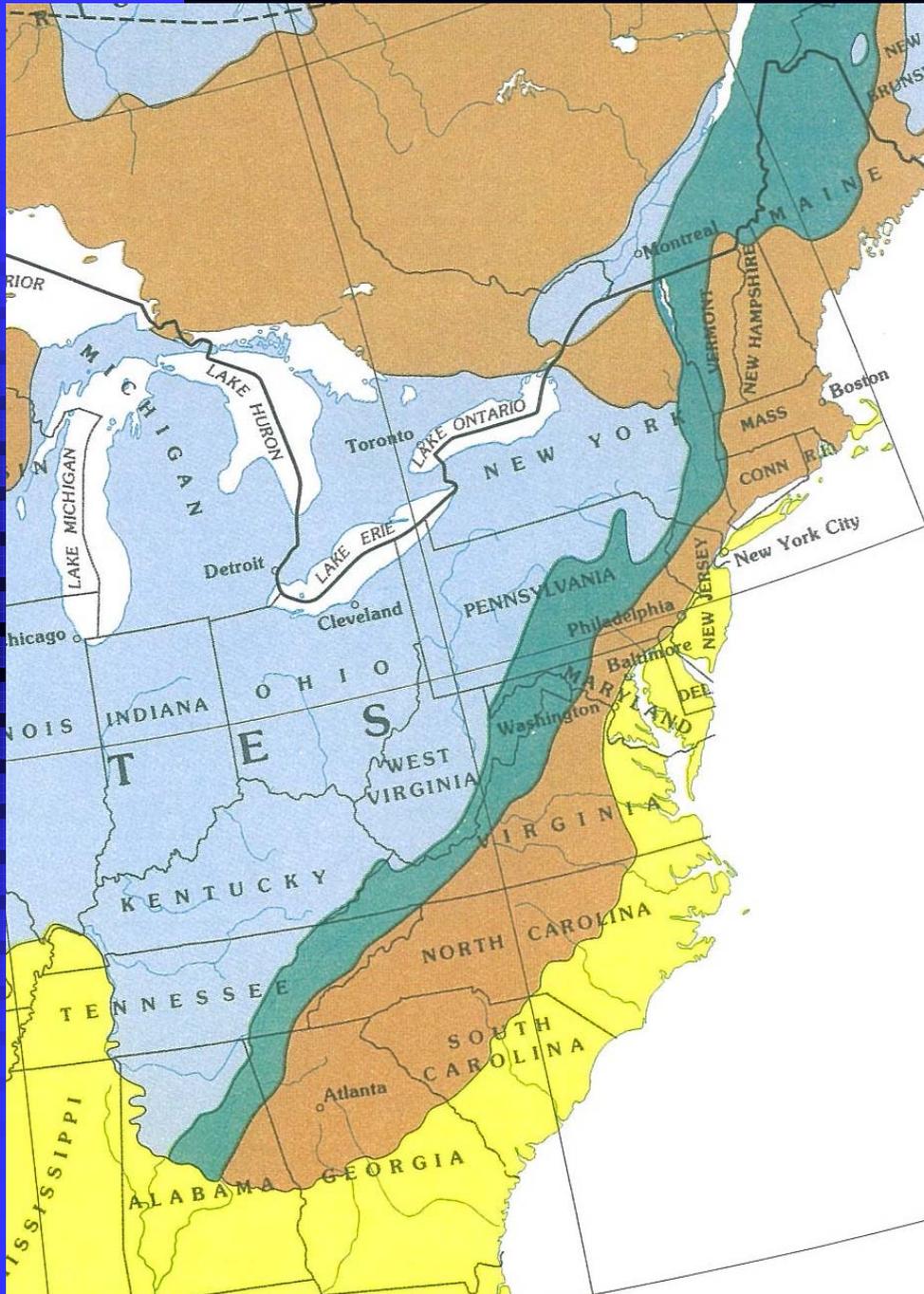


# Aquifer Storage and Recovery

NYC Department of Environmental Protection

# Extent of Aquifers



# ASR - Part of the Solution

- Regional Water Resource Planning
- Strategic Water Reserve
- Preserve and Use Excess Reservoir Water
- Storage in the Lloyd Aquifer (and Magothy)
- Recharge Protects Coastal Communities

