



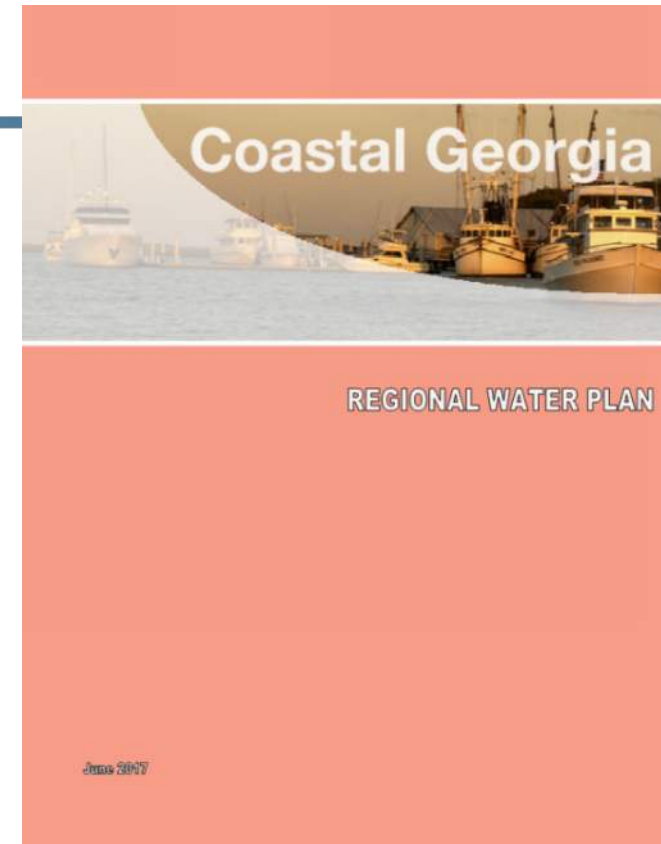
Georgia's
State Water Plan

**2017 Regional Water Plan Update
Coastal Georgia Regional Water Planning Council
Savannah Area Outreach Presentation
April 23, 2019**

www.georgiawaterplanning.org

Outreach Meeting Agenda

- Welcome and Introductions
- Coastal Georgia Regional Water Planning Background
- Background/History of Water Resource Concerns in Savannah Coastal Area
 - Mary Walker (USEPA) – Savannah River TMDL/5R
 - Dr. Jim Kennedy (EPD) – Floridan Aquifer Saltwater Intrusion
- Break to Serve Lunch for a “Working Lunch”
- EPD Permitting and the Coastal Georgia Regional Water Plan
- Future Implementation & Continued Regional Water Planning
- Facilitated Q&A



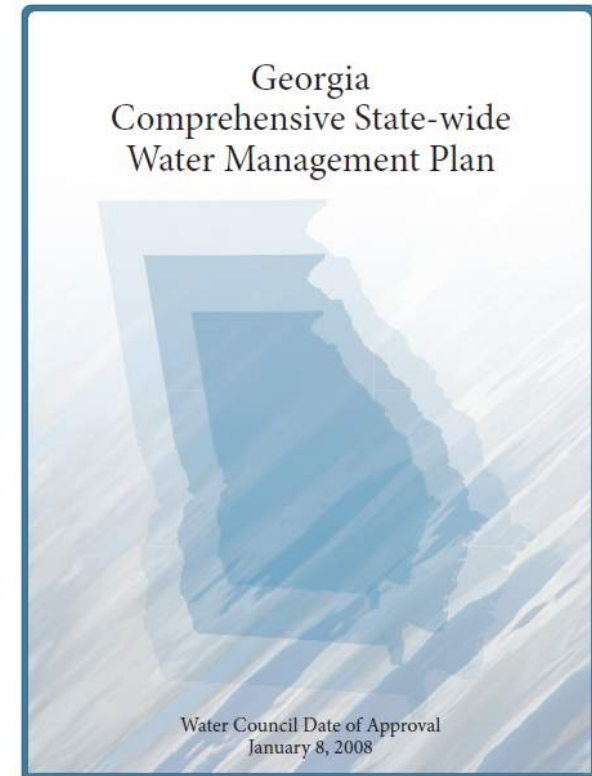
Drivers for Regional Water Planning

- Rapid population growth of Georgia
- Balance increasing and sometime conflicting demands
- Address water challenges in a more proactive and comprehensive manner
- Flexible and adaptive process utilizing a regional focus



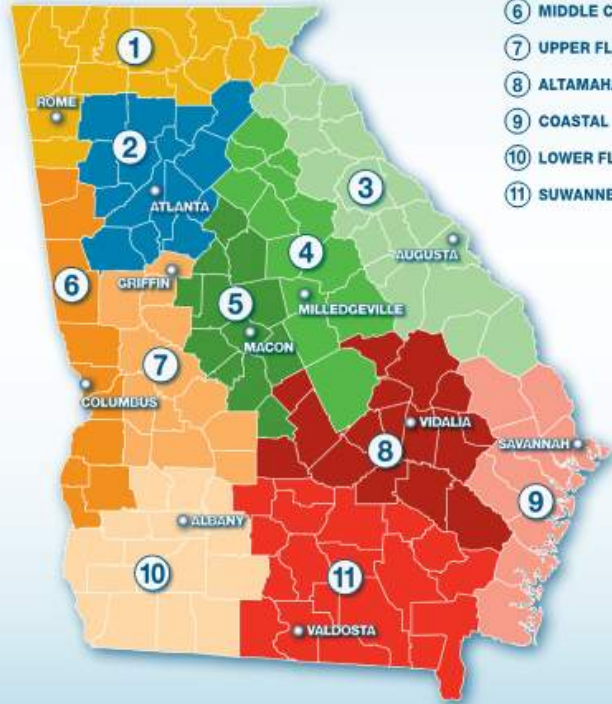
Regional Water Planning Efforts Statewide

- Comprehensive Statewide Water Management Planning Act (2004)
 - Georgia Water Council
 - Stakeholder process
 - State Water Plan (2008)
- Regional Water Planning
 - Councils appointed (2009)
 - Initial plans adopted after 3-year planning process (2011)
 - Updated plans adopted (2017)
 - Plans reviewed, revised every five years

