



# Modeling of Salt-Water Intrusion at Hilton Head Island South Carolina

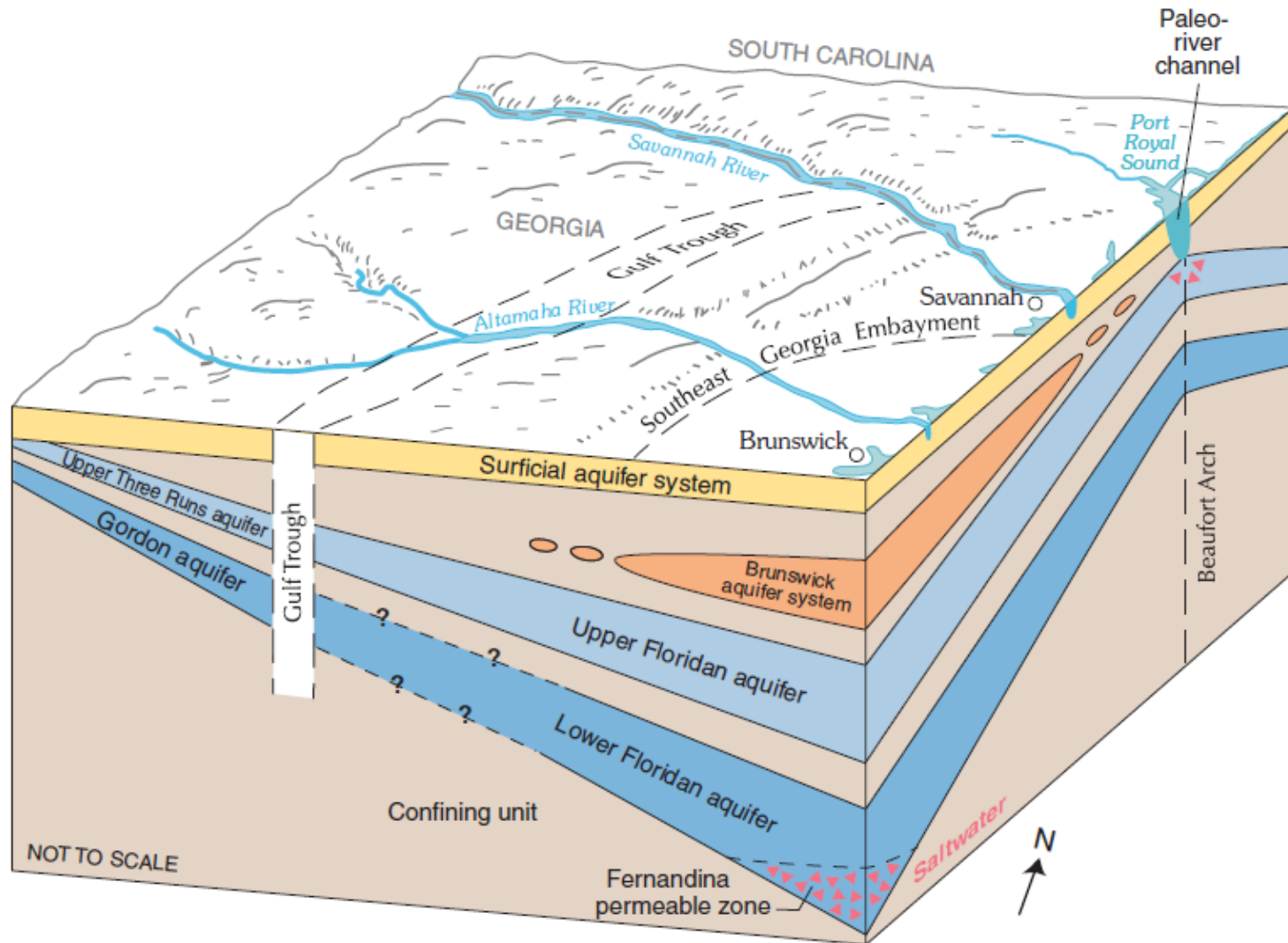
6 August 2010

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Georgia Environmental Protection Division

