

The Use of Ground-Water Flow Models in New Jersey Water Resource Technical Reviews

An example using the USGS Regional Aquifer System Analysis (RASA) Model in the New Jersey Coastal Plain

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Background

- Water Allocation Process
 - Ground water diversions >100,000 gpd need a permit
- NJGS Role in Water Permitting
 - provide technical assistance to the Bureau of Water Allocation
- Model Maintenance Agreement
 - NJGS use of USGS ground water models

Common Review Issues

- Operational zone of influence
- Effects to other users
- Saltwater intrusion
- Irrigation estimates
- Contaminant migration
- Effects to surface water
 - streams and wetlands
- Impacts to Water Supply Critical Areas
 - pre-existing cone(s) of depression

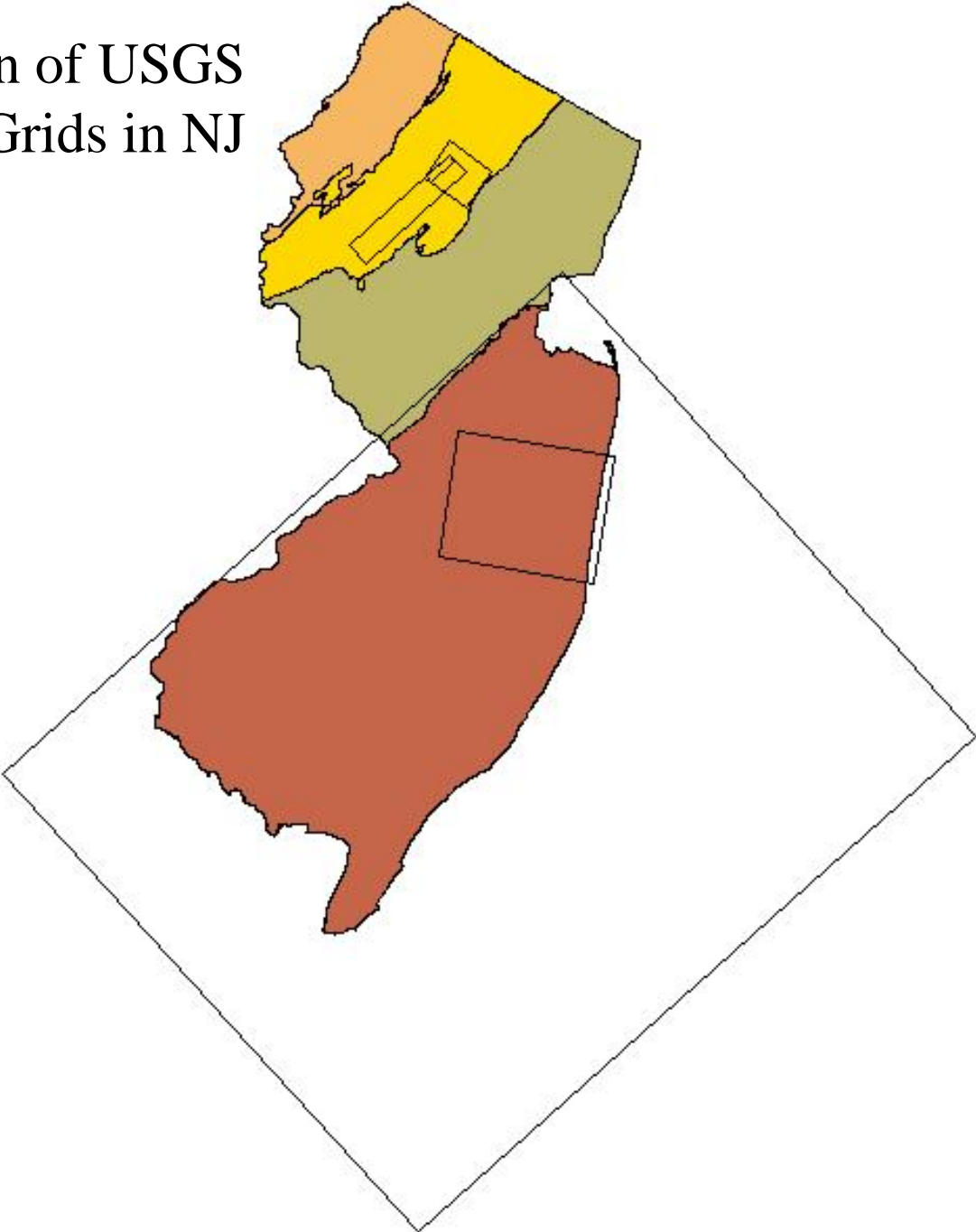
Why use Numerical Models

- More “in-depth” analyses are common
 - ground water - surface water interaction
- Transient effects
 - seasonal use, changes in recharge, ASR wells
- Contamination studies
 - potential transport
- Develop our own and use USGS models
- Provide a better approximation than analytical models