# Importance to NYC and the Region

- In-City Reservoir
- Cost Effective
- Storage, Not Watershed
- Flexible - Source in Cat, Del, or Croton
- Greater than 25% of Cat/Del Storage
- Protected from Potential Terrorism

# ASR - Technical Approach

- Inject Drinking Water to the Lloyd Aquifer
  - ◆ From the NYC Distribution System
  - ◆ During Years with Normal Precipitation
- Pump Out During Time of Need
  - ◆ Always Leave 10% Behind
  - ◆ Enhanced Recharge to the Lloyd

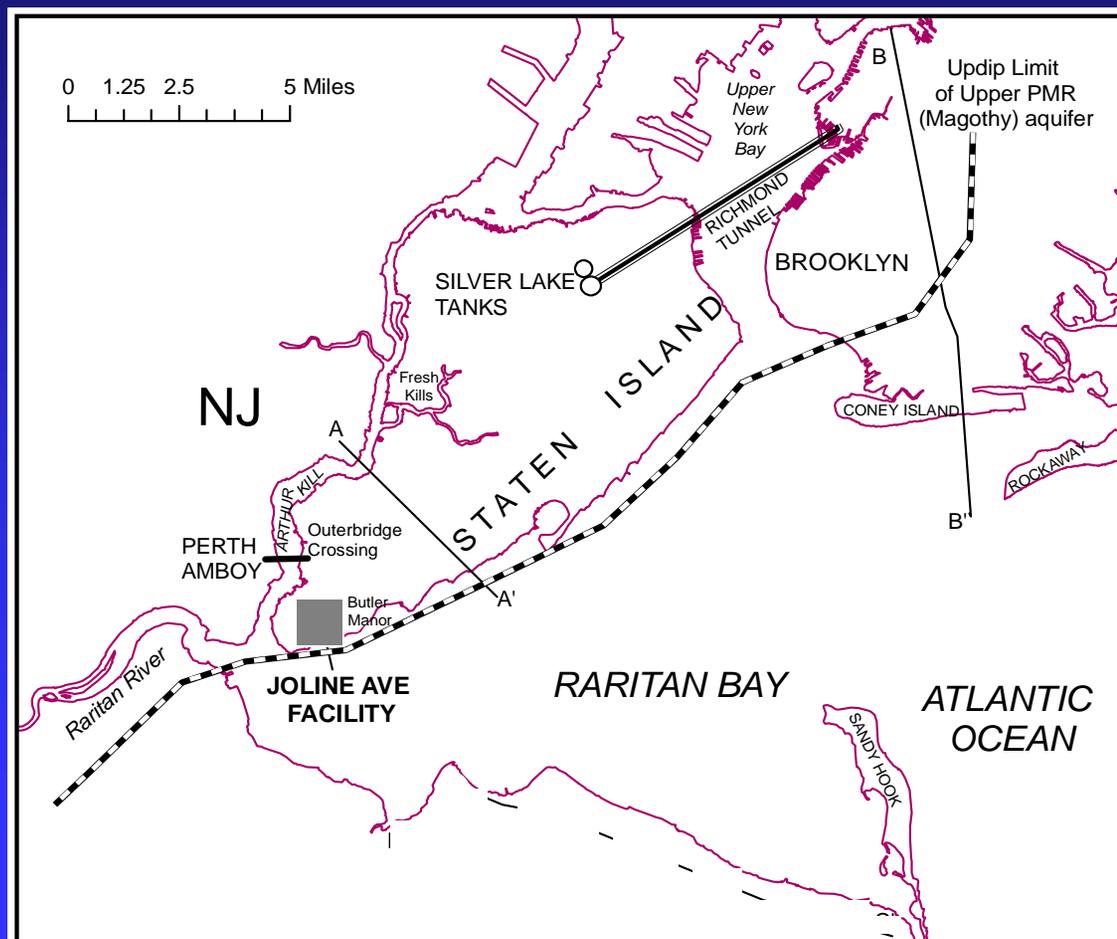
# NYC Groundwater System

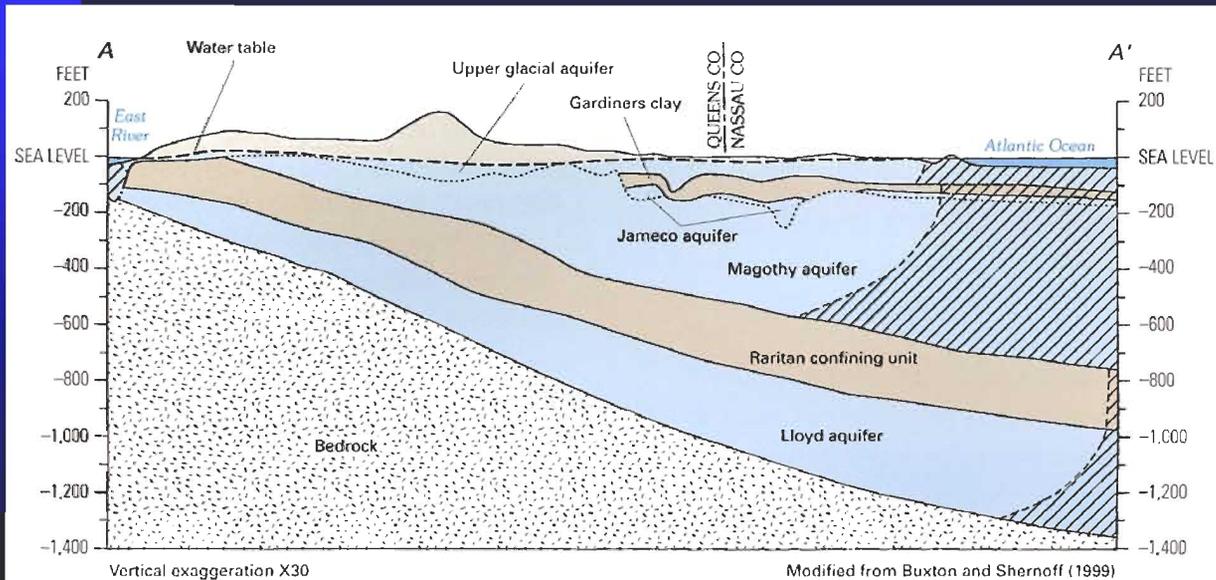
- Located in Southeast Queens
- Incorporated former Jamaica Water Supply Company (JWSC)
- GW System includes 69 Wells
- Aquifer Production
  - ◆ 68 MGD Permitted Capacity
  - ◆ 80 + MGD Sustainable Yield
  - ◆ 100 + MGD Past Production