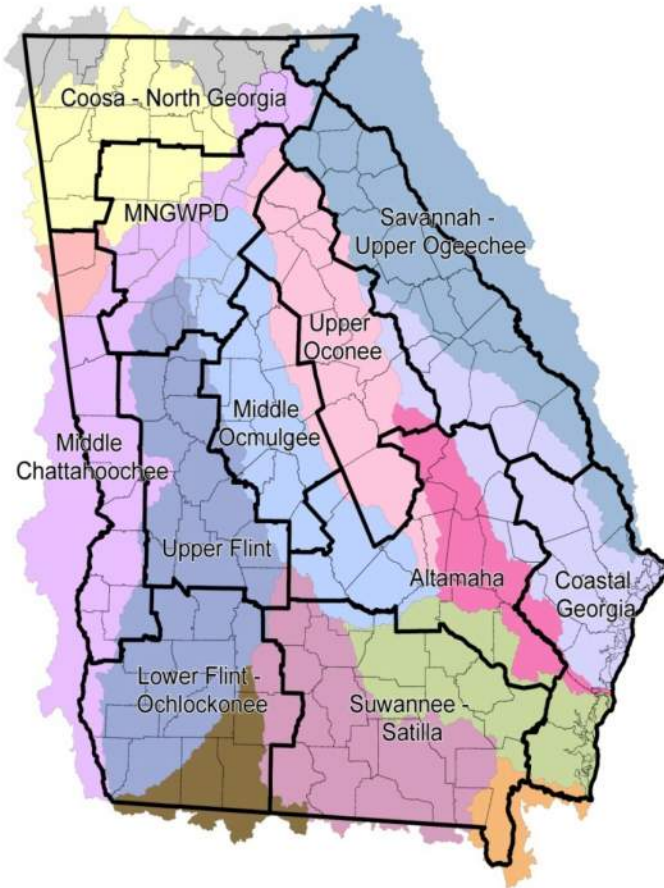


Georgia's Water Planning Regions

- ① COOSA-NORTH GEORGIA
- ② METRO WATER DISTRICT
- ③ SAVANNAH-UPPER OGEECHEE
- ④ UPPER OCONEE
- ⑤ MIDDLE OCMULGEE
- ⑥ MIDDLE CHATTAHOOCHEE
- ⑦ UPPER FLINT
- ⑧ ALTAMAHA
- ⑨ COASTAL
- ⑩ LOWER FLINT- OCHLOCKONEE
- ⑪ SUWANNEE-SATILLA



Water Planning Regions



Where to Find the Plan



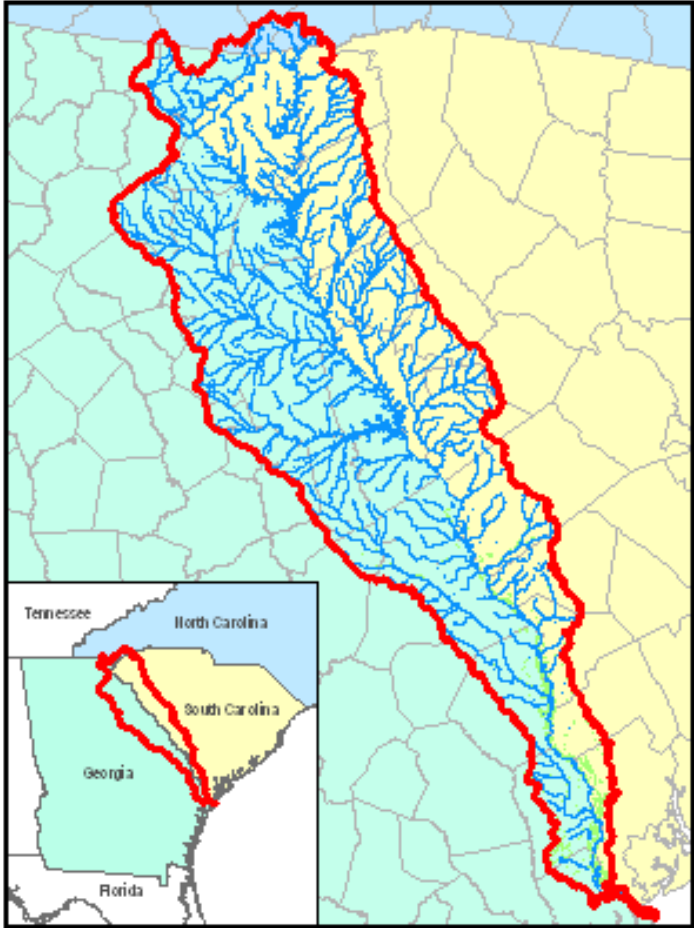
waterplanning.georgia.gov



Background/History of Water Resource Concerns in Savannah Coastal Area

www.georgiawaterplanning.org

Savannah River Basin



Savannah River Basin 5R Process

- Dissolved oxygen in the Savannah Harbor
- Collaborative development of dissolved oxygen standards
 - Georgia EPD, South Carolina DHEC, U.S. EPA
- Collaborative development of modeling tools
 - Same agencies +technical advisory group



Savannah River Basin 5R Process

- Savannah Harbor DO TMDL (2006)
- Dischargers Group formed (2010)
- Subcategory 5R Alternative Restoration Plan for Savannah River Basin (2015)
- Participants:
 - U.S. EPA
 - Georgia EPD
 - South Carolina DHEC
 - Technical Modeling Advisory Group
 - Savannah River/Harbor Dischargers Group



