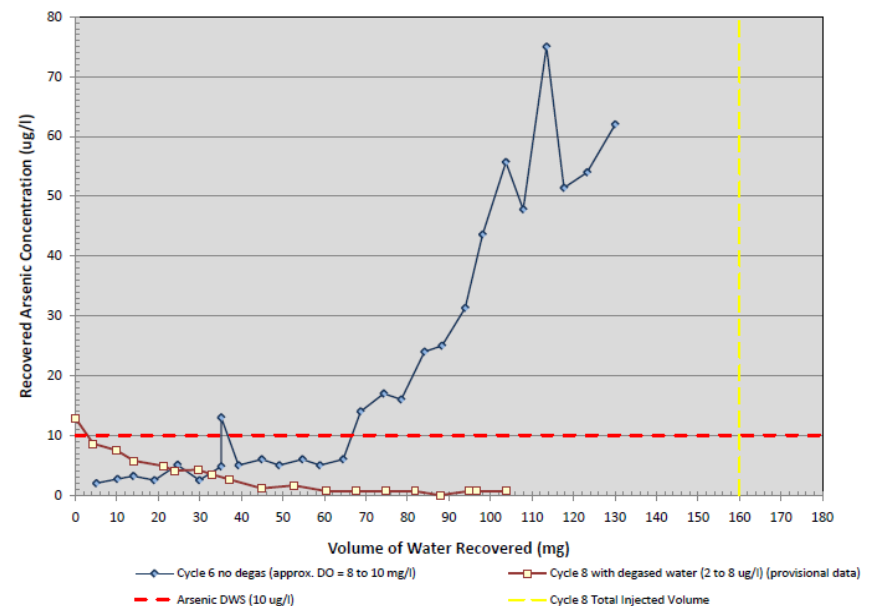
Bradenton Pre-treatment Study



- Added an oxygen removal pre-treatment process
- It worked, but it's expensive



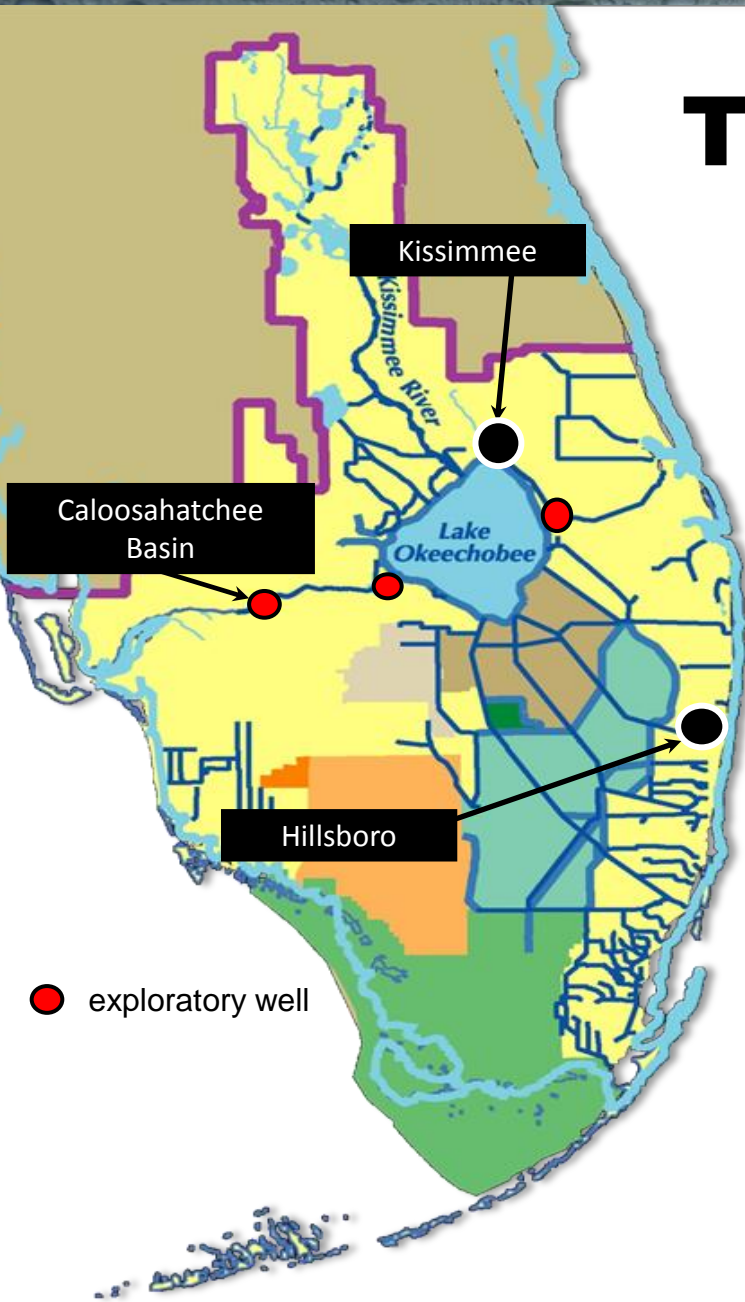
Bradenton ASR Pre-treatment Pilot Project
Comparison of Cycle 6 and Cycle 8 Arsenic Concentrations in the ASR Well During Recovery