USGS Models Used by NJGS

- RASA Model
 - ASR, saltwater intrusion
- Long Valley (Lamington) Model
 - seasonal effects to surface water
- Rockaway Model
 - transient effects from ground water withdrawal
- Toms River\Metedeconk Model
 - surface water effects (Pinelands)
- Picatinny Model
 - budget changes in source water to wells

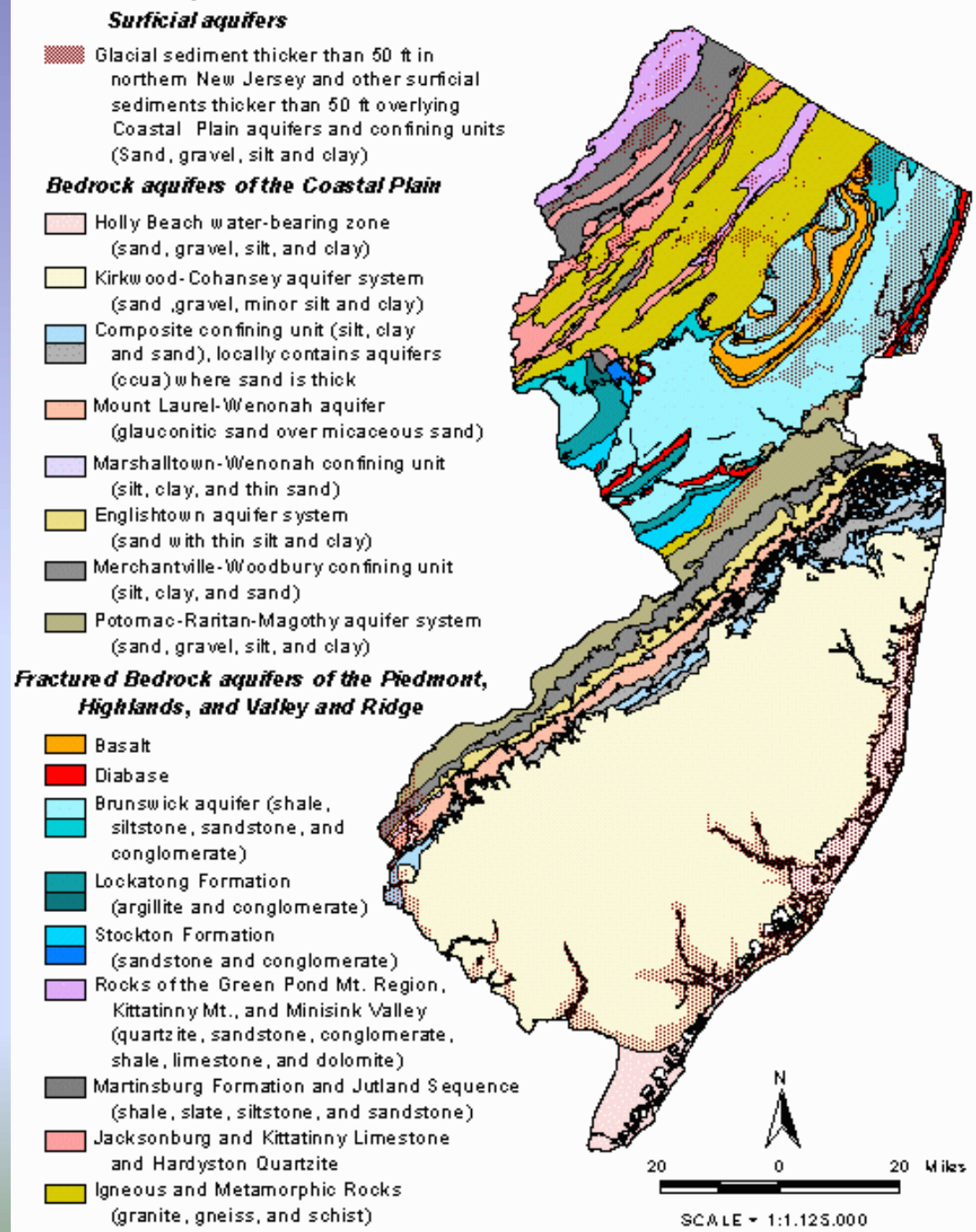
Location of USGS
Model Grids in NJ



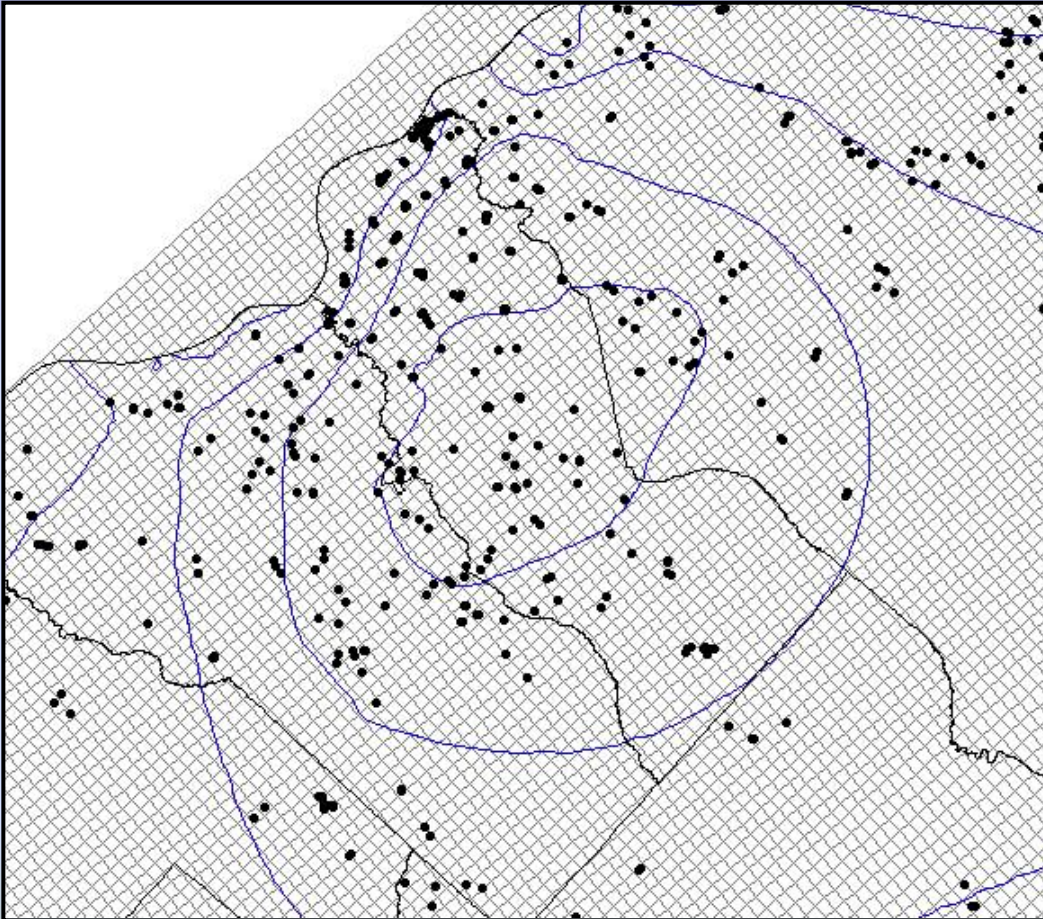
Models Represent Diverse Geologic Conditions