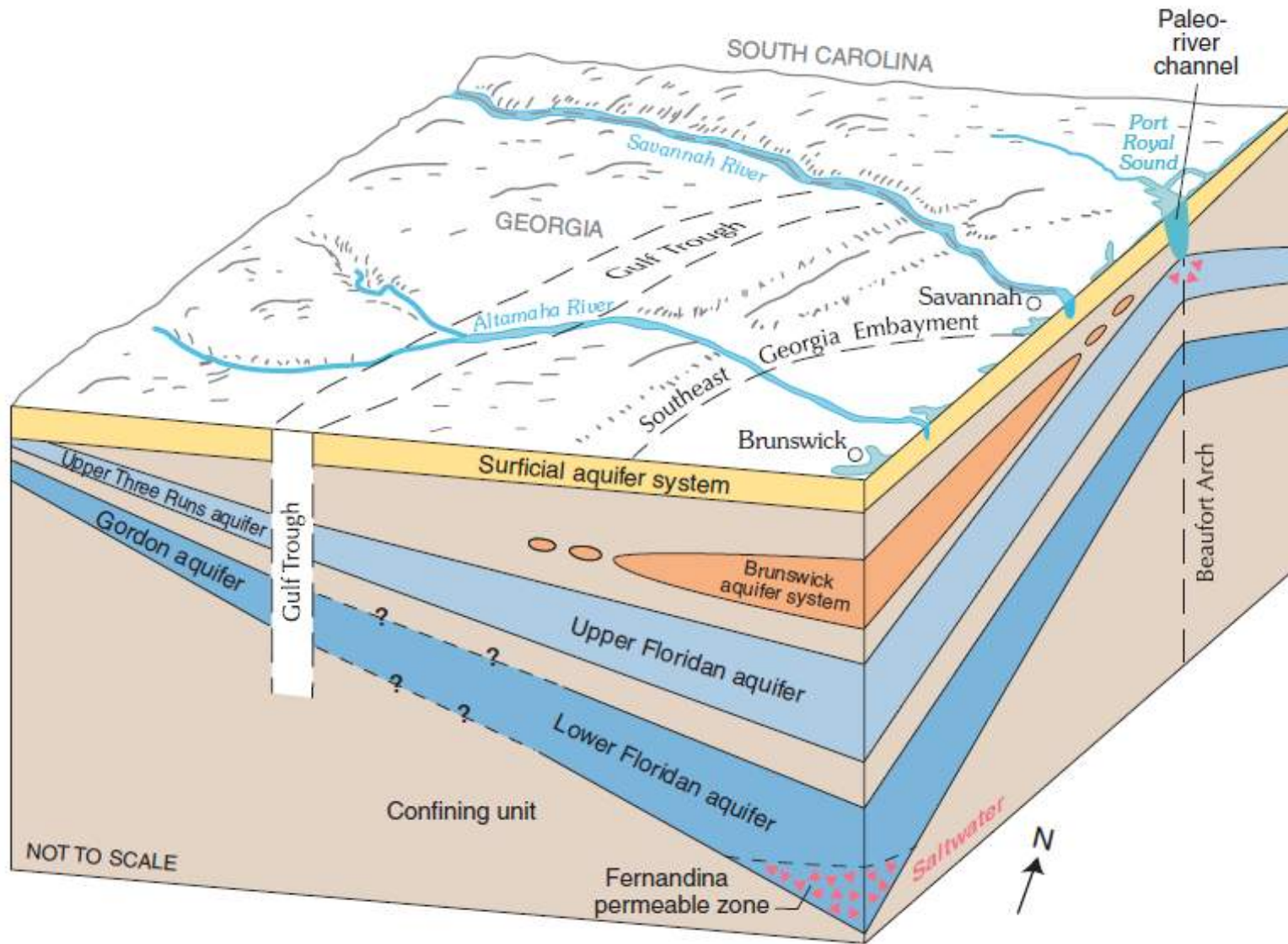


Modeling of Salt Water Intrusion in Coastal Georgia

James L. Kennedy, Ph.D., P.G.
Georgia Environmental Protection Division
State Geologist