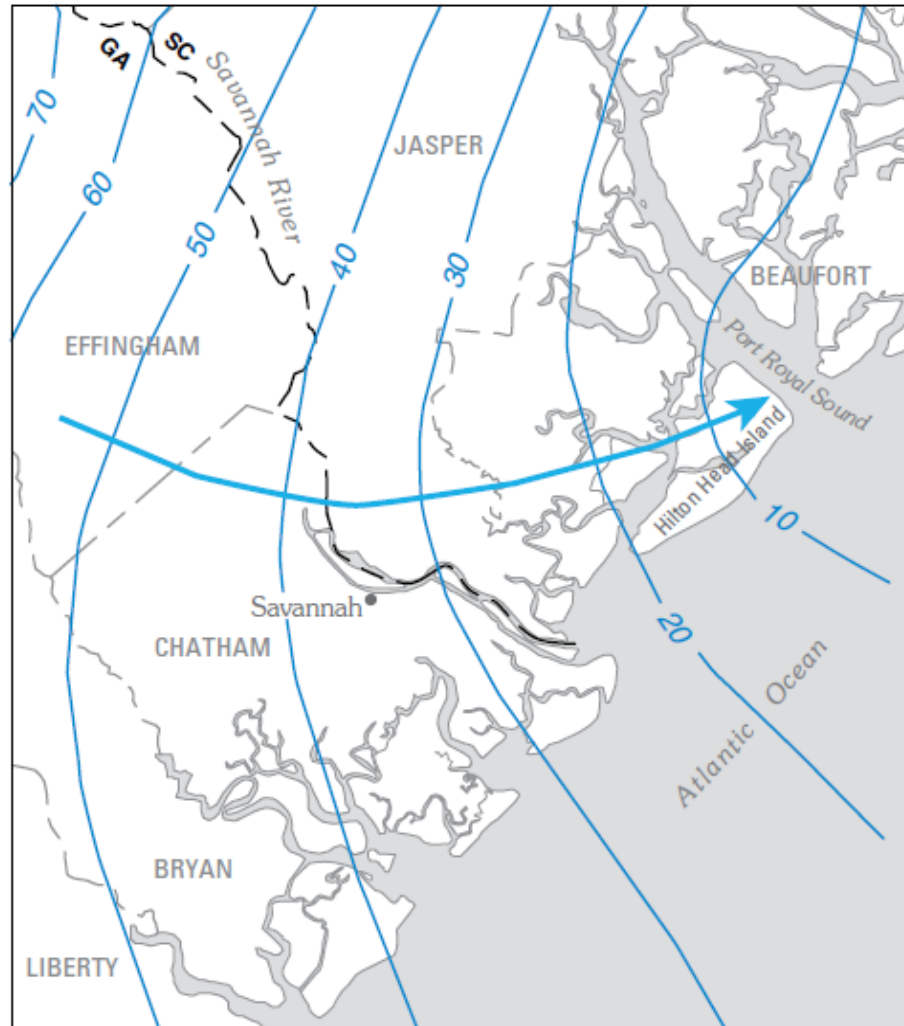
State Geologist

# Aquifers in Coastal Georgia

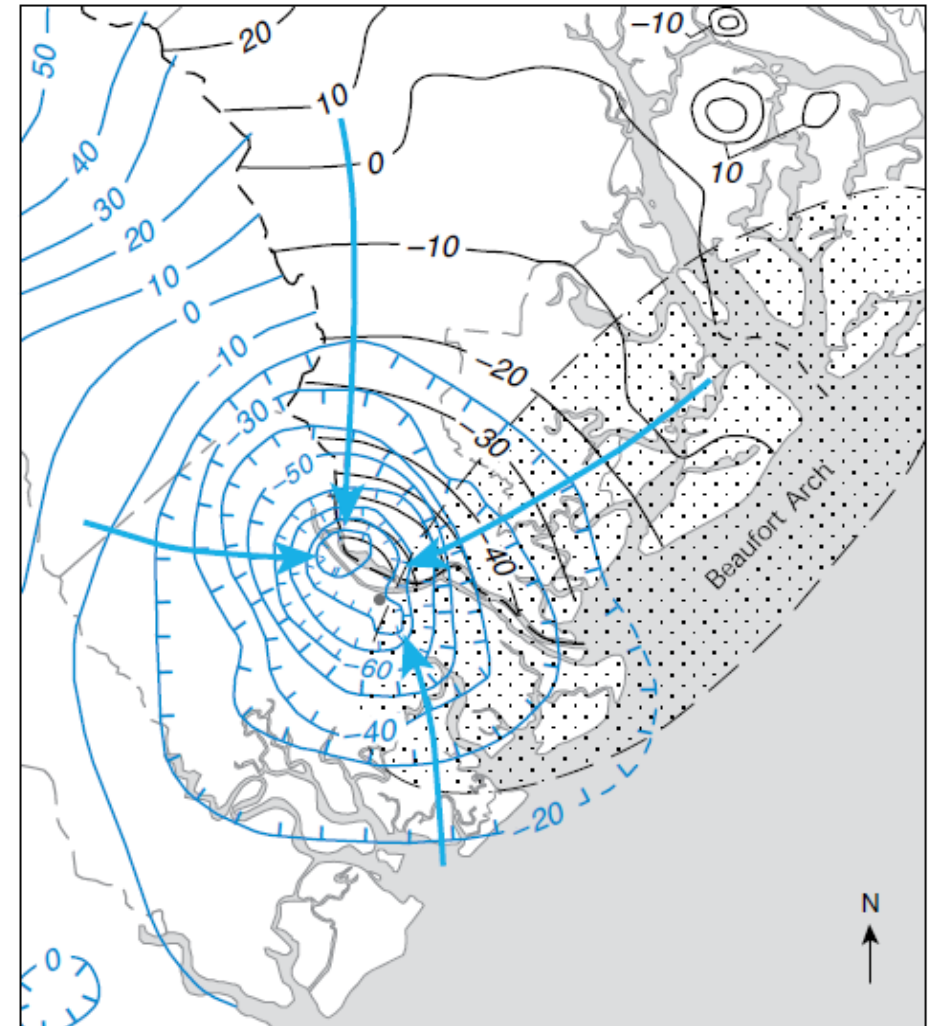


# Upper Floridan Aquifer Potentiometric Surface

**A. Predevelopment**



**B. May and September 1998**

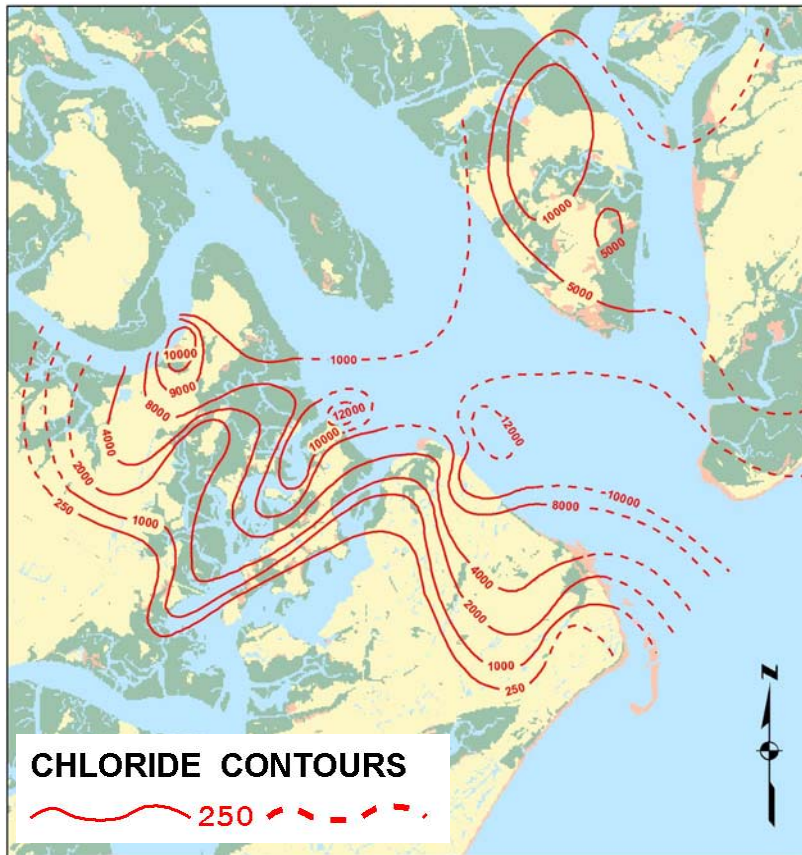


Base from U.S. Geological Survey  
1:100,000 and 1:250,000-scale data

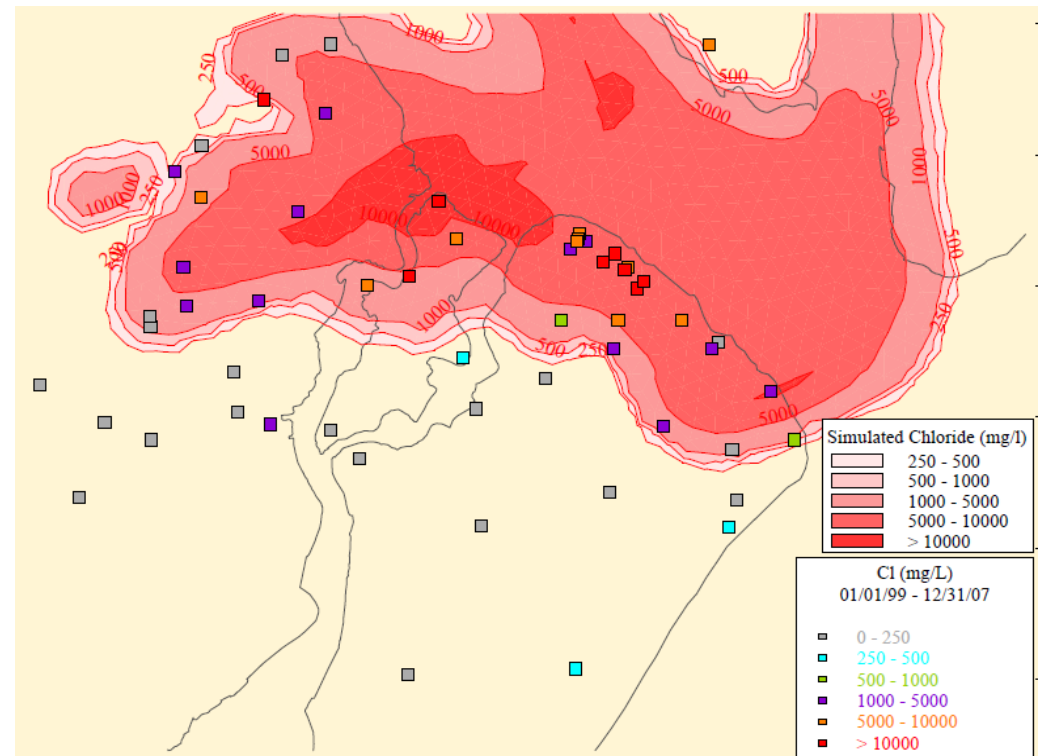
USGS SIR 2006-5058

0 5 10 15 MILES  
0 5 10 15 KILOMETERS

## SCDHEC Contours



## Simulated Contours



The model was considered to be adequately calibrated because simulated water levels closely matched water levels measured in wells and the model closely simulated when the salt water plume arrived at wells and the range of chloride concentrations at the well



# Management Scenario Simulations – 30 Year Projections

Simulation of Pumping Reductions		
As Percent Reduction of Base Case* Pumping		
Scenario	Savannah Area	Hilton Head Island Area
Base Case	0%	0%
A	50%	0%
B	0%	50%
C	50%	50%

\*Base Case Pumping

Savannah Area 69 MGD (2000)