Northern part of state - fractured rock aquifers

Southern part of state - interbedded sequence of sand and clay

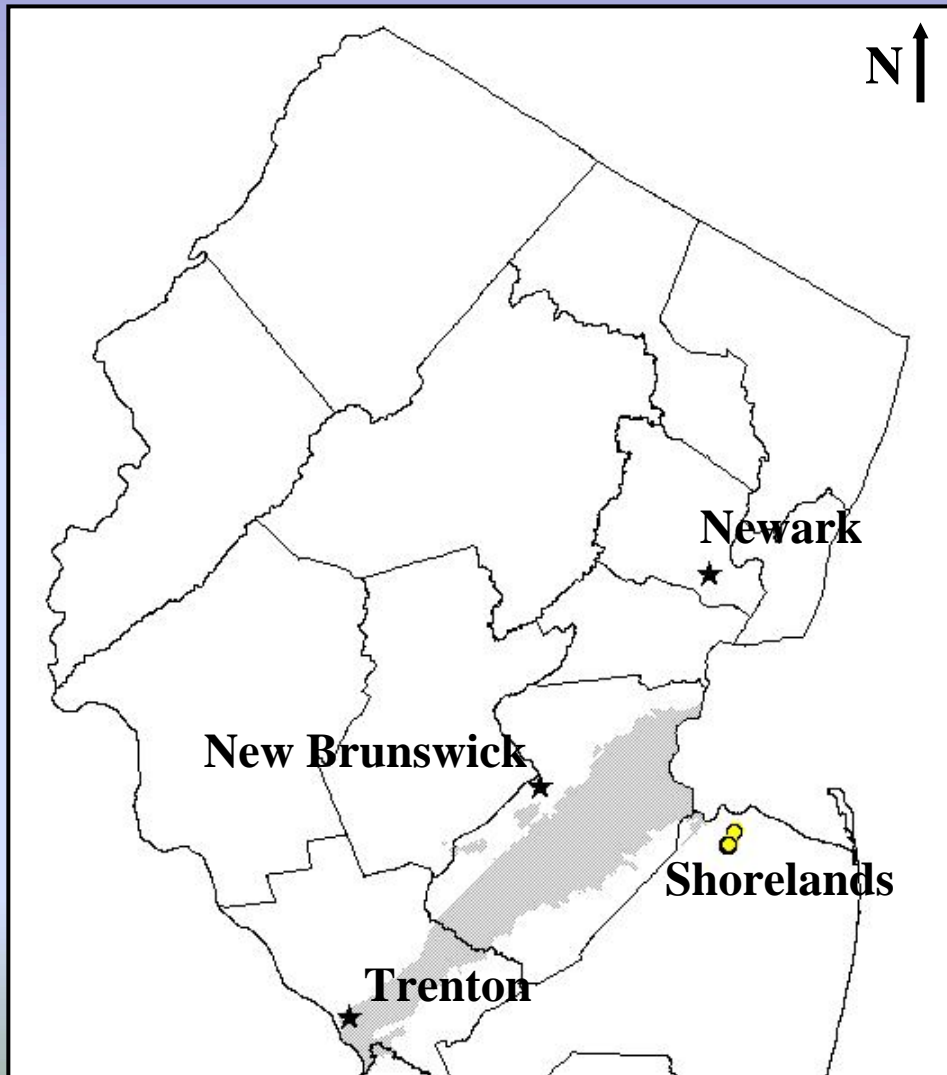


NJGS Modifications to USGS Models



- NJGS receives raw MODFLOW files
- Develop software for visualization
 - Helps us assign parameters accurately
 - Visual Output