The Recent EPA Letter

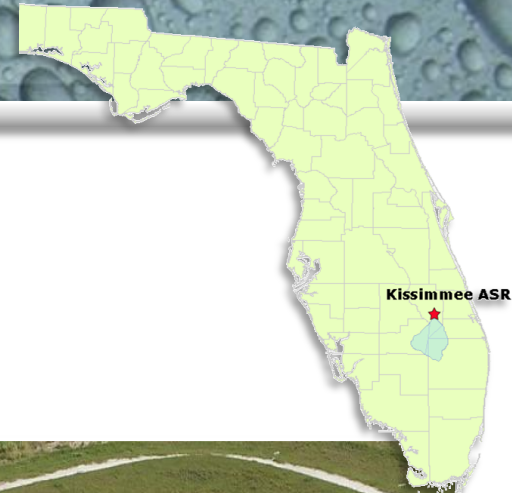
- **Describes how Florida (FDEP) can apply UIC requirements to ASR when arsenic is a concern**
- **A permit will prevent endangerment if it “includes conditions to prevent any pathway for human consumption of waters that exceed the MCL for arsenic....”**
- **Florida could decide that it is appropriate for ASR wells to remain under permits with conditions to protect public health and maximize protection of the USDW**
- **Permits should require practices to reduce arsenic mobilization and minimize the area with arsenic mobilization**
- **A user of the USDW other than the public water system should not have access to the impacted area.....the burden of public health protection should not be transferred to any entity other than the ASR operator**
- **Tools for ASR operation could include pretreatment, consistent operation, full recovery of injected water, site access controls, setbacks in water well construction rules that control access to contaminated groundwater...**

The CERP ASR Pilots



CERP Kissimmee River ASR Pilot

- Media-filtered surface water, followed by UV disinfection
- Recovery efficiency near 100%
- Some early arsenic but later diminished
- Ultraviolet disinfection impacted by water quality
- Well rehabilitation required
- Apparent nutrient (P) reduction (from >100 ppb to <20 ppb)
- Built by USACE, transferred ownership to SFWMD