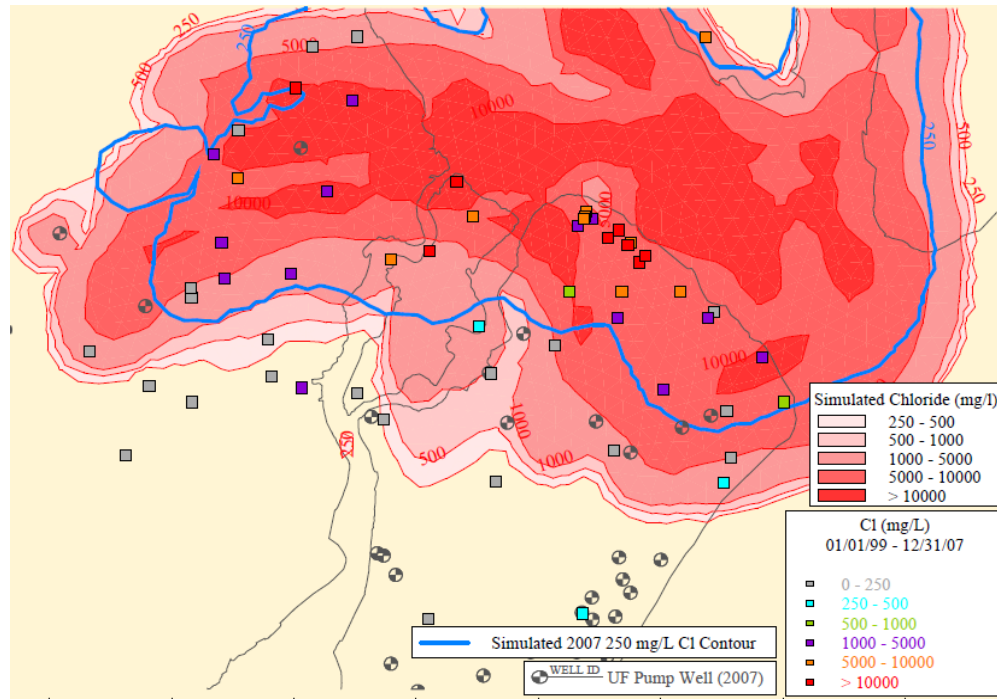
Hilton Head Island 9 MGD (2007)



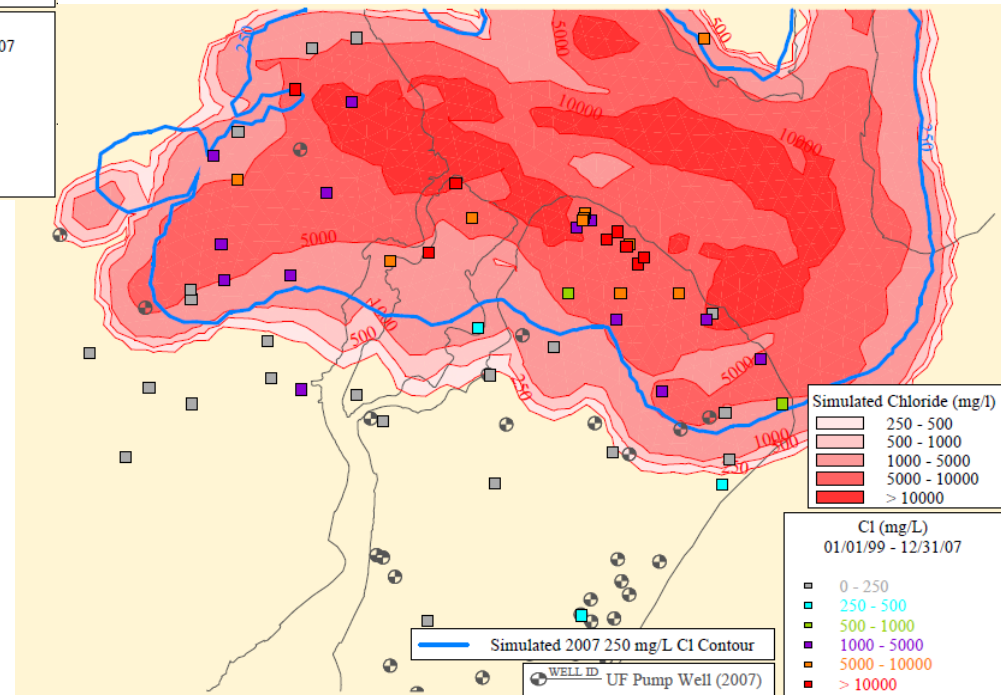


# Reducing Withdrawals Would Not Eliminate Salt-Water Intrusion

**30 Years of Pumping with No Reductions in Savannah Area or Hilton Head Island Withdrawals**

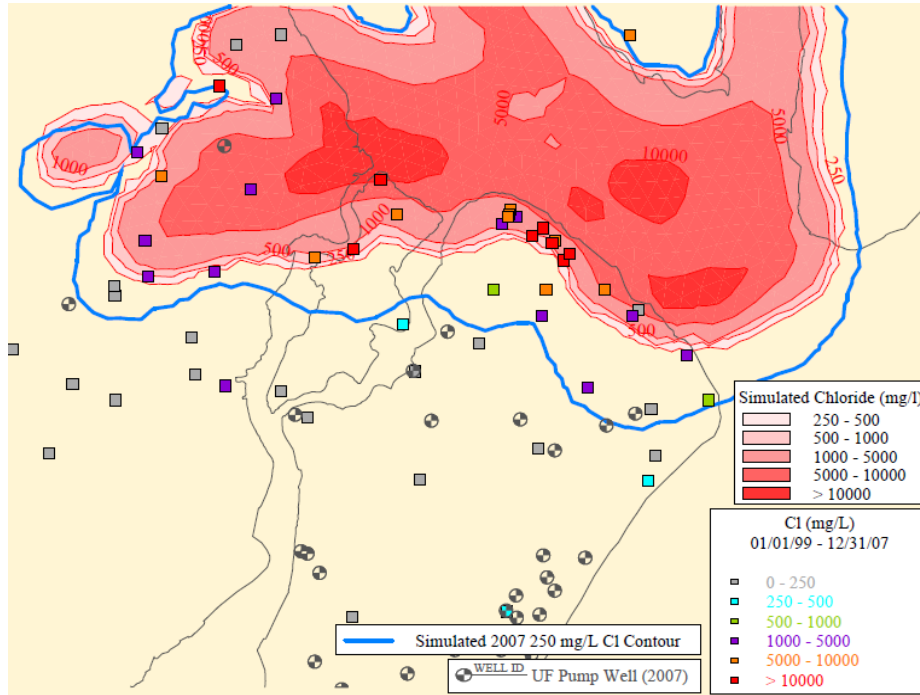


**After 30 Years of Pumping with 50% Reductions in Savannah Area and Hilton Head Island Withdrawals the Plume Still Moves Inland**