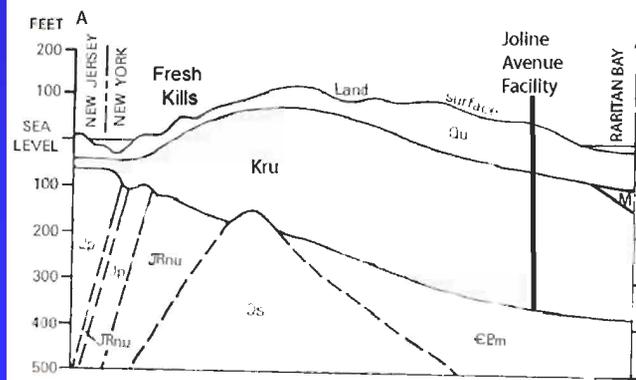
# Staten Island Joline Ave





- EXPLANATION**
- Area of salty ground water
  - Confining unit

Sea level refers to the National Geodetic Vertical Datum of 1929



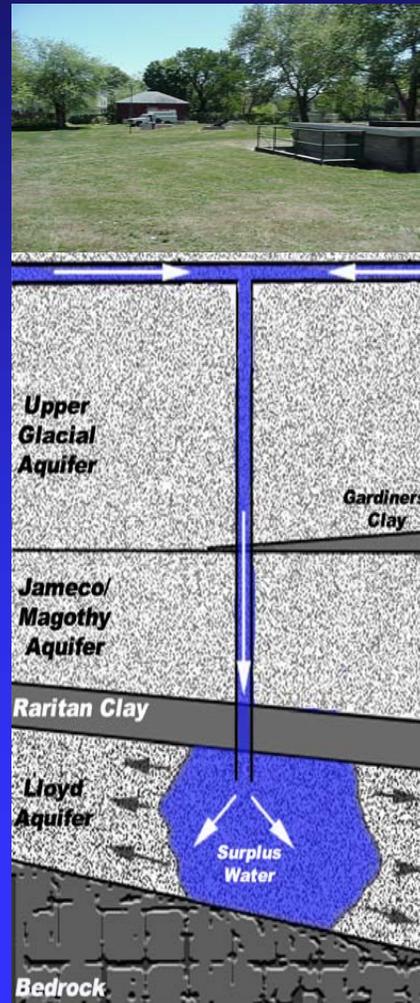
**EXPLANATION**  
**GEOLOGIC UNITS**

- M Magothy Formation
- Gr Upper Pleistocene deposits
- Kru Raritan Formation, undivided
- p Palisade Diabase
- JRnu Newark Supergroup, undivided
- Os Staten Island Serpentine (of Merrill, 1898)
- EBm Manhattan Schist

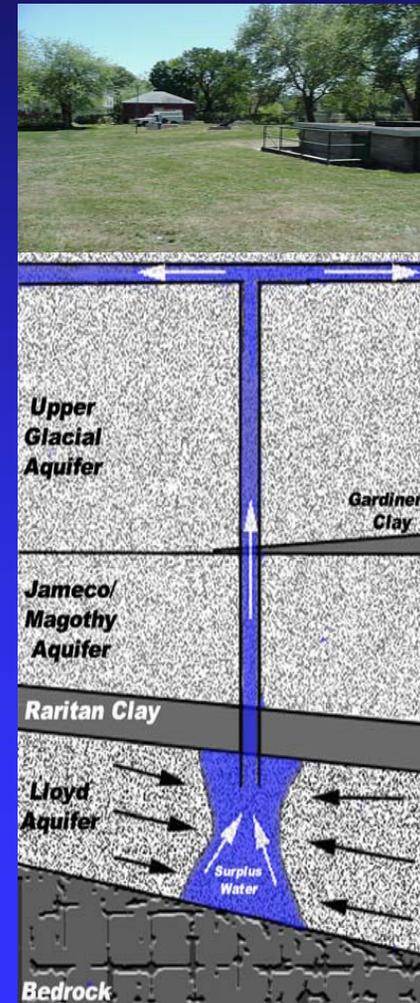
--- GEOLOGIC CONTACT---Dashed where inferred