Aquifers in Coastal Georgia



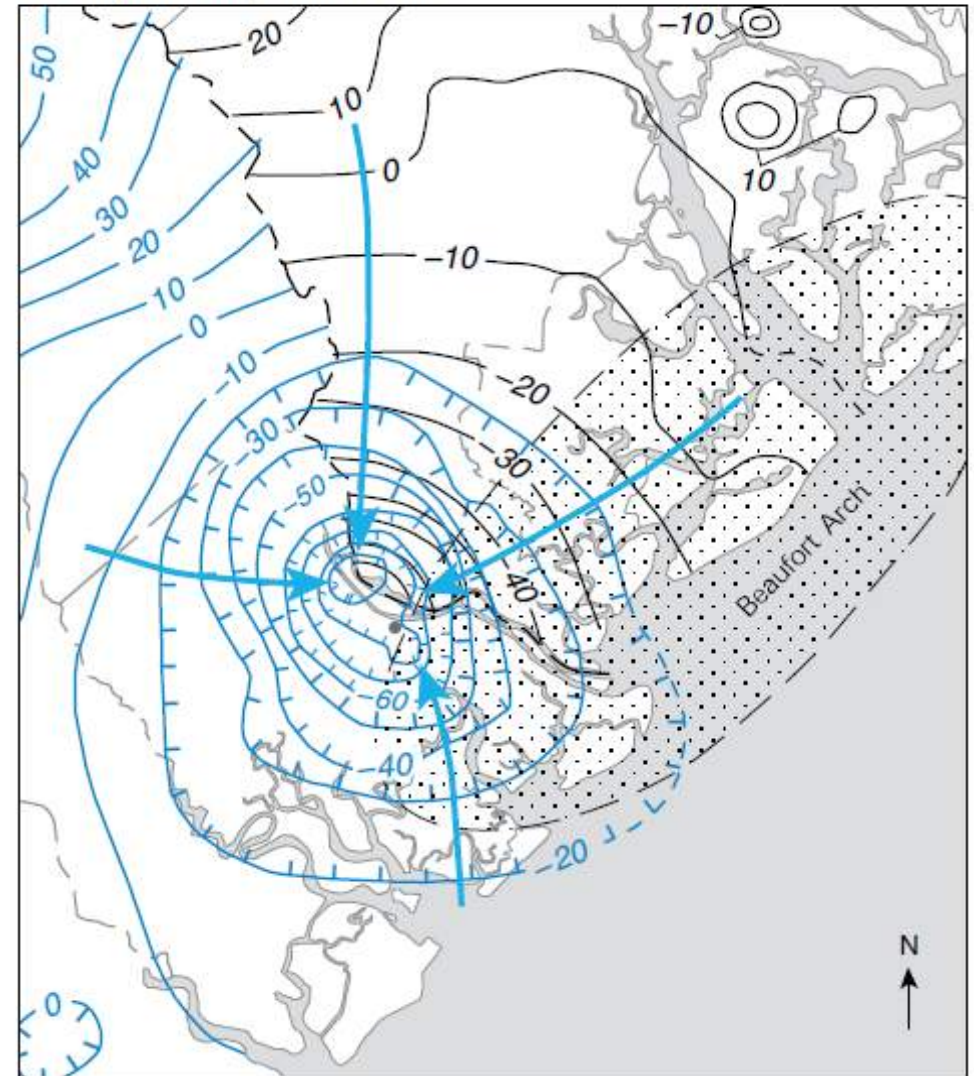


Upper Floridan Aquifer Potentiometric Surface

A. Predevelopment

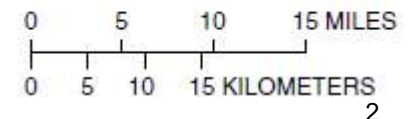


B. May and September 1998



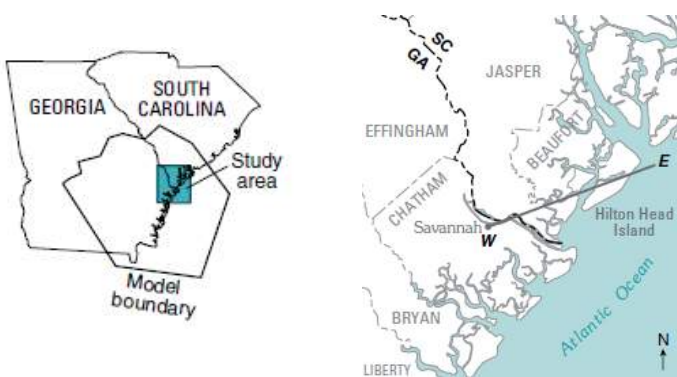
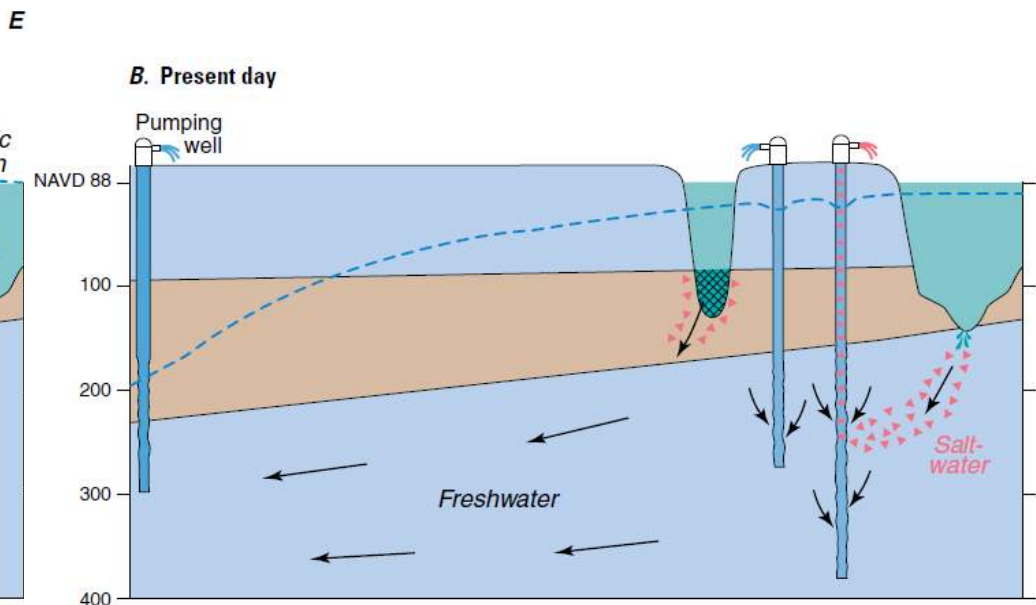
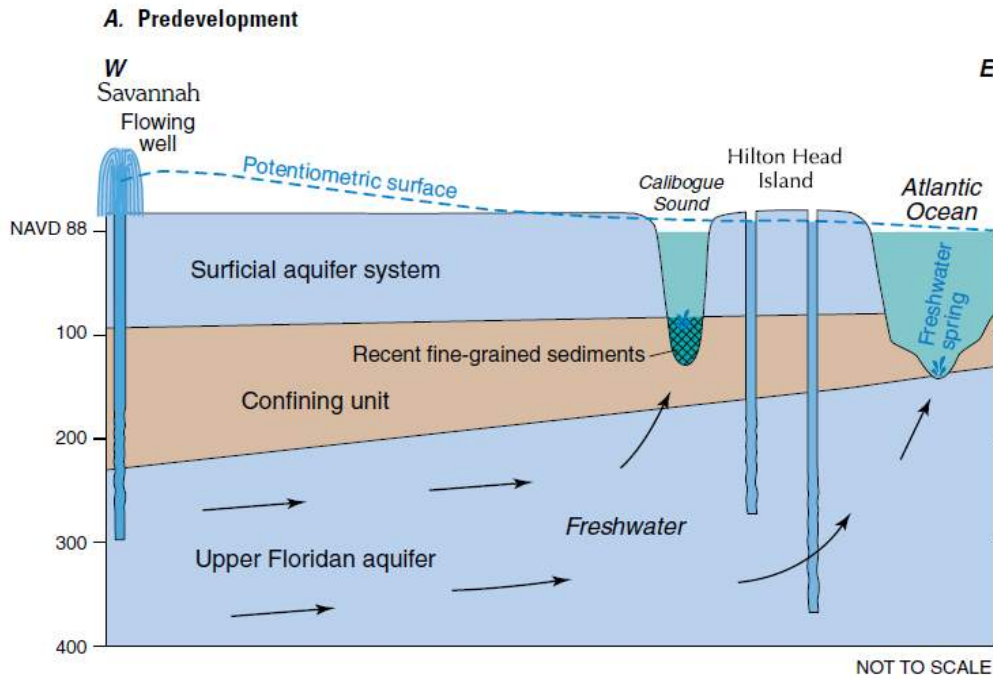
Base from U.S. Geological Survey
1:100,000 and 1:250,000-scale data