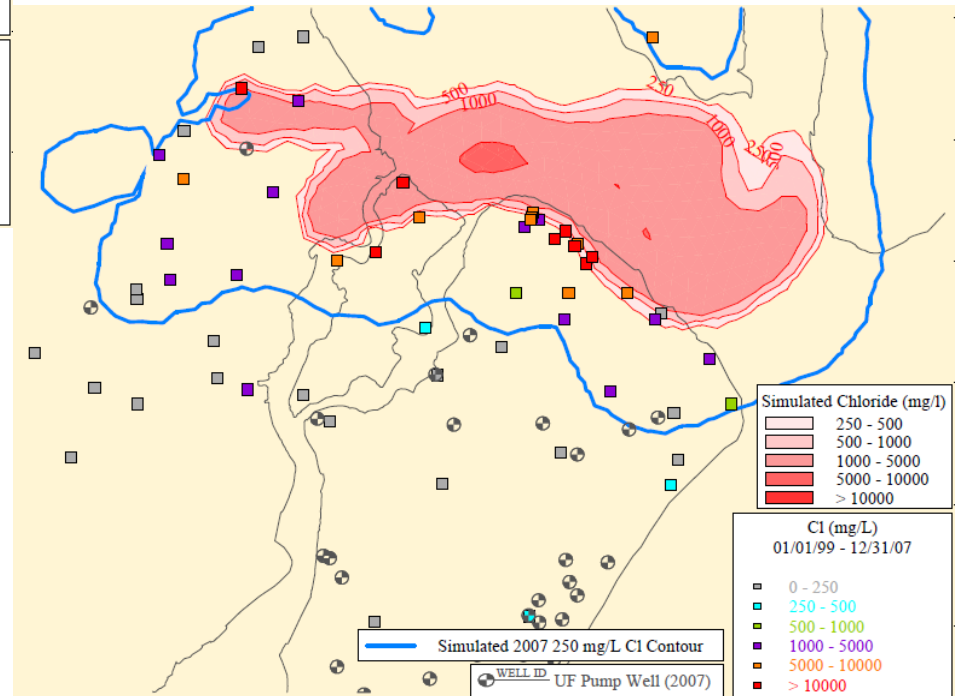


# Withdrawals in Savannah and HHI Were Needed to Create the Plume

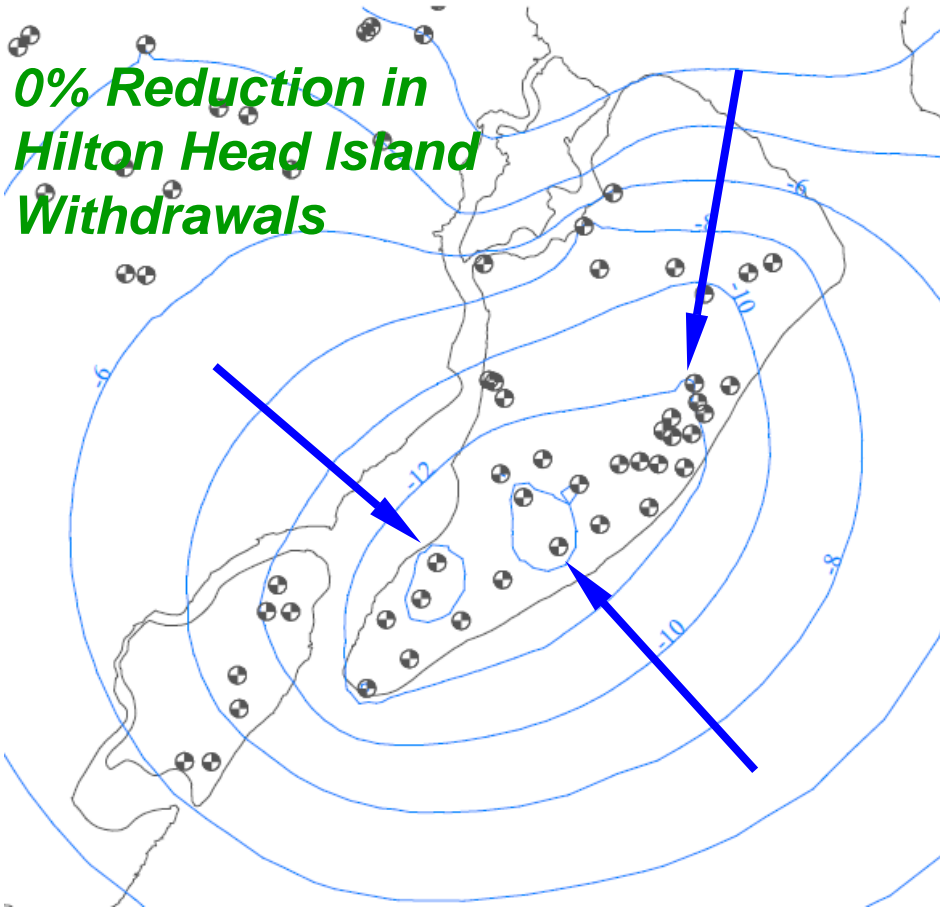


**Historical Pumping on Hilton Head Island with No Pumping in the Savannah Area**

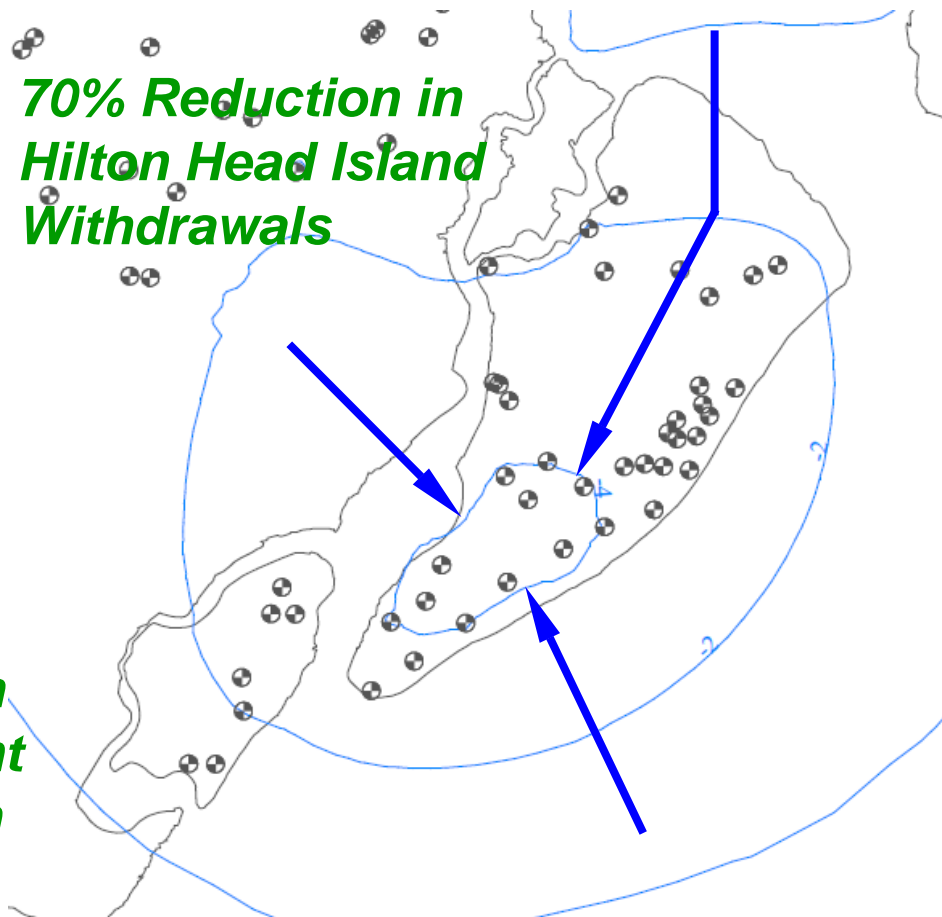
**Historical Pumping in the Savannah Area with No Pumping on Hilton Head Island**