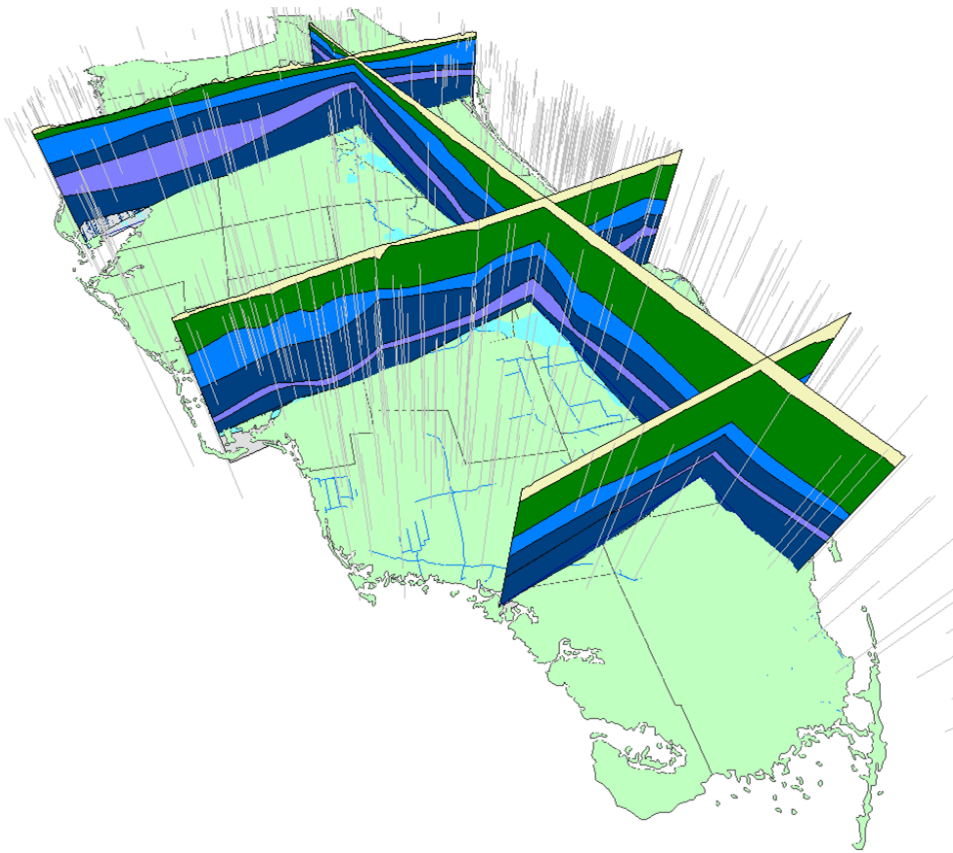
CERP Hillsboro ASR Pilot

- Mechanical filtration coupled with UV disinfection
- Three test cycles through 2012
- Recovery efficiency around 40%; expected to increase with continued cycles
- Well rehabilitation required
- Lower efficiency because aquifer has higher salinity (TDS = 4,000 mg/L)
- Currently looking to partner with a local utility to keep operating