# ASR Concept

## Injection Cycle

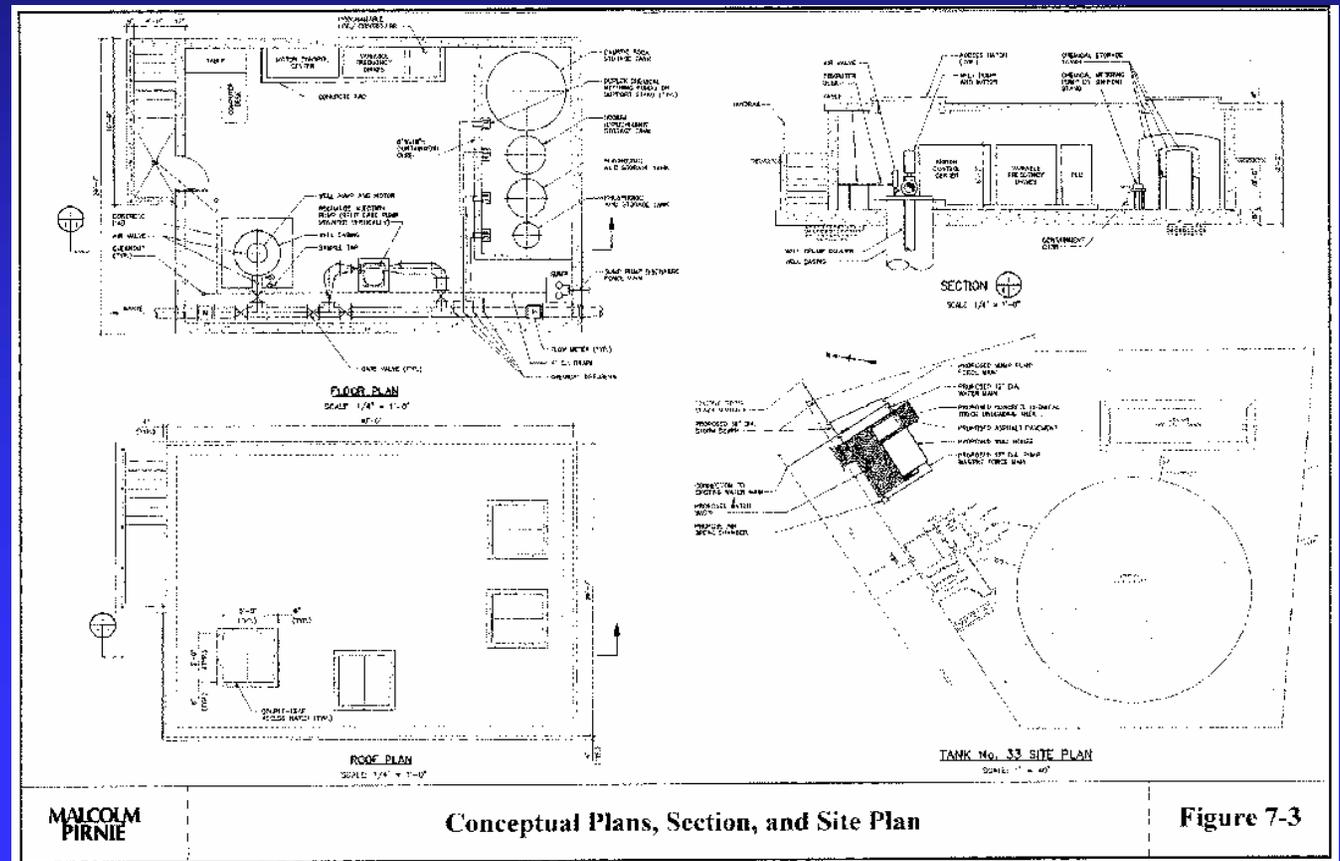


## Recovery Cycle



# ASR - Part of the Solution

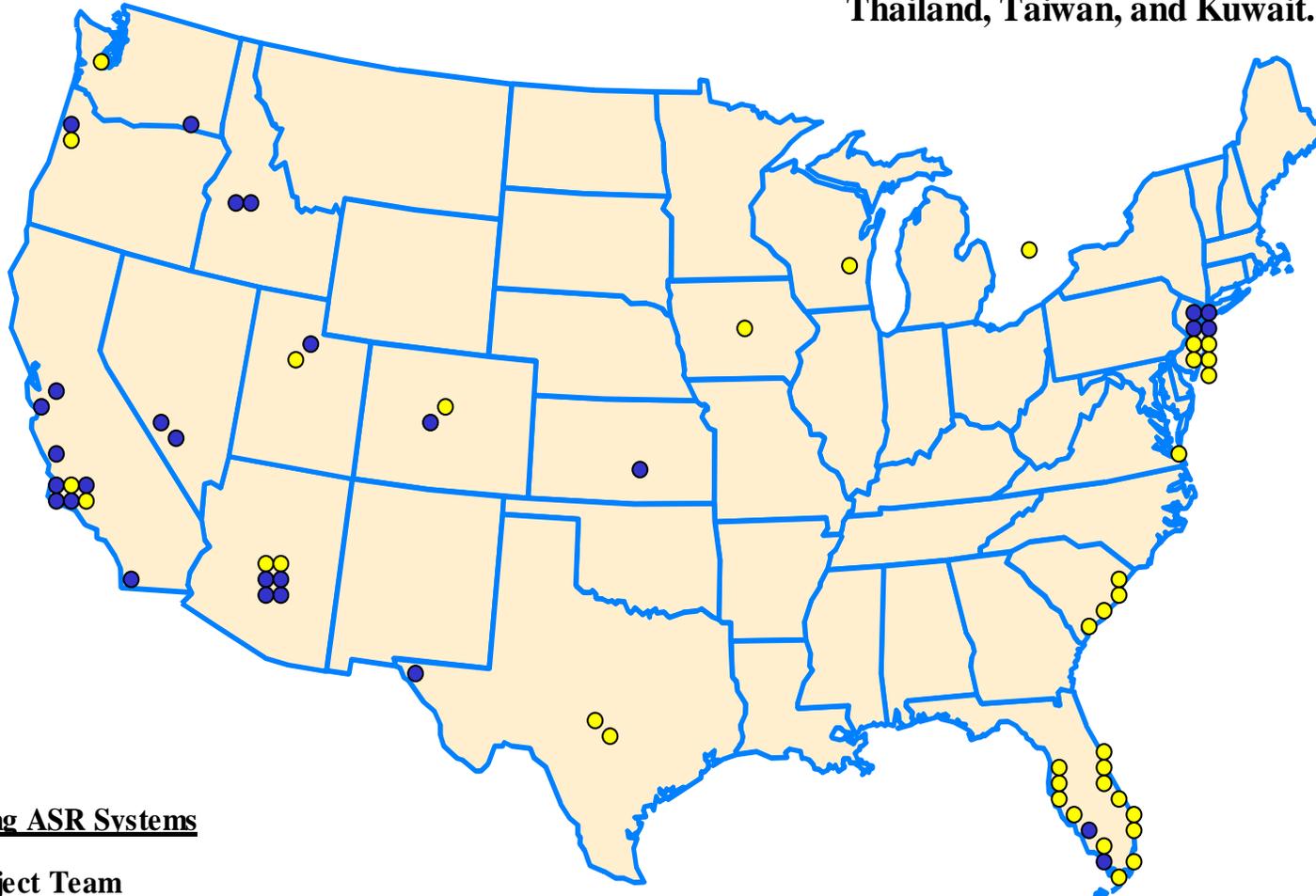
Simple - No Additional Treatment Needed



# Where ASR is Working

ASR Systems are also operating in the United Kingdom, Canada, Australia, Israel.

ASR Systems are also under development in the Netherlands, New Zealand, Thailand, Taiwan, and Kuwait.