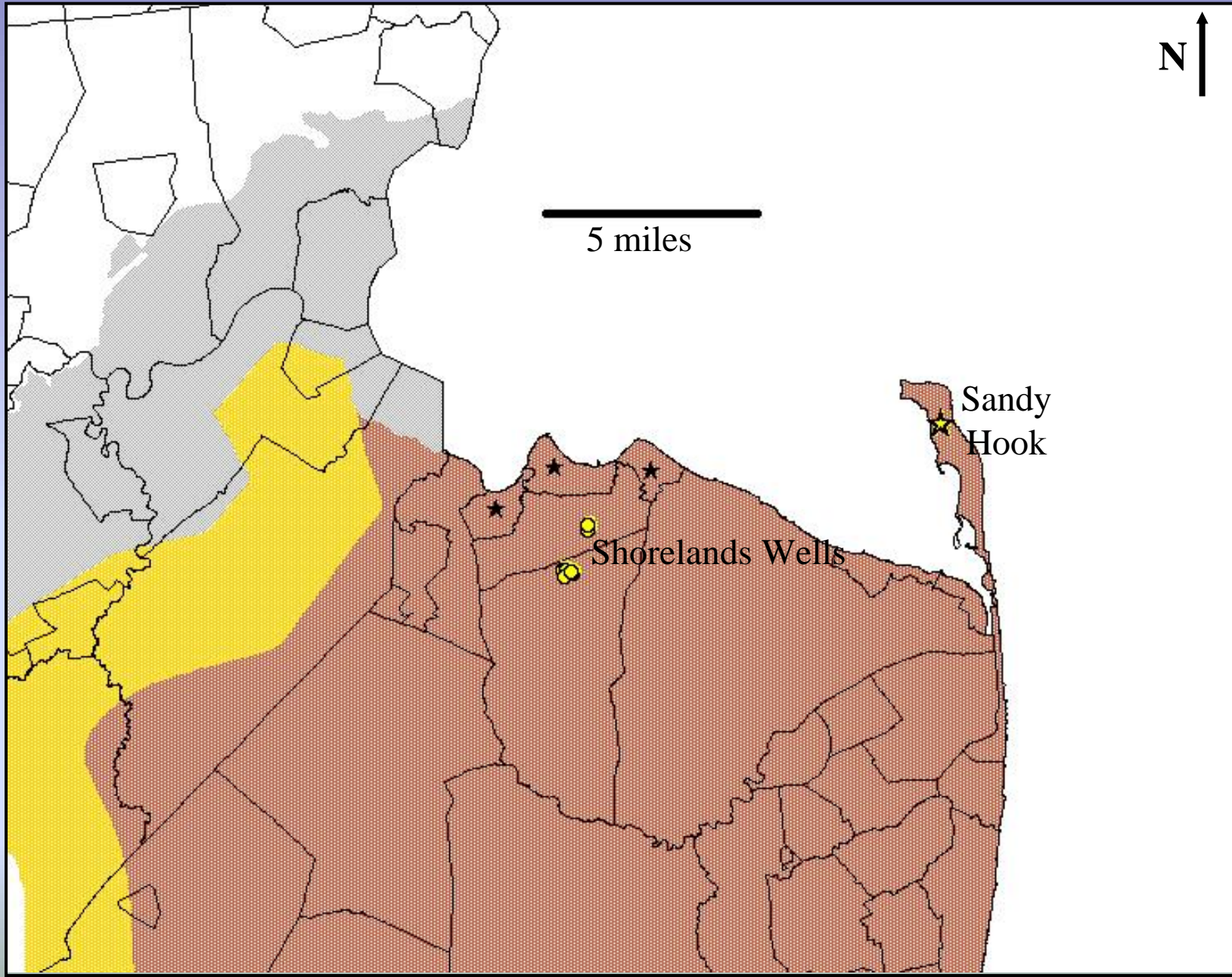
Shorelands Water Company



- Existing allocation inside Critical Area 1
- Wells in PRM Aquifer System (upper and middle aquifers)
- Located near previous saltwater “issues”
- High seasonal use pattern
- **Question: Is seasonal increase significant to induce offshore movement of saltwater**



5 miles



