Downward Migration of Saltwater in the Savannah, Georgia, and Hilton Head Island, South Carolina, Area

by

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SC DHEC CONTRIBUTIONS to the GEORGIA SOUND SCIENCE INITIATIVE

in cooperation with

The CITY OF SAVANNAH, GEORGIA
AND
The BEAUFORT-JASPER WATER AND SEWER AUTHORITY

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South Carolina Department of Health and Environmental Control
Purpose of Investigation

• Determine if salty water from overlying marshes, tidal rivers, and the Atlantic Ocean is migrating downward through the upper confining unit as a result of pumpage from the underlying Upper Floridan aquifer
Location of study area.
Relationship of geophysical logs to general geology (after Ransom and others, 2006)
Geologic core of the upper confining unit taken beneath Port Royal Sound (photograph by C. Ransom III, 1988).
Estimated potentiometric surface of the Upper Floridan aquifer and direction of groundwater flow prior to 1880 (after Counts and Donsky, 1963).
Diagram illustrating downward saltwater migration through the upper confining unit.
Current Questions:

- What is the rate of downward saltwater migration through the upper confining unit?

- When will chlorides begin increasing in the Upper Floridan aquifer?

- When will chloride concentrations impact wells that withdraw water from the Upper Floridan aquifer?
Location of Bull River test site for pore-water extraction.
Procedure for pore water extraction
5 mLs of Porewater

“Hockey Puck”
Chloride concentrations with depth at the Bull River test site (after Ransom and others, 2006).
Diagram illustrating direction of groundwater flow in the surficial aquifer in response to recharge and discharge.
Offshore drill rig used to obtain discrete water samples above the upper confining unit.
Map showing chloride concentrations near the base of the surficial aquifer (chloride concentration of saltwater is about 19,000 mg/L chloride; Hem, 1970).
Model simulation for the year 2050 simulating saltwater in the (a) Upper Floridan aquifer and (b) midway through the upper confining unit.
Savannah Harbor (courtesy of US Army Corps of Engineers).
Savannah Harbor showing general geology (courtesy of US Army Corps of Engineers)
Conclusions

Saltwater is moving downward into the Upper Floridan aquifer where the potentiometric surface is below sea level.

Higher concentrations of chlorides are present in where the upper confining unit is thinnest.

Saltwater will continue to migrate downward until the vertical gradient across the upper confining unit is reversed.