USGS SIR 2006-5058





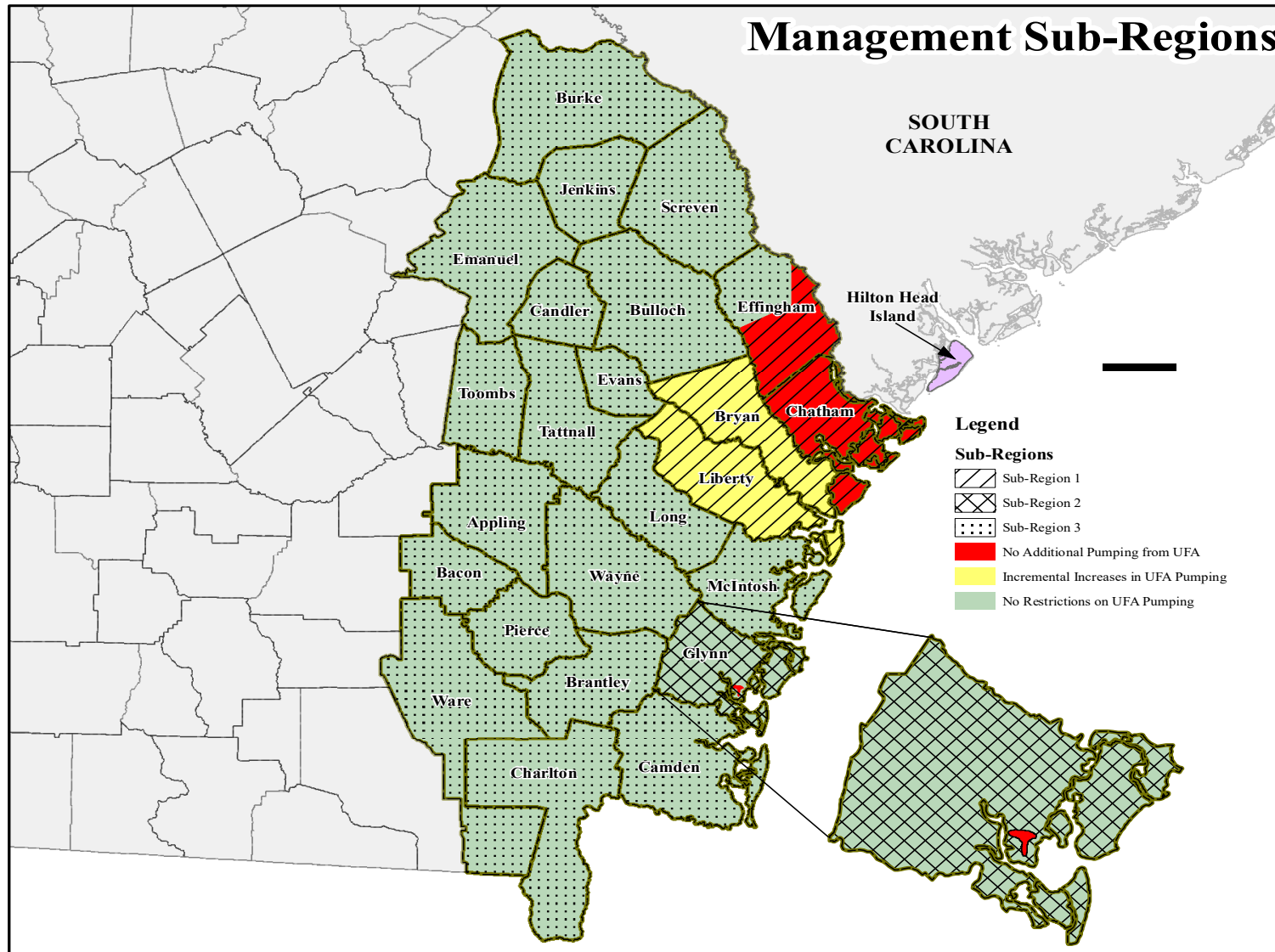
Direction of Groundwater Movement Effects Salt Water Intrusion



USGS Scientific Investigations Report 2006-5058



The Coastal Georgia Water and Wastewater Permitting Plan for Managing Salt Water Intrusion (June, 2006)





October 2007 Memorandum of Agreement Between SC DHEC and GA EPD

Memorandum of Agreement Between the South Carolina Department of Health and Environmental Control and the Georgia Environmental Protection Division

Background

Georgia and South Carolina withdraw groundwater from the Upper Floridan aquifer for many uses. This pumping has lowered water levels and salt water started to enter the aquifer on the northern end of Hilton Head Island during the 1980s. Public supply wells on the northern end of Hilton Head Island have already become contaminated and have been taken out of service. Salt water may also be moving downward by vertical migration into the aquifer from areas overlain by saltwater marshes and the Atlantic Ocean.

Reduction in use of the aquifer could stop movement of salt water into the aquifer. Mathematical models have been developed, and are currently being refined, to assist the South Carolina Department of Health and Environmental Control (SCDHEC) and the Georgia Environmental Protection Division (GaEPD) in determining how much and where the reductions in pumping would be most beneficial.

Objective

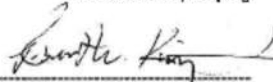
The Agencies acknowledge that their common objectives are to stop the movement of the salt water into the Upper Floridan aquifer beneath southern Beaufort County and Hilton Head Island and to protect the aquifer from the vertical migration of saltwater through the confining unit.

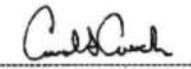
Agreement

The SCDHEC and GaEPD (the "Agencies") agree that:

- Further work is required on the Georgia Coastal Sound Science initiative (CSSI) model before it can be fully considered for management decisions by either Agency regarding the Upper Floridan aquifer. Refinements of the model, and subsequent modeling scenarios, are to be completed by June 2008.
- The Agencies will have an equal opportunity to review and critique the model refinements by means of a Technical Advisory Committee (TAC). The TAC will include representatives from each Agency and the U.S. Geological Survey (USGS).
- Both Agencies must approve the refined model before it can be used for future management decision-making.

- The TAC will identify subsequent modeling scenarios.
- Refinement of the CSSI model and subsequent modeling scenarios will be conducted in general accordance with a work plan acceptable to each state Agency, and with technical input from the USGS.
- The jointly approved model will be used as one of several tools for future management decision-making.
- Other appropriate information, such as measured water level data, historical information, etc., may also be used to assist the Agencies in achieving the objectives stated above.
- The Agencies will, in good faith, share information that would be useful in refining the model, including but not limited to ground water levels, measurements of chloride and specific conductance, operation of public supply wells, and other hydrologic data pertinent to movement of salt water in the aquifer.
- The Agencies will, in good faith, agree to undertake the management steps necessary to accomplish these objectives including, as required, reductions in pumping.