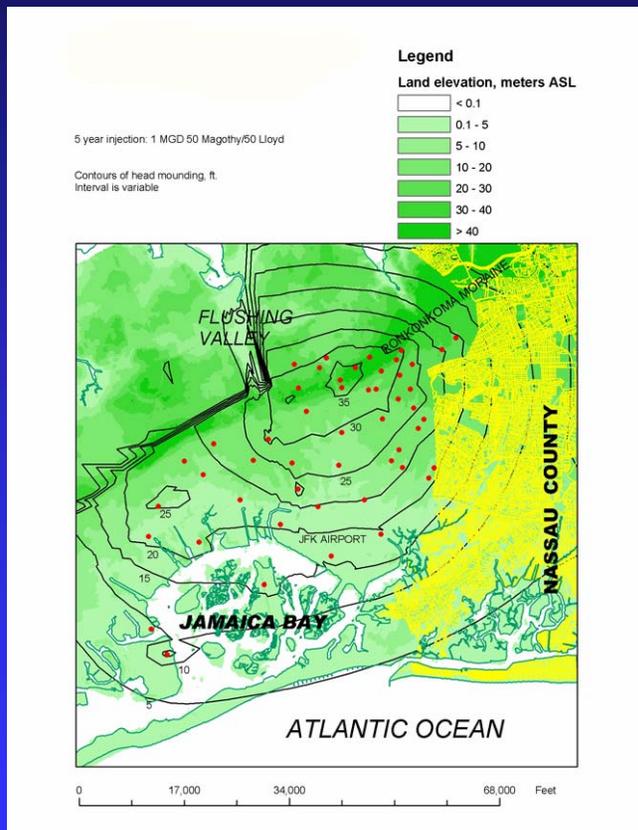
## Operating ASR Systems

- Project Team
- Others

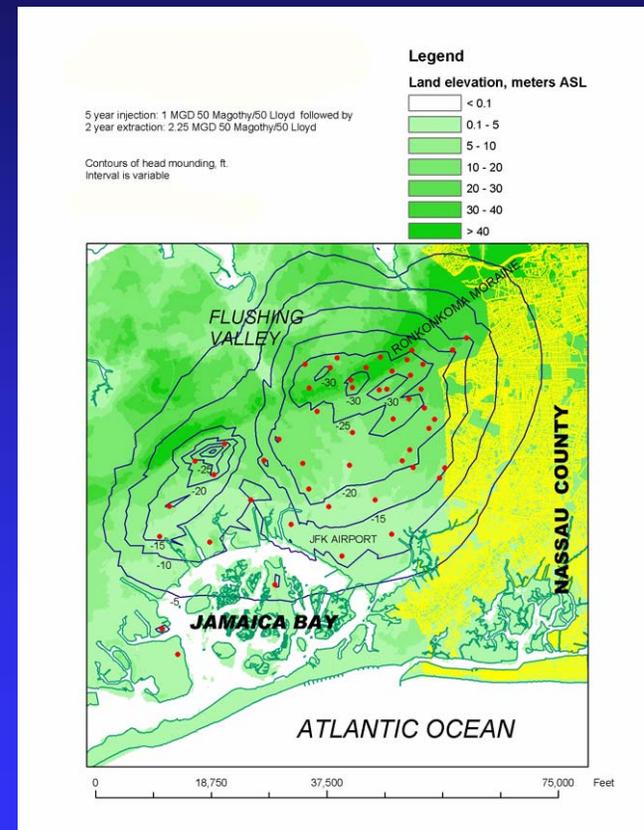
Over 60 Operating ASR Sites in 16 States

Over 100 more ASR projects in development.