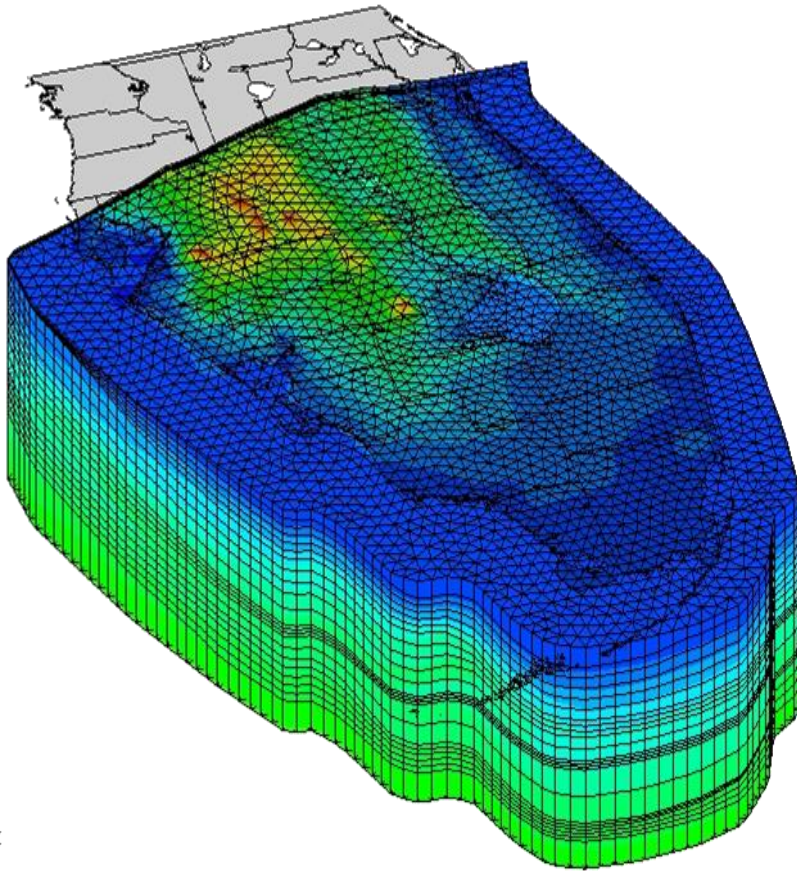
Hillsboro ASR

CERP ASR Regional Study



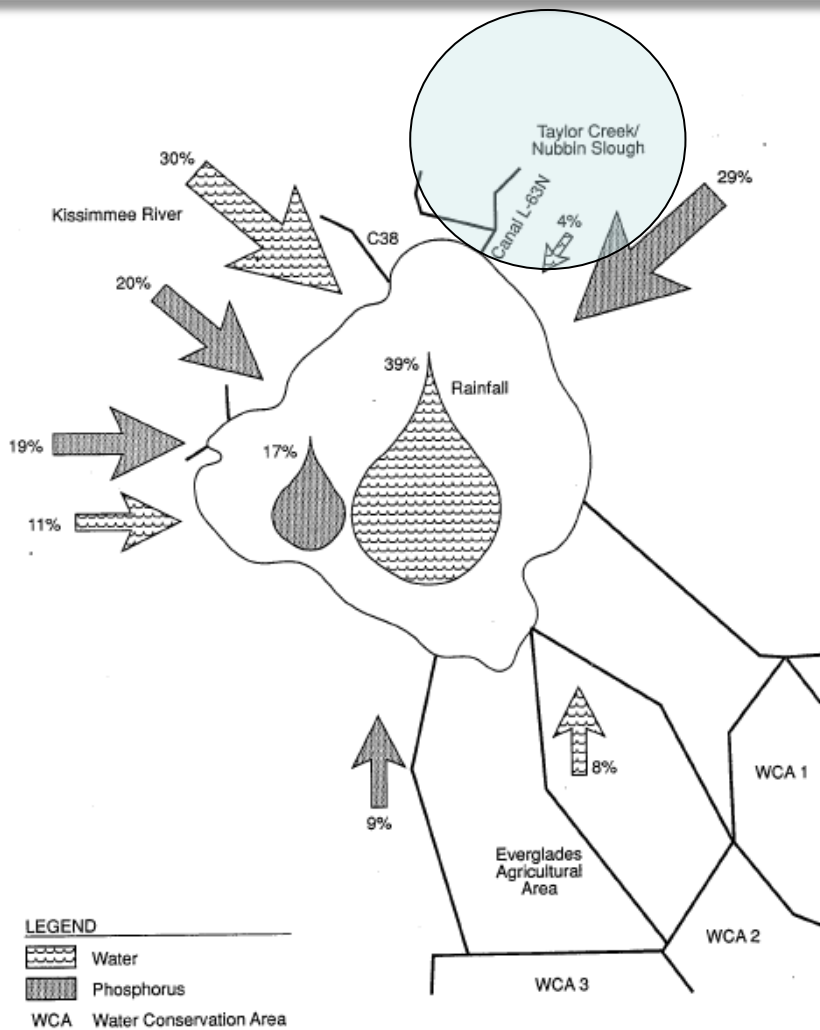
- To address regional issues beyond the scope of the pilot projects associated with full-scale ASR (333 wells) implementation
- Groundwater model and ecological risk assessment underway
- Simulations tied to pilot project cycle testing data
- Final Report due in 2014

Groundwater Model Results



- All physical attributes from the previous studies were integrated into a groundwater model
- Simulations assumed wells distributed in locations as originally envisioned in CERP
- **Indicated that about +/- 140 ASR wells can be operated to meet all criteria**
- Ecological evaluations now underway assuming a reduced number of wells
- Final report by late 2014

L-63N Canal ASR Project



NOTE: Minor tributaries contribute the balance of the inputs adding up to 100 percent.