Robert W. King Jr., P.E.
Deputy Commissioner
Environmental Quality Control
Date: 10/15/07


Dr. Carol Couch
Director
Environmental Protection Division
Date: 10/15/07



CSSI Modeling Technical Advisory Committee (TAC)

- Mr. Drennan Park, South Carolina Department of Natural Resources
- Mr. Robert Faye, USGS Retired representing South Carolina
- Dr. James Kennedy, Georgia Environmental Protection Division
- Dr. Mark Maimone, CDM representing Georgia
- Dr. Leonard Konikow, USGS representative on the TAC
- TAC met on 14 March, 7 May, and 8 July 2008

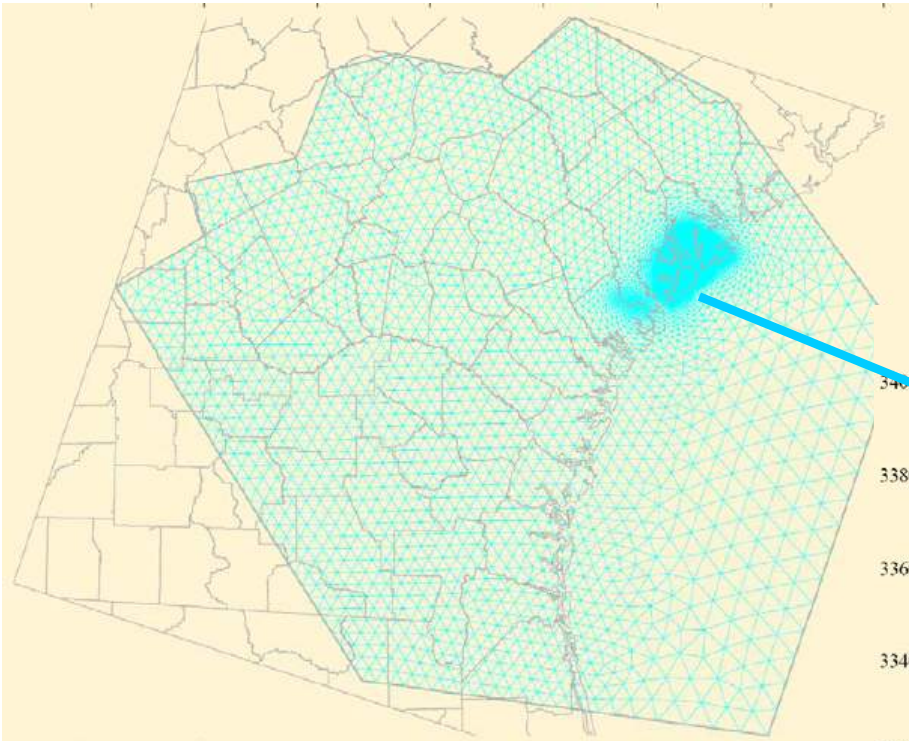


Refinement of the USGS Salt Water Intrusion Model

- USGS attempted to refine the salt water intrusion model so that it could be used to support future management decision-making
- The Agencies had an equal opportunity to review and critique the USGS model refinement by means of the TAC
- Both Agencies had to have approved the refined USGS model before it could be used for future management decision-making
- The TAC unanimously did not approve the refined USGS model and therefore it could not be used to support future management decision-making