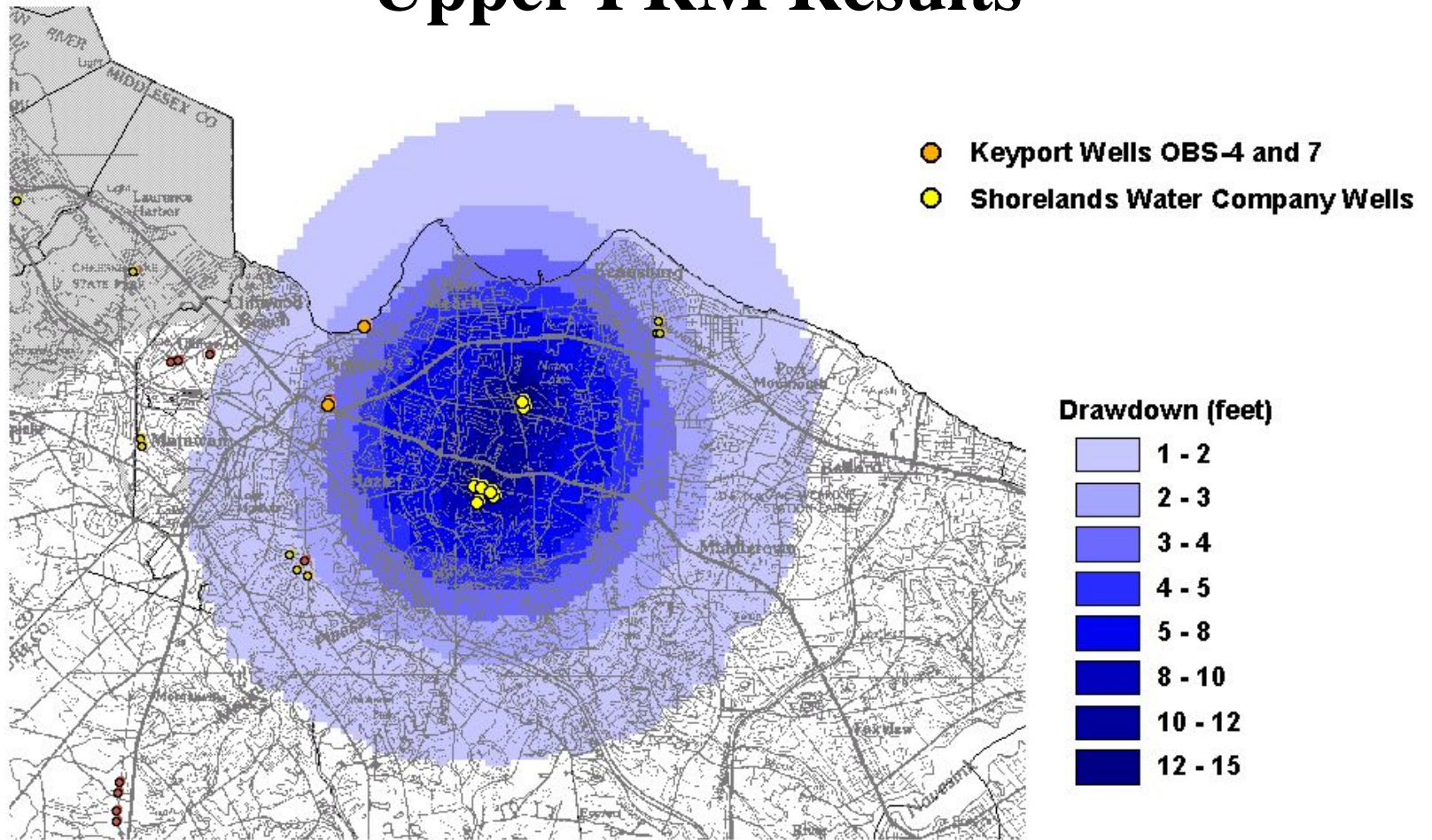
Sandy Hook

Shorelands Wells

Modeling Techniques

- No change to conceptual model
 - same grid, boundaries, etc...
- Add wells and monthly increase (225 MGM from all wells)
 - discretize pumping in upper and middle aquifers
- Need to adjust RASA Model for transient simulations needed
 - historical use indicates pumping from May - September