# Any Withdrawals Would Cause Salt Water to Move Into the Aquifer



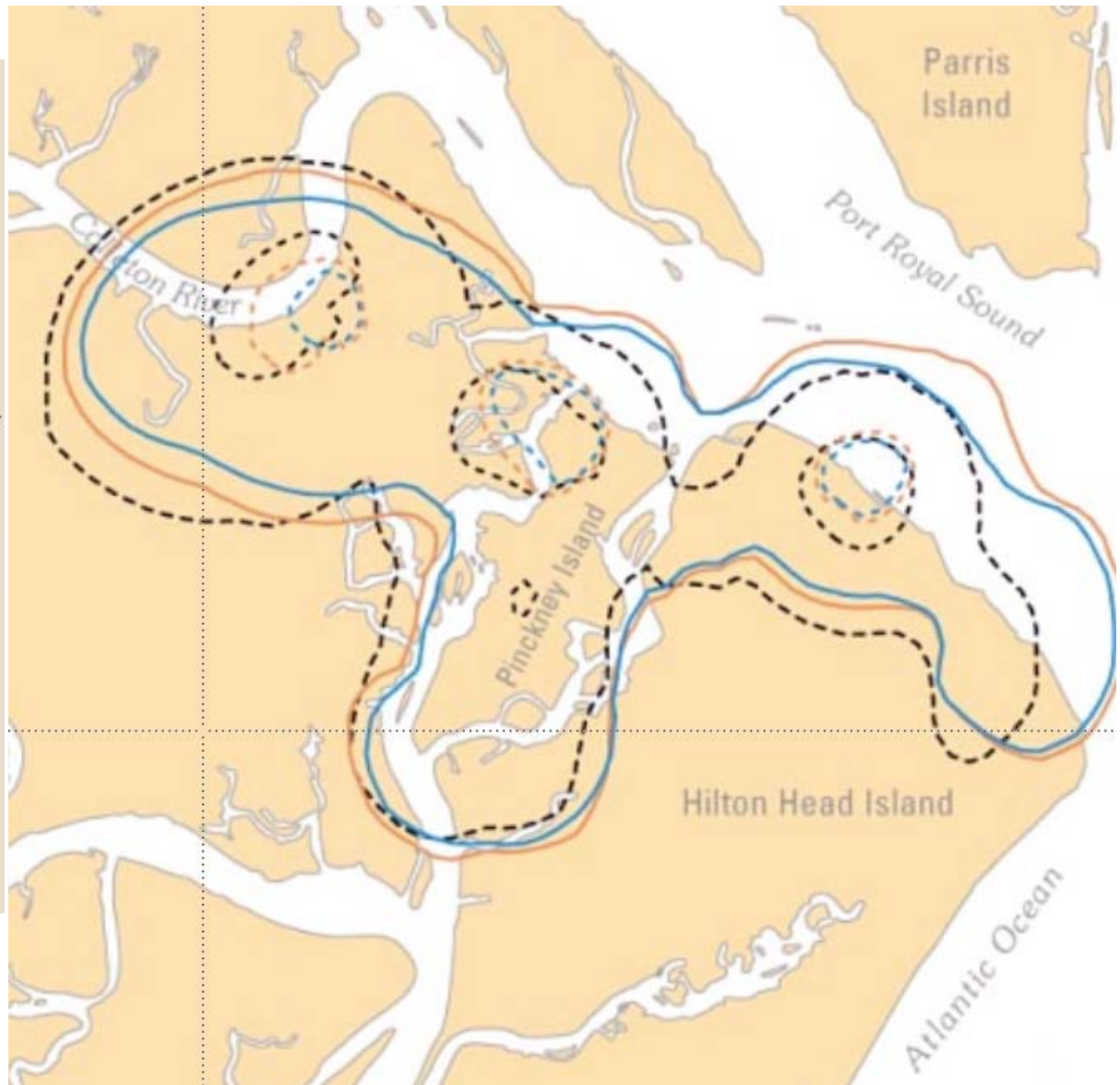
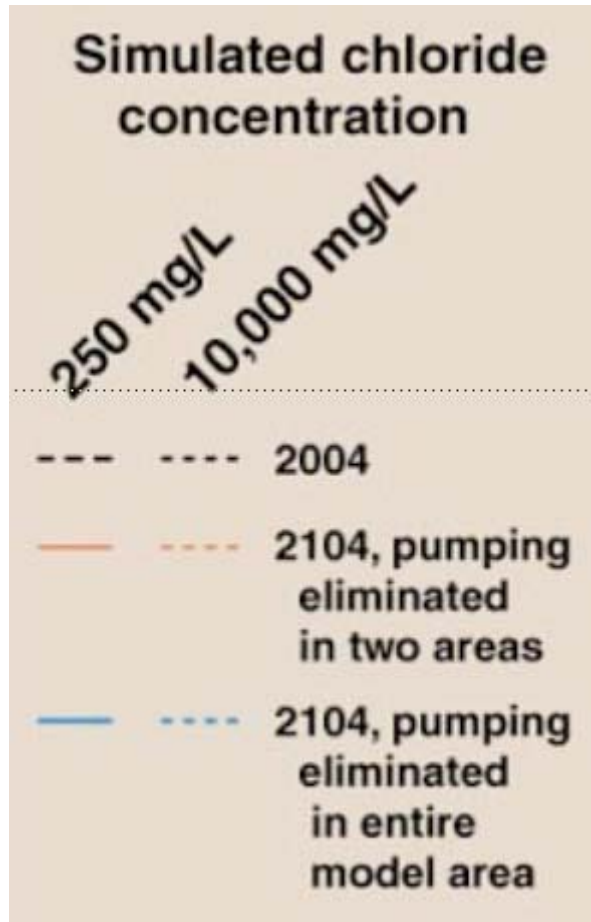
**Direction of Groundwater Movement** ←



**Even with a 100% reduction in Savannah area withdrawals groundwater movement is toward a cone of depression on Hilton Head Island and not toward the ocean**



# *Salt-Water Plumes Would Continue to Exist Even With No Withdrawals*

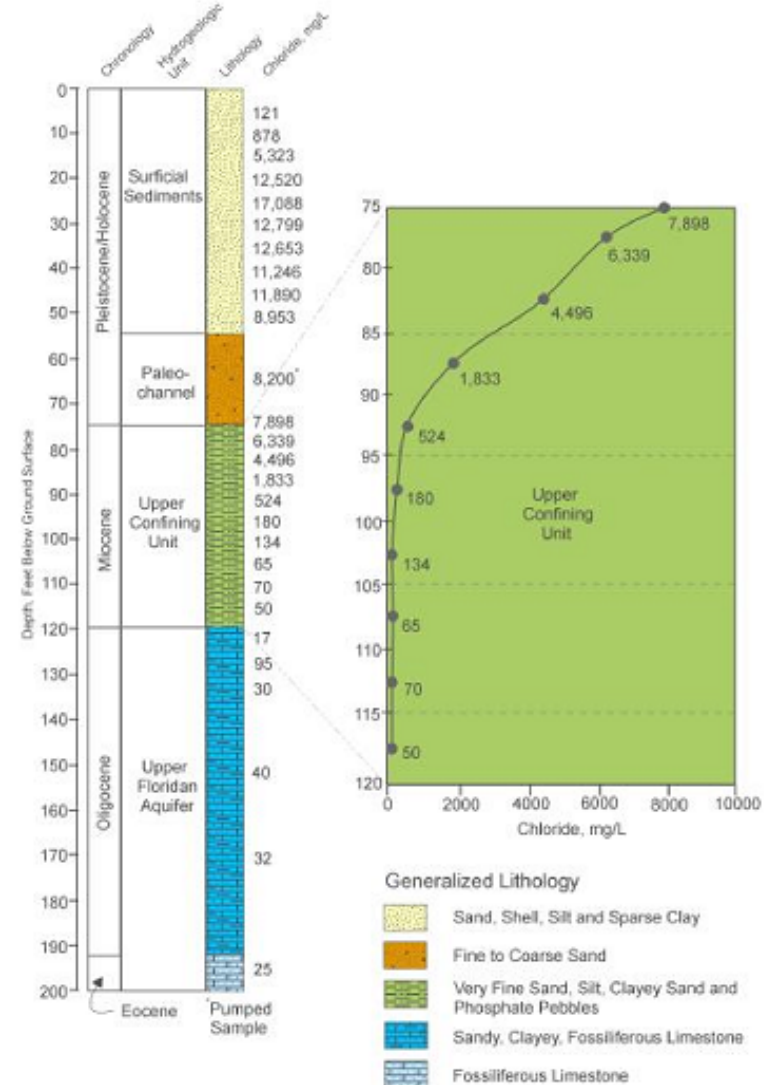




# *Results of Salt-Water Intrusion Modeling*

- Reducing groundwater withdrawals from the aquifer, even by large amounts, would not eliminate salt-water intrusion into the aquifer
- Groundwater withdrawals in both the Savannah area and on Hilton Head Island were needed to create the inland extent of the current salt water plume on Hilton Head Island
- Almost any groundwater withdrawals would cause salt water to continue to move into the aquifer and toward water supply wells
- Salt-water plumes would continue to exist well into the future even if all groundwater withdrawals were eliminated