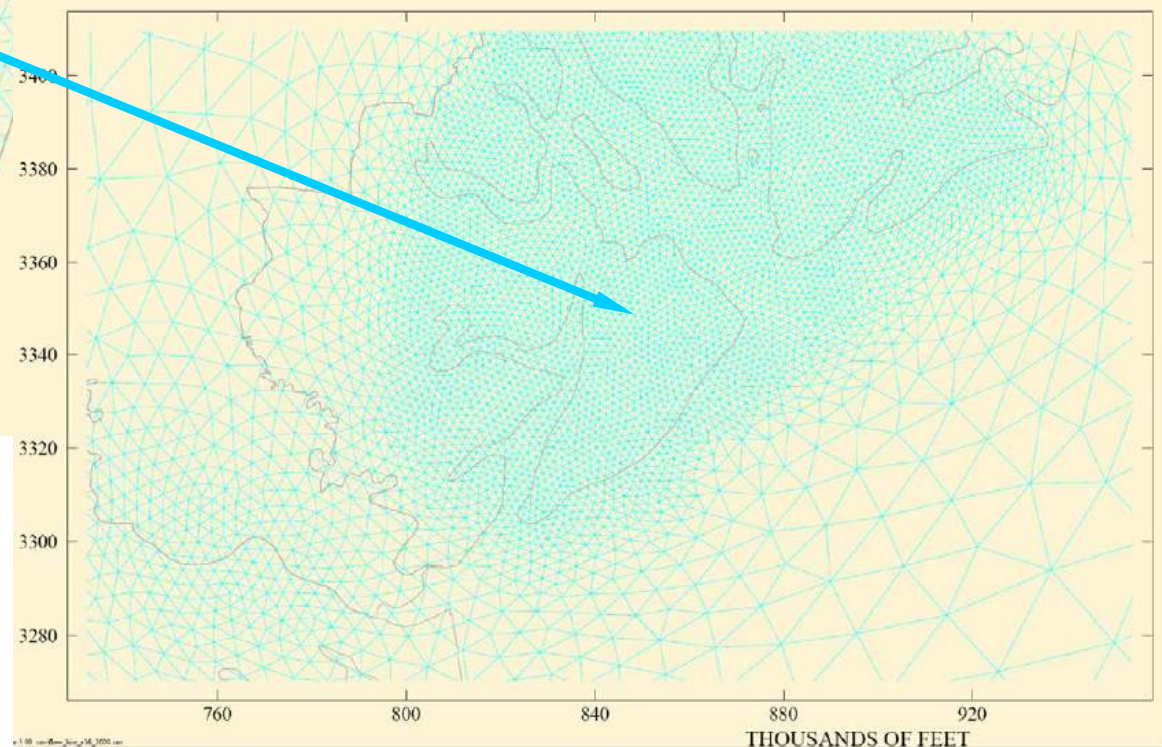


Salt Water Intrusion Model of Coastal Georgia



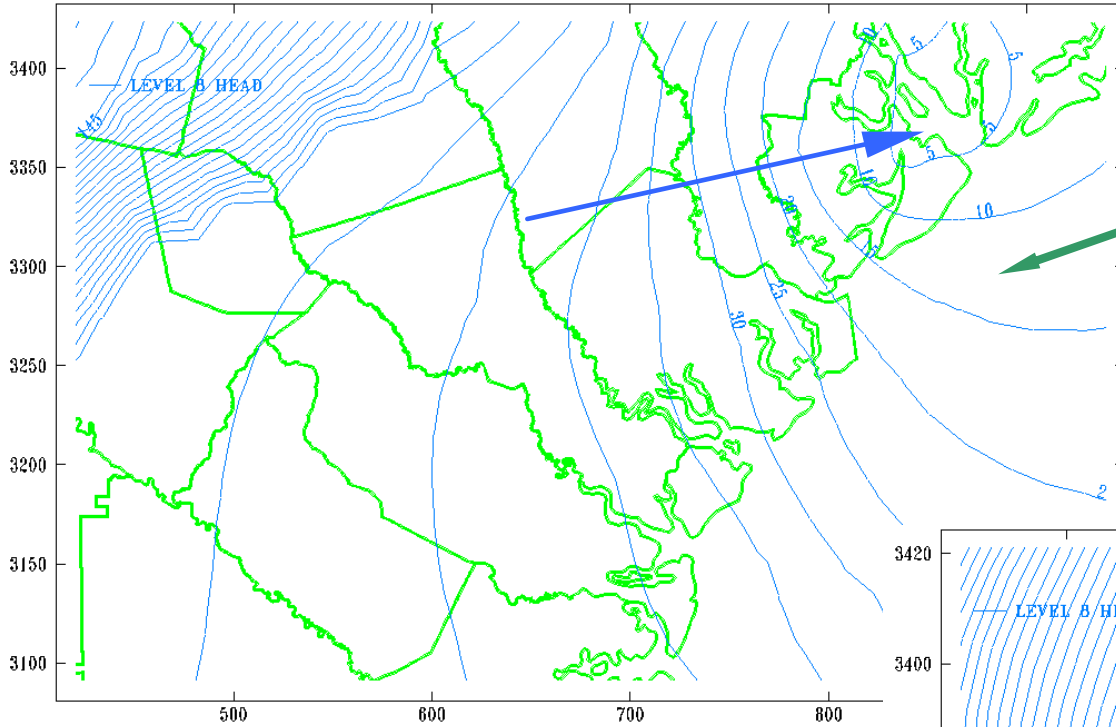
Model extent included the entire coast of Georgia

Model grid included 16,000 nodes at Hilton Head Island



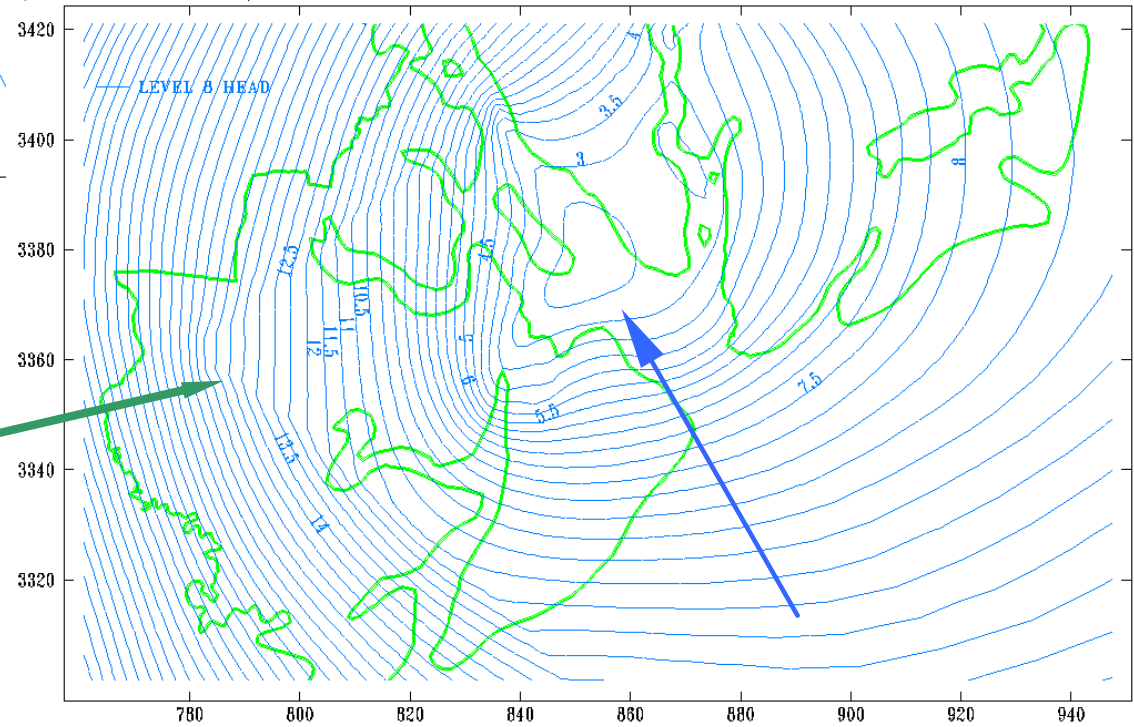


Potentiometric Surface With No Pumping in Model Domain



Potentiometric Surface in the Savannah Area, Yellow Zone, and Hilton Head Island

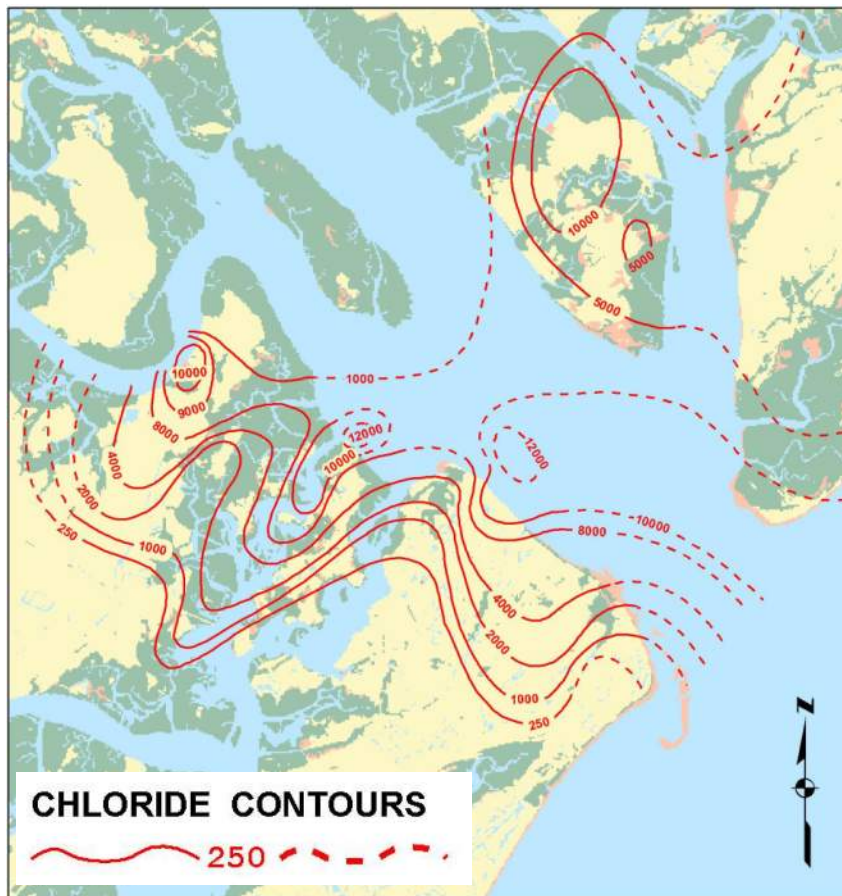
Potentiometric Surface at Discharge Area North of Hilton Head Island



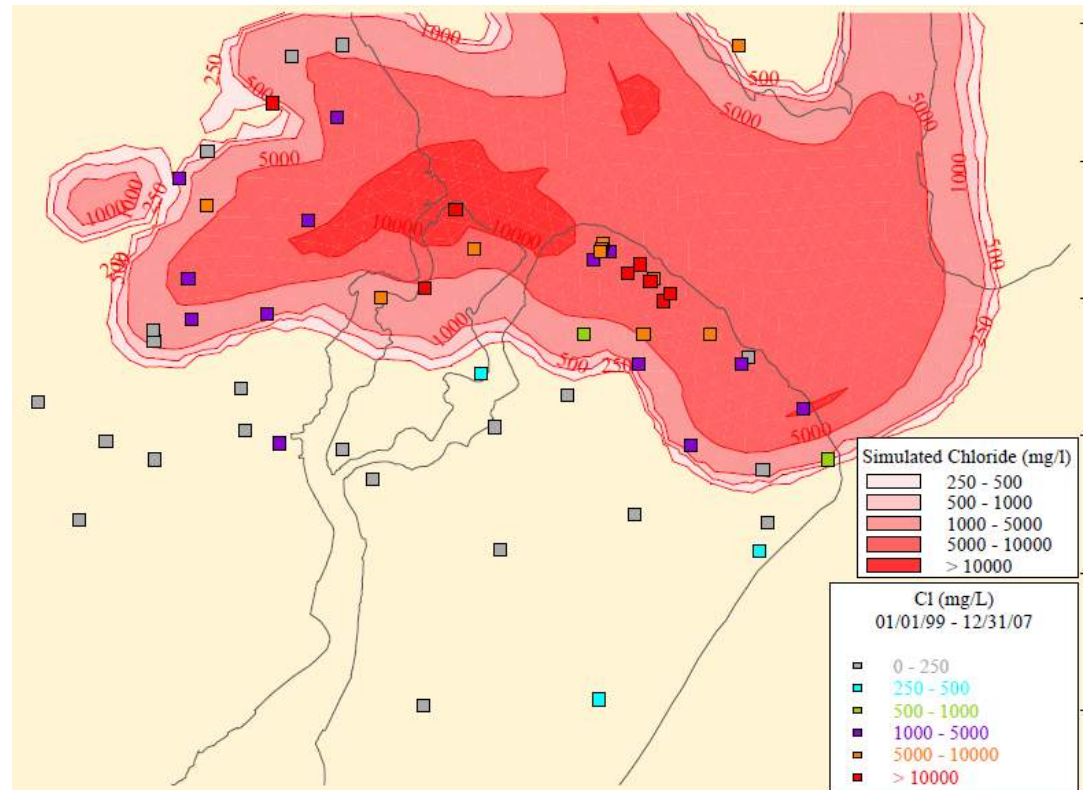


SCDHEC 2007 Chloride Contours vs. Simulated 2007 Chloride Contours

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

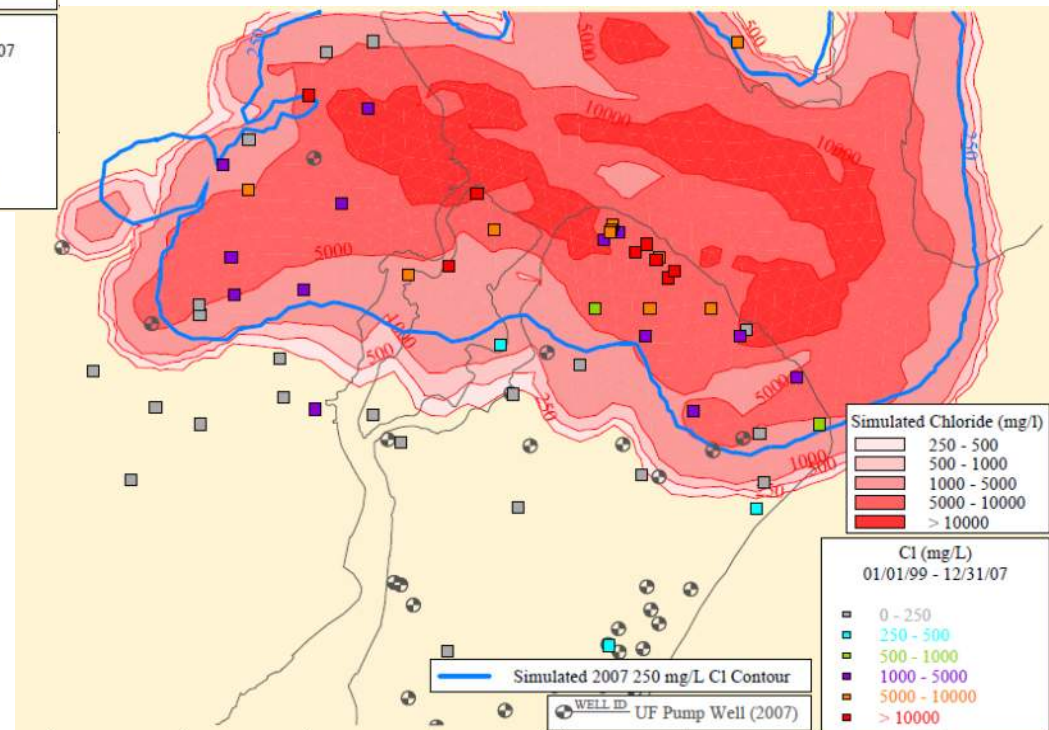