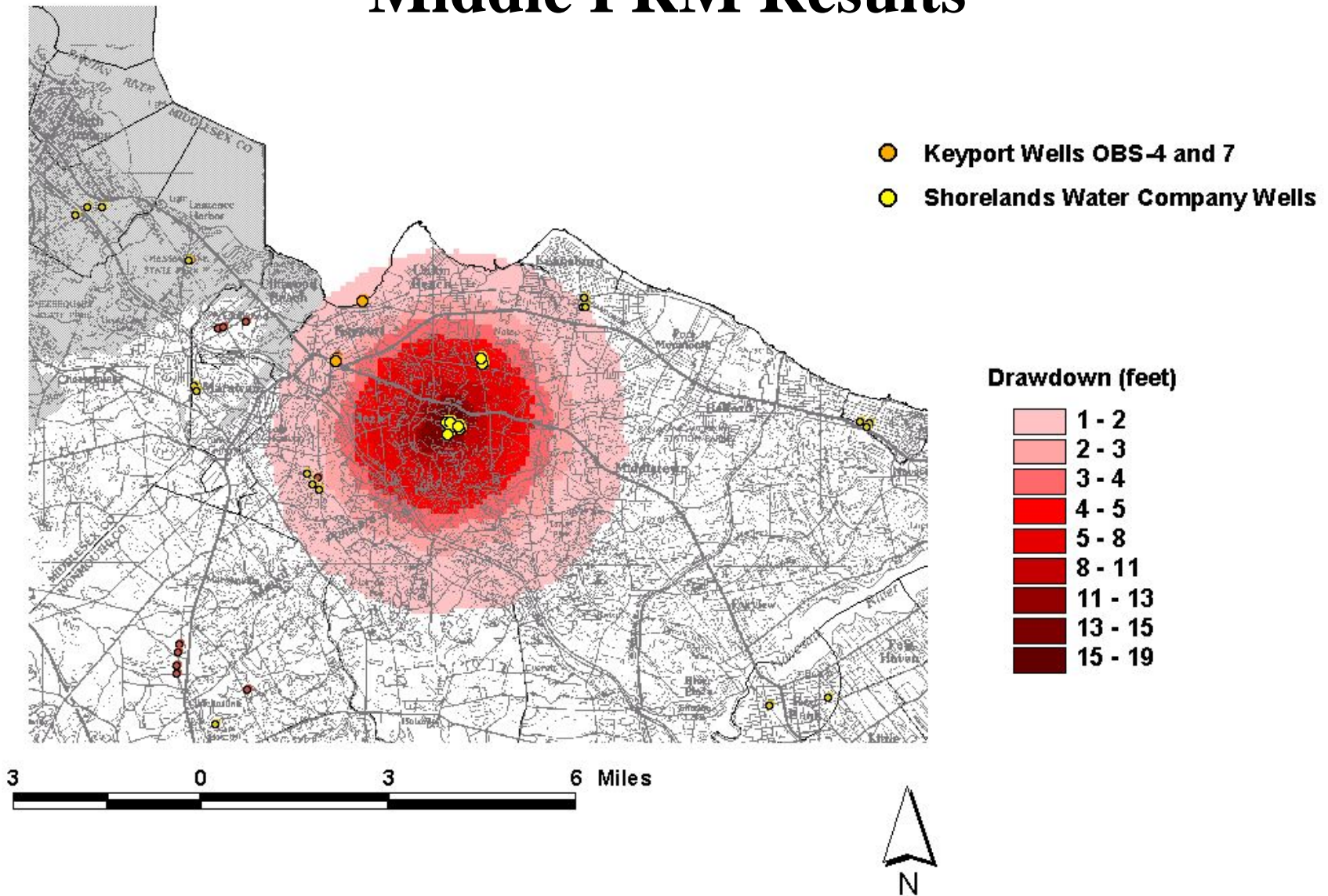
Upper PRM Results



3 0 3 6 Miles



Middle PRM Results

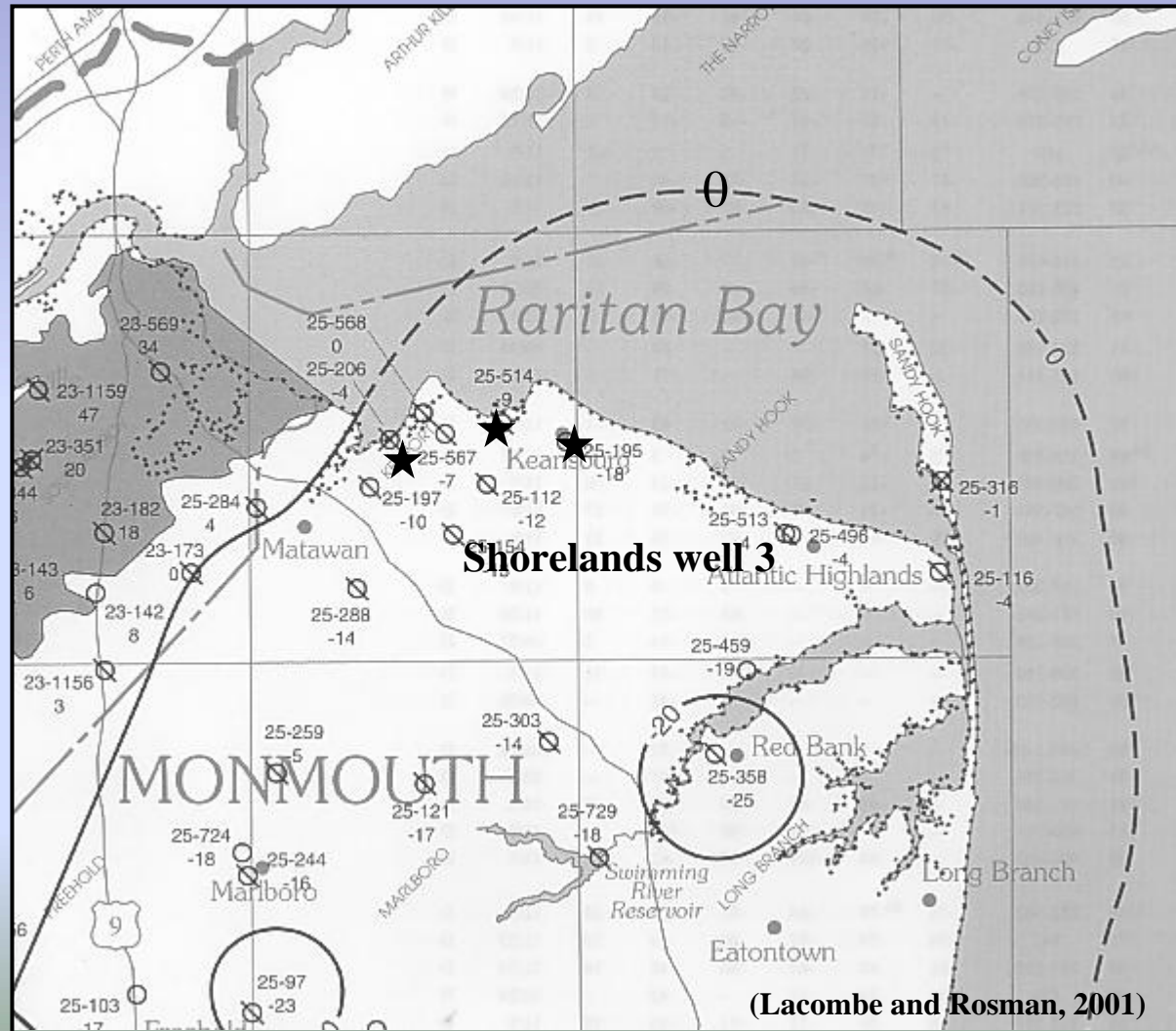


Issues

- Is “seasonal” drawdown significant for chloride increases in upper aquifer wells prone to saltwater?