# Groundwater Flow Modeling

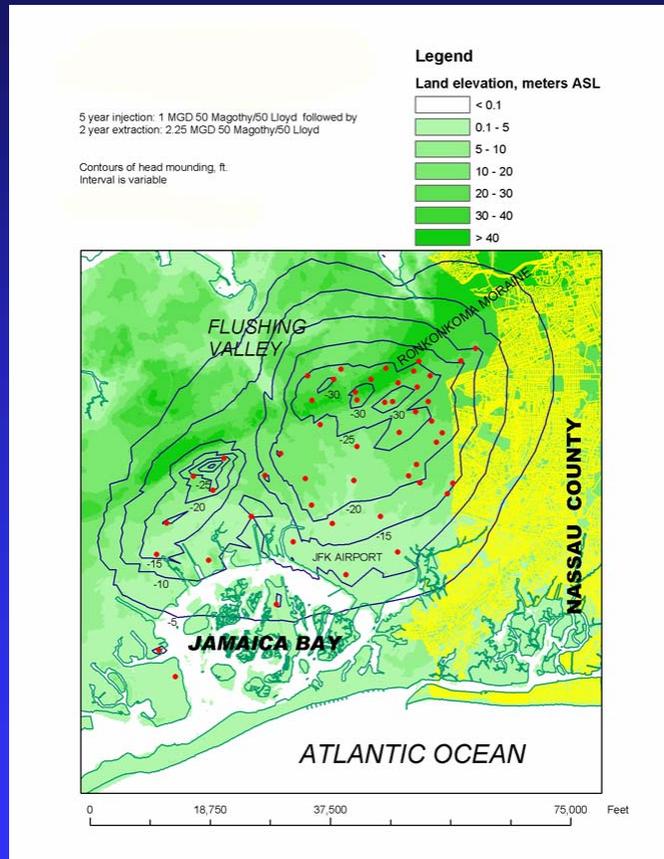


**Heads in the Lloyd Aquifer  
after Injecting 1 mgd in  
50 Wells for 5 Years**

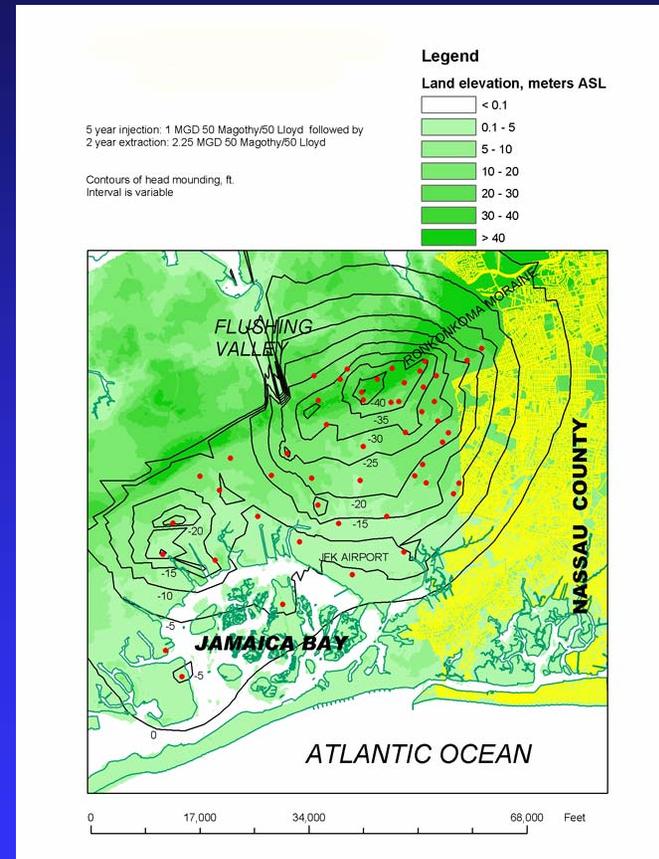


**Heads in the Magothy Aquifer  
after Pumping 2.25 mgd from  
50 Wells for 2 Years**

# Groundwater Flow Modeling



**Heads in the Magothy Aquifer  
after Pumping 2.25 mgd from  
50 Wells for 2 Years**



**Heads in the Lloyd Aquifer  
after Pumping 2.25 mgd from  
50 Wells for 2 Years**

# Technical Issues

- Design Issues
  - ◆ Injection / Recovery Capacities
- Water Quality Issues
  - ◆ Fate of DBPs
  - ◆ Effect of Storage Time on Quality
- Impact Issues
  - ◆ Water Levels, Salt Water
  - ◆ Impacts to Nearby Users of the Lloyd
- Other Issues Detailed in Work Plan

# Data Collection Activities

- USGS
  - ◆ Regional and Pilot Testing Scale Groundwater Flow Modeling (MODFLOW)
  - ◆ Saltwater Intrusion Modeling (SUTRA 3D)
  - ◆ Mineralogy Testing of Aquifer Matrix
  - ◆ Borehole Geophysics
  - ◆ Microbial Testing of Aquifer Matrix and Groundwater by Dr. Frank Chapelle USGS
  - ◆ Steady-State and Transient Mineralogy Modeling by Dr. David Parkhurst USGS using PHAST
  - ◆ Disinfection by-Product (THM & HAA) Testing and Analysis by Dr. George Aiken
- Extensive Regional and Local Water Level Measurements
  - ◆ Baseline and Pilot Test
- Extensive Regional and Local Water Quality Samples and Analysis
  - ◆ Baseline and Pilot Test

# ASR #1 - Planning-in Progress

- Staten Island (1)
  - ◆ Drilling set for Oct 3
- Southeast Queens (2)
  - ◆ Magothy
  - ◆ Lloyd

# Regulatory Issues-in Progress

- 1<sup>st</sup> ASR Well in NY State
- Moratorium on New Lloyd Withdrawals
- Currently Working with NYSDEC and NYSDOH
  - ◆ Long Island Well Permit
  - ◆ SPDES Permits
  - ◆ Public / Adjudicatory Hearing
- USEPA UIC Permit Issued

# Outreach-in Progress

- ◆ **Elected Officials - NYC and Nassau County**
- ◆ **Community Boards**
- ◆ **Community and Public Interest Groups**