Exploring Regional Groundwater Supply Alternatives to Manage Saltwater Intrusion in the Hilton Head Island Area

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Acknowledgements

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- South Carolina Department of Health and Environmental Control (SCDHEC)
- South Carolina Department of Natural Resources (SCDNR)
Presentation Overview

• Study Area
• Study Background
• Coupled Flow-Transport Groundwater Model
• Analysis of Pumping/Injection Impacts on Salt Water Intrusion
• Summary – Next Steps
Study Area

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Background

Historical Savannah and Hilton Head Pumpage

Increasing Chloride Concentrations at Hilton Head Wells since the 1980s

1984 Upper Floridan Heads

Potentiometric Surface of the Upper Floridan Aquifer, 1984
(From USGS Water-Resources Investigations Report 87-1285, Figure 8)

- 0 Feet
- 100 Feet
Study Background

- SCDHEC/SCDNR Data - Saltwater Intrusion Observed on Hilton Head Island
- Interstate Governor's Committee Tasked With Examining Mitigation Options
- Past Investigations
  - GAEPD Coastal Georgia Sound Science Initiative (CSSI) Studies
  - USGS
  - Savannah Harbor Expansion (SHE) Study
Model Development

- Based on USGS Coastal Model and CDM SHE Model
- Updated Based On Recent Data (CSSI, USGS, SCDHEC)
- Finite Element DYNSYSTEM (www.dynsystem.com)
- Grid Detail Added to HH Area (1,500 – 2,000 feet)
• Middle Floridan aquifer incorporated into model in SC
• Layers subdivided for salt water intrusion modeling
Miocene thickness in Hilton Head model

Miocene thickness from USGS SIR2006-5058
Model Calibration

- Coupled Flow-Transport Model
- Head Calibration – Transient (1915-2007), Tidal Fluctuations, Pump Test
- Transport Simulation – Comparison With Maximum Chloride Concentrations in Upper Floridan Based on Vertical Profile Data
Flow Calibration

1915 – 2005
Savannah Area Wells

1983 – 2003
Hilton Head Wells
Simulated Upper Floridan Heads

Potentiometric Surface of the Upper Floridan Aquifer, December 1957
(From USGS Water-Supply Paper 1611, Plate 5)
Simulated 1998 Upper Floridan Heads

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Chloride Transport Simulation

Max Simulated Cl: 5,000 to 10,000 mg/L
Max Simulated Cl: >10,000 mg/L

1980
1990
2004

Maximum Measured Chloride (mg/L)

- 0 - 250
- 250 - 500
- 500 - 1,000
- 1,000 - 5,000
- 5,000 - 10,000
- > 10,000
Chloride Transport Simulation

SCDHEC Contours of Chloride Concentrations

Model Simulated 2004 Chloride Concentrations
Pumping Impacts Analysis

- Hilton Head and Savannah Pumping Impacts on Salt Water Intrusion
- Pumping Reduction Alternatives
- Engineered Systems to Address Salt Water Intrusion: Injection/Extraction barriers.
Chloride Transport Simulation – Pumping Impacts Evaluation

Historical Simulation Without Hilton Head Pumping

Historical Simulation Without Savannah Pumping

2007
Pumping Impacts Evaluation – Simulated Upper Floridan Chloride Concentrations after 30 Years

Base Case: No Pumping Reduction

Pumping Reduction: 50% Savannah, 50% HH
Pumping Impacts Evaluation

- CDM completed study in 2010, provided training to GAEPD
- 2010-2011 GAEPD continued analysis
Pumping/Injection Barrier Evaluation

Injection Barrier of 7 MGD Designed to Prevent Salt Water from Entering the Aquifer (limit downward vertical movement)

Extraction at 13.7 MGD Captures Salt Water Plume

No downward gradient under PRS

Injection Barrier Simulated at Coastline
Next Steps

• Hilton Head salt water intrusion must be addressed jointly by GA and SC.
• Coastal SWI Steering Committee using model to examine options
• Alternatives simulated to date include pumping reductions and injection/extraction barriers.
Questions?

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