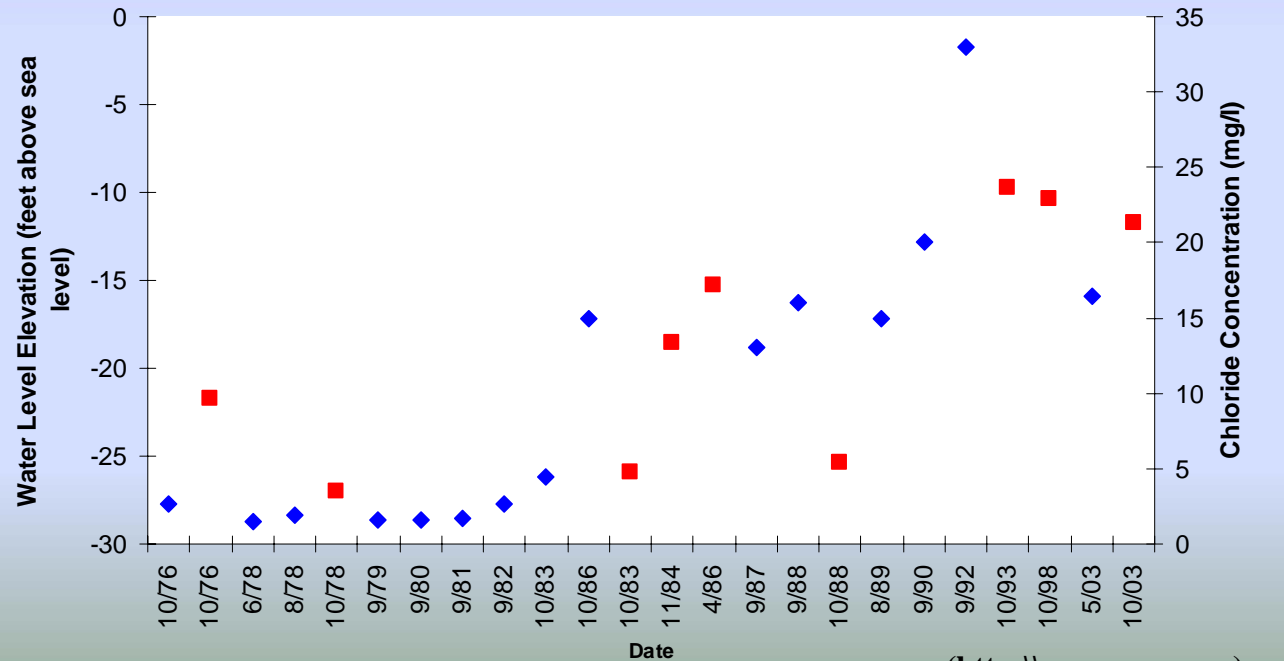
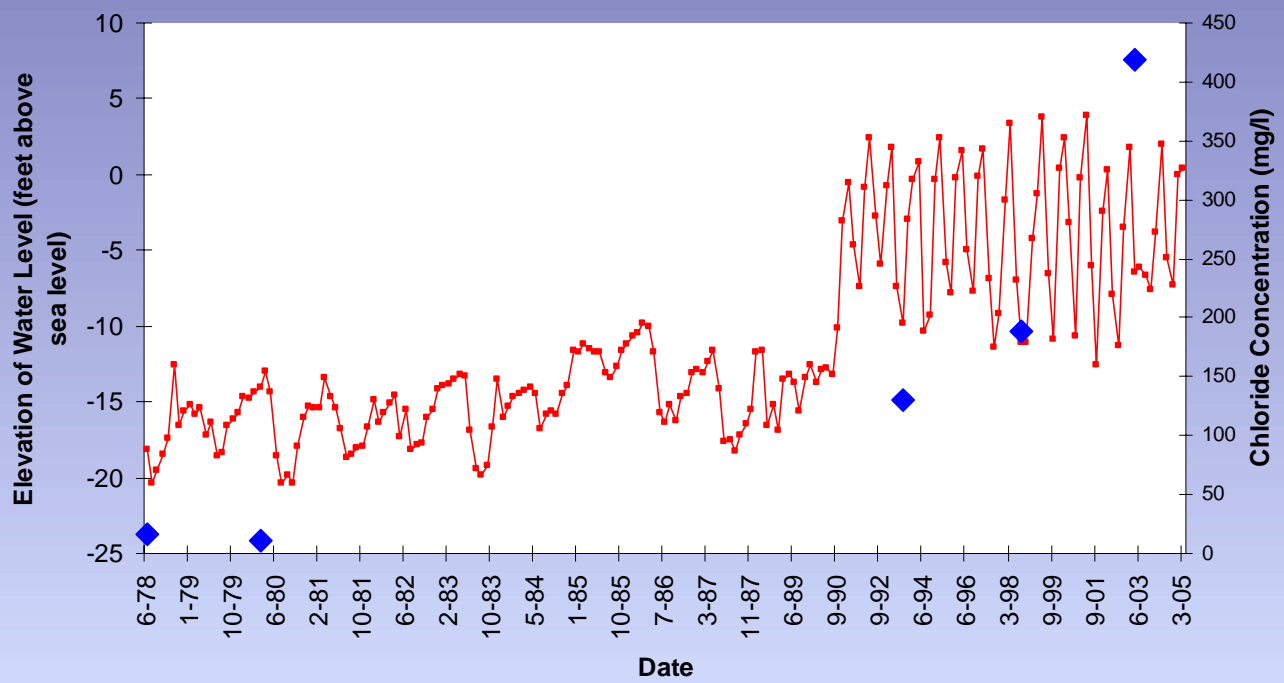
1. Water levels are still below sea level in aquifer

2. Aquifer in good hydraulic connection with Raritan Bay



(Lacombe and Rosman, 2001)

3. Observation wells indicate increasing Cl concentrations even with recovering water levels



Summary

- Numerical flow models allow in-depth analyses of hydrologic systems
- Increasingly more difficult questions
- Flexibility allows for multiple scenarios
- Results used to assist in permitting decisions