# Downward Migration of Salt Water Through the Upper Confining Unit

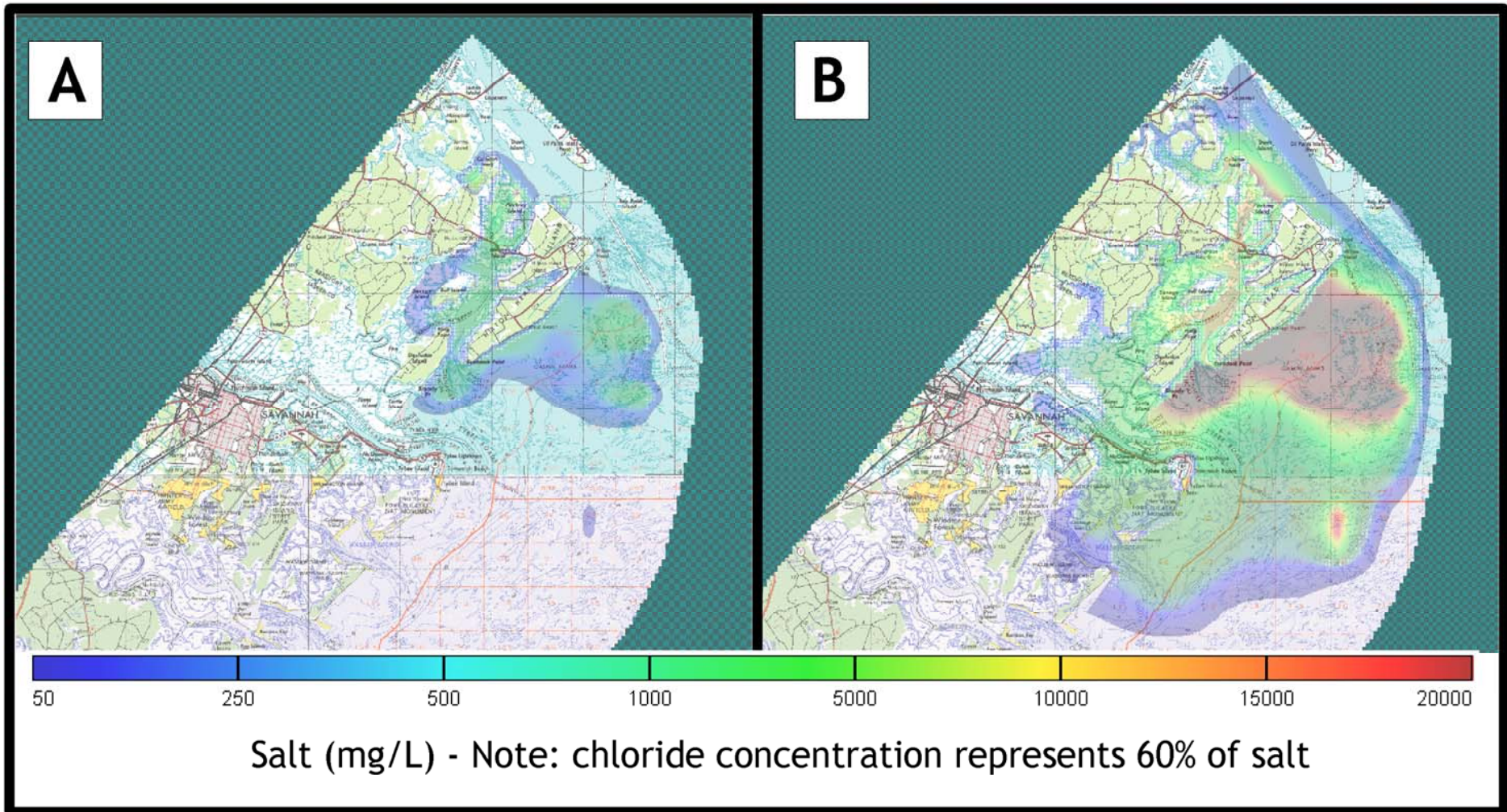




# Simulated Regional Downward Migration of Salt Water

**2050 Salt Water at the Top of the Upper Floridan Aquifer**

**2050 Salt Water Midway Through the Confining Unit**

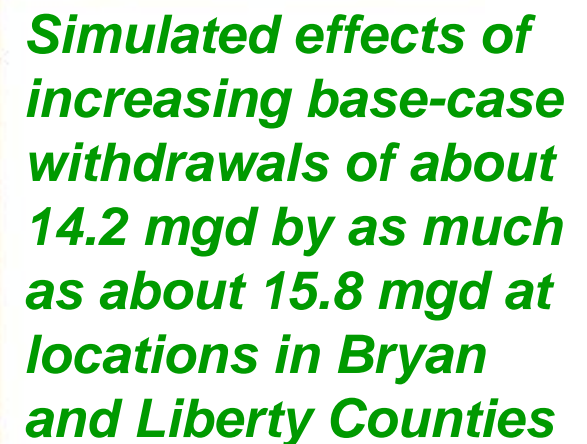






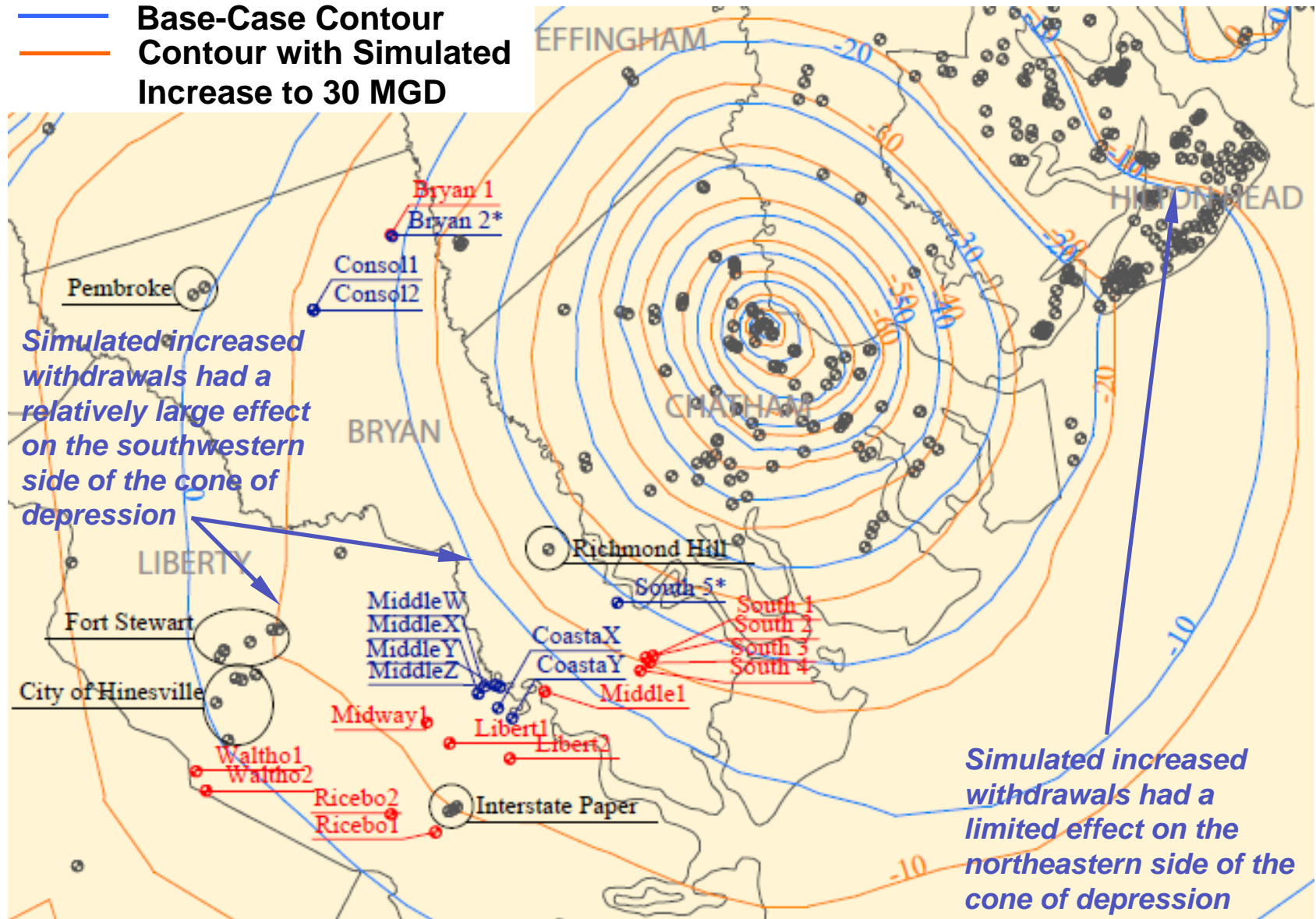
# *Results of Salt-Water Intrusion Modeling*

- The model simulation of vertical salt water migration for the year 2050 showed that downward migration of salt water will first enter the aquifer where the upper confining unit is thinner
- The model of vertical salt water migration has not yet simulated what impacts downward migration of saltwater through the upper confining unit could have on the overall quality of groundwater in the Upper Floridan aquifer at water supply wells



# Increase Groundwater Withdrawals from about 14.2 to 30 MGD

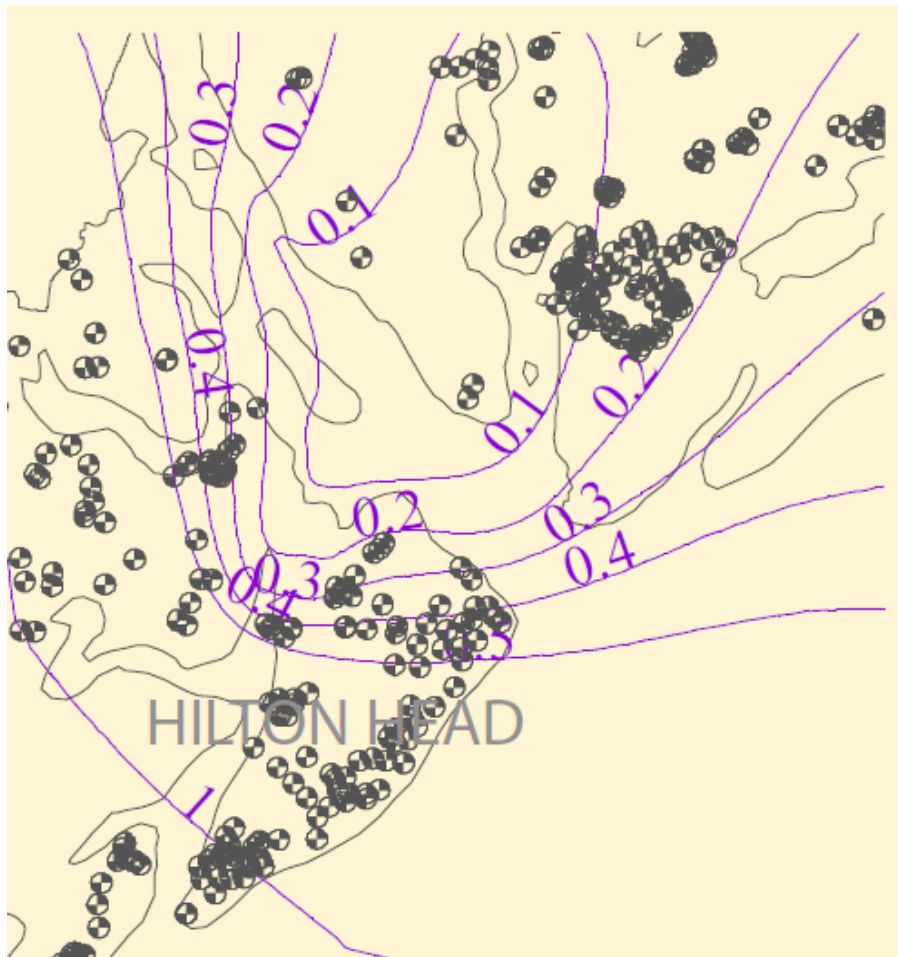
- Base-Case Contour
- Contour with Simulated Increase to 30 MGD



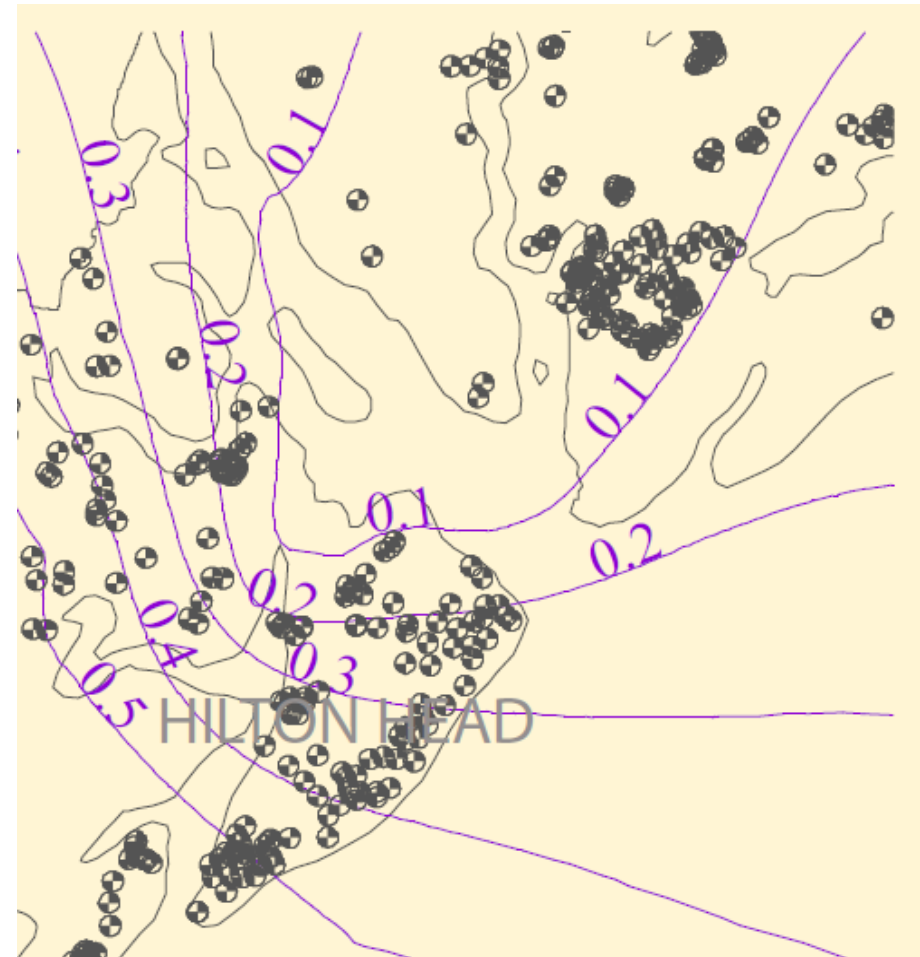


# Increased Yellow Zone Withdrawals Would Lower HHI Groundwater Levels

**Additional Water Level Drawdowns  
with Simulated Withdrawals  
Increased by 15.8 MGD to 30 MGD**



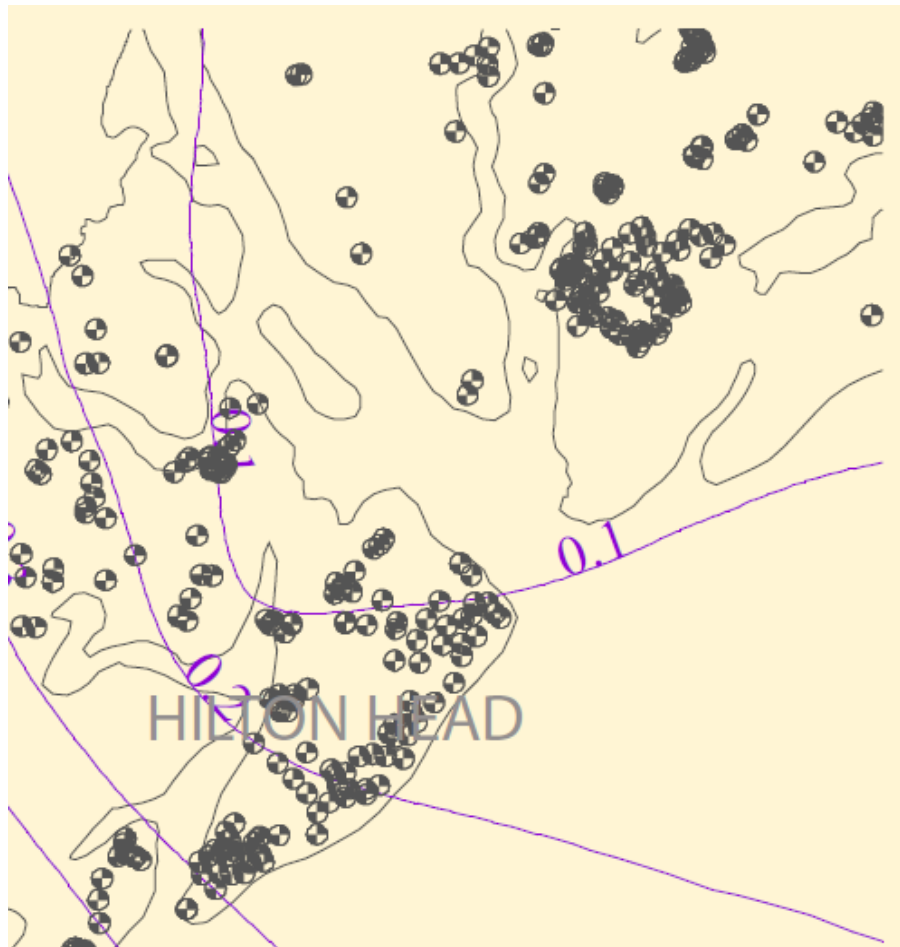
**Additional Water Level Drawdowns  
with Simulated Withdrawals  
Increased by 7.9 MGD to 22.1 MGD**