Built and Tested by the SFWMD in Late 1980's

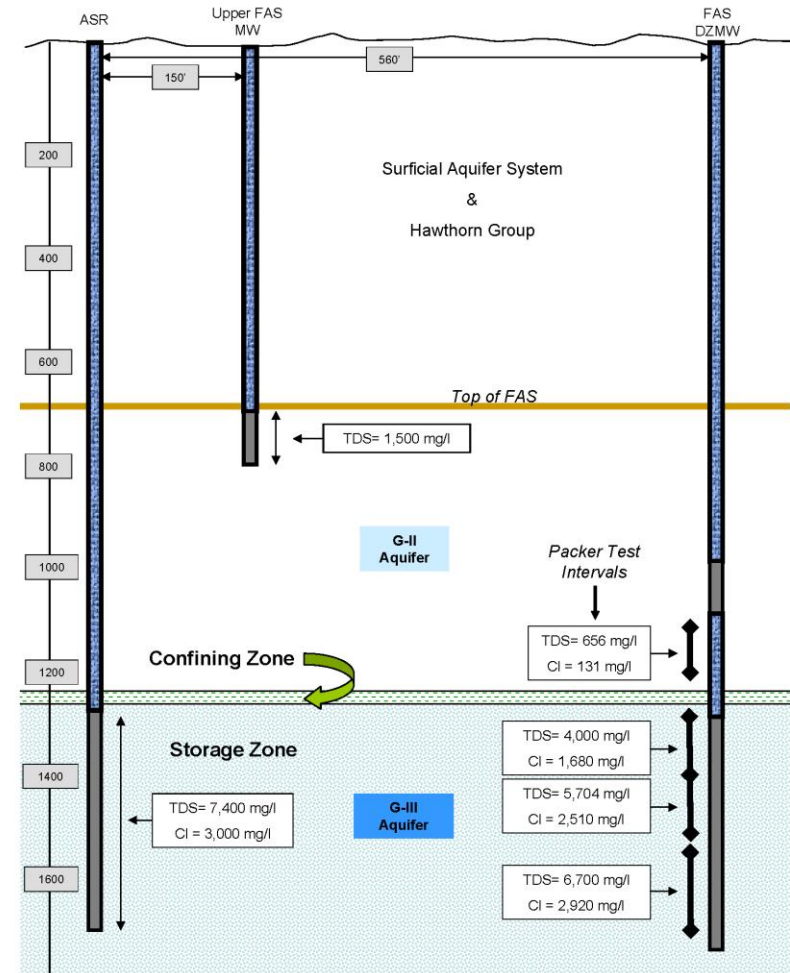


- High capacity well – 8 mgd
- Idle for 30 years
- All the components still work – but need some refurbishment
- Minimal cost to become operational
- Aquifer Exemption granted to allow testing without disinfection



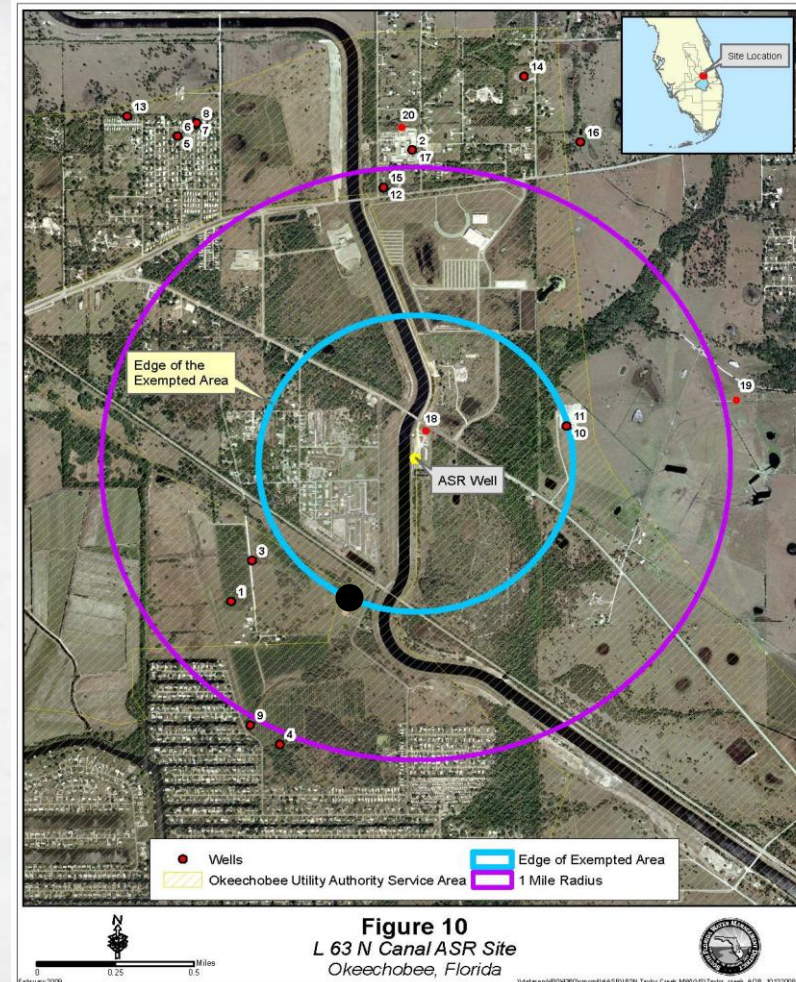
Site Characterization

- Uppermost 500' of FAS is not very productive
- Data from cycle tests indicate that the storage zone is confined
- Confinement extends from base of upper monitor zone to top of storage zone
- Storage zone contains water with TDS > 4,000 mg/L



L-63N Canal ASR – Aquifer Exemption

- No users of the FAS within one mile of the site.
- Allows recharge of “raw” canal water
- Exempted area extends ½ mile around the ASR well
- Will require construction of a new monitor well at edge of the exempted area
- Limited duration – only for cycle testing
- FDEP has approved
- Meeting with the EPA next week



Aquifer Microbiology

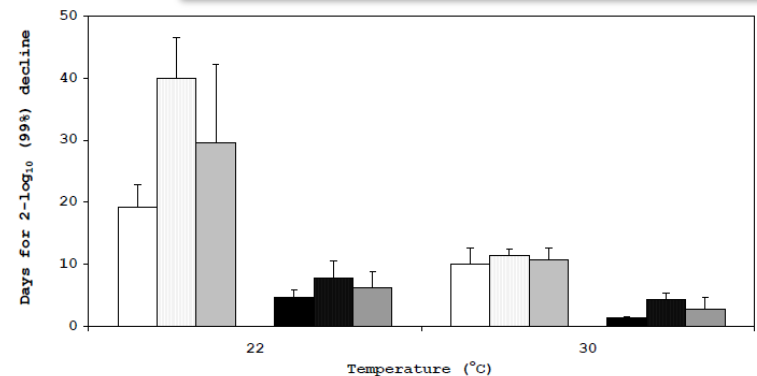
2004: Fate of Microorganisms in Aquifers

David John , USF; Joan Rose , MSU; and John Lisle, USGS

- Laboratory “bench-top tests” using mixtures of FAS groundwater + surface water + microorganisms
- Die-off rates calculated under a variety of salinities and temperatures
- Microorganisms (e-coli and coliform) survived for ~ 1 to 6 weeks



Fecal coliform



□ Avon Park aq. □ Lake Lytal aq. □ Groundwater
 ■ Bill Evers res. ■ Clear Lake res. ■ Surface water

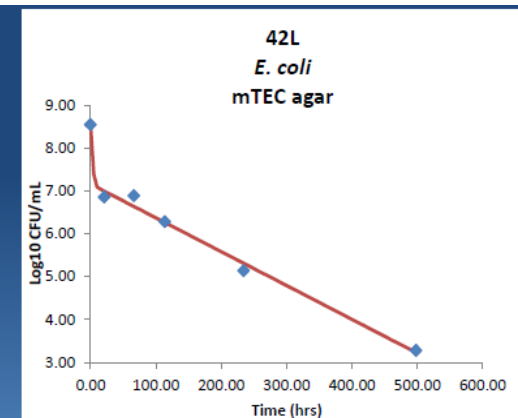
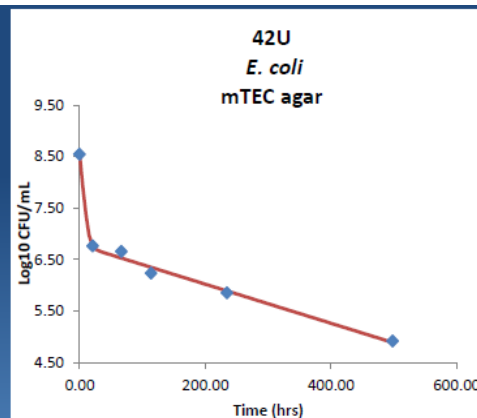
Note: The ground water and surface water bars are the combined data from Avon Park and Lake Lytal aquifers AND Bill Evers and Clear Lake reservoirs, respectively.

Studies on Pathogen Inactivation

2013: Survival of Microbial Indicators in the Floridan Aquifer Using Comprehensive Everglades Restoration Plan Wells

Dr. John Lisle, USGS

- Utilized flow-through diffusion chambers to expose indicator species to water from dual-zone monitor wells
- Innovative design allows for calculation of die-off rates under flowing, sealed wellhead conditions
- Confirmed die-off rates of the bench-top study...about 3 to 6 weeks



Other LEC Systems

West Palm Beach

- Cycle testing began July 2013
- WPB has recharged almost 1 billion gallons that would have otherwise been lost to tide
- ASR well can recharge at rates up to 7.2 MGD
- 120 million gallons of water have been recovered during Cycles 1 and 2. Cycle 3 recovery will commence in May 2014



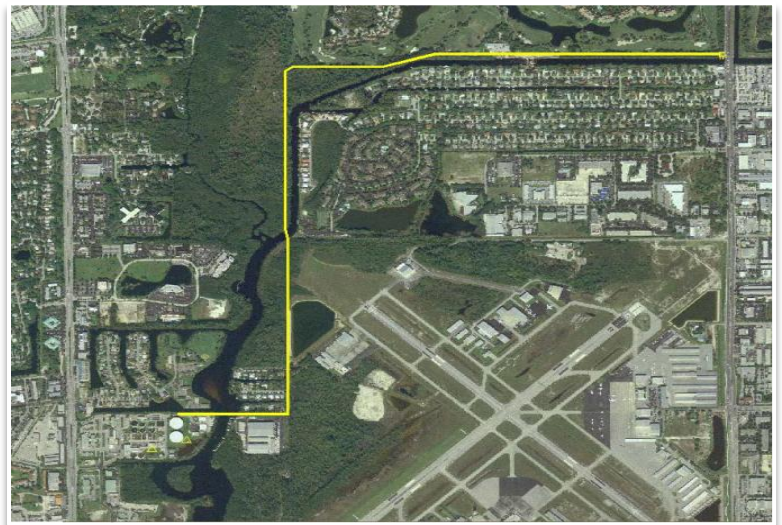
Miami-Dade

- Recently installed UV systems
- Initiated testing at SWWF, but interrupted with disinfection system problems
- Will start testing WWF system next month



The Naples Reclaimed System

- Hybrid system stores surface water from the Golden Gate canal and excess reclaimed water during low demand periods
- Currently constructing the third ASR well (about 1 mgd per well)
- Wells are completed just below the base of the USDW (about 1,200 feet deep)
- System supports objective of lowering potable per capita from 270 GPDPC to less than 200 (goal is 150)



In conclusion....

- ASR has a long history in Florida, and is expanding, albeit slowly
- Arsenic has been an issue, but technical and regulatory solutions have been found
- Innovative approaches are still ongoing

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Questions?

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