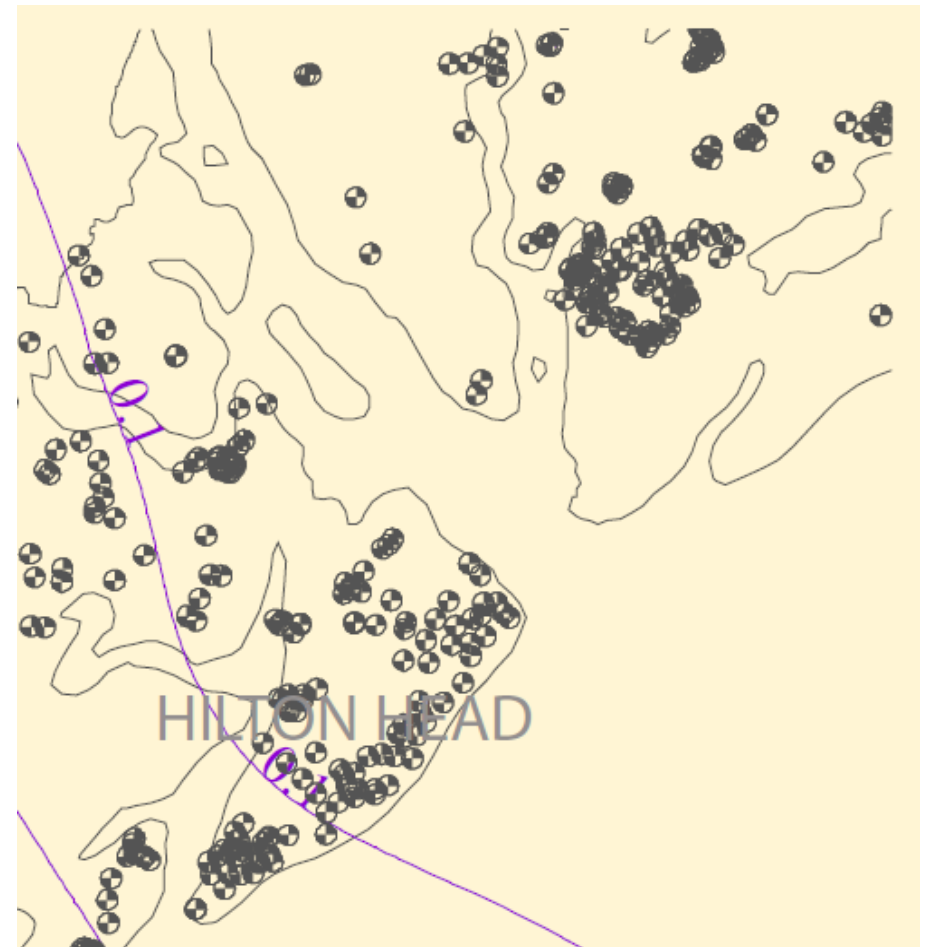


# *Increased Yellow Zone Withdrawals Would Lower HHI Groundwater Levels*

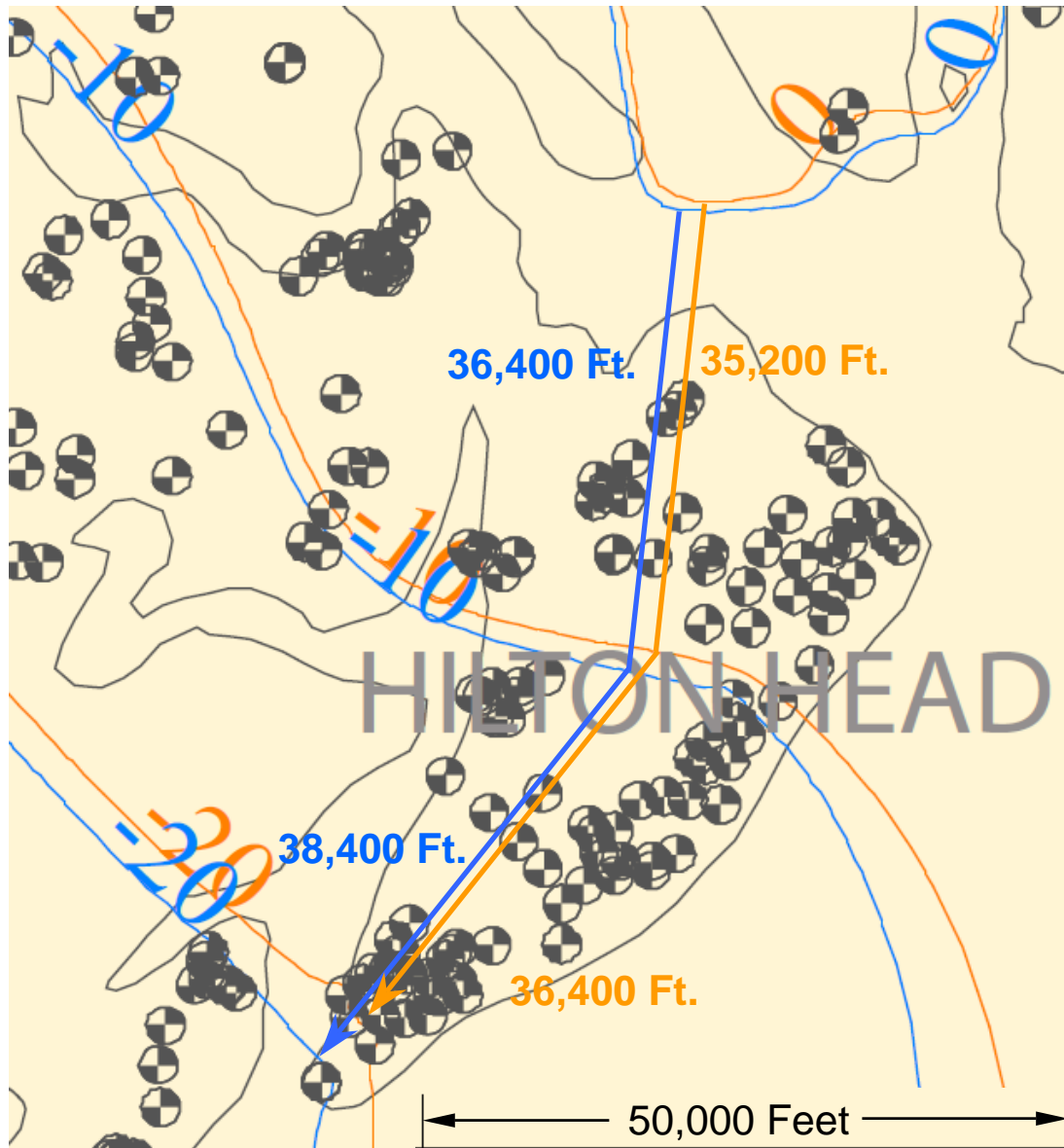
***Additional Water Level Drawdowns  
with Simulated Withdrawals  
Increased by 4 MGD to 18.1 MGD***



***Additional Water Level Drawdowns  
with Simulated Withdrawals  
Increased by 2 MGD to 16.2 MGD***



# Slight Increase in Rate of Salt Water Plume Movement



- **Base-Case Contour**
- **Contour with Simulated Increase to 30 MGD**

With base-case contours a hydraulic head drop of 20 feet occurs over 74,800 feet. With contours for an additional 15.8 mgd of simulated withdrawal a hydraulic head drop of 20 feet occurs over 71,600, 3,200 feet less than the base-case contours. The increase in hydraulic gradient with an additional 15.8 mgd of simulated withdrawal was  $3,200 \text{ feet} / 74,800 \text{ feet} = 4.3\%$ . The slight increase in hydraulic gradient would cause the rate of salt water plume movement to increase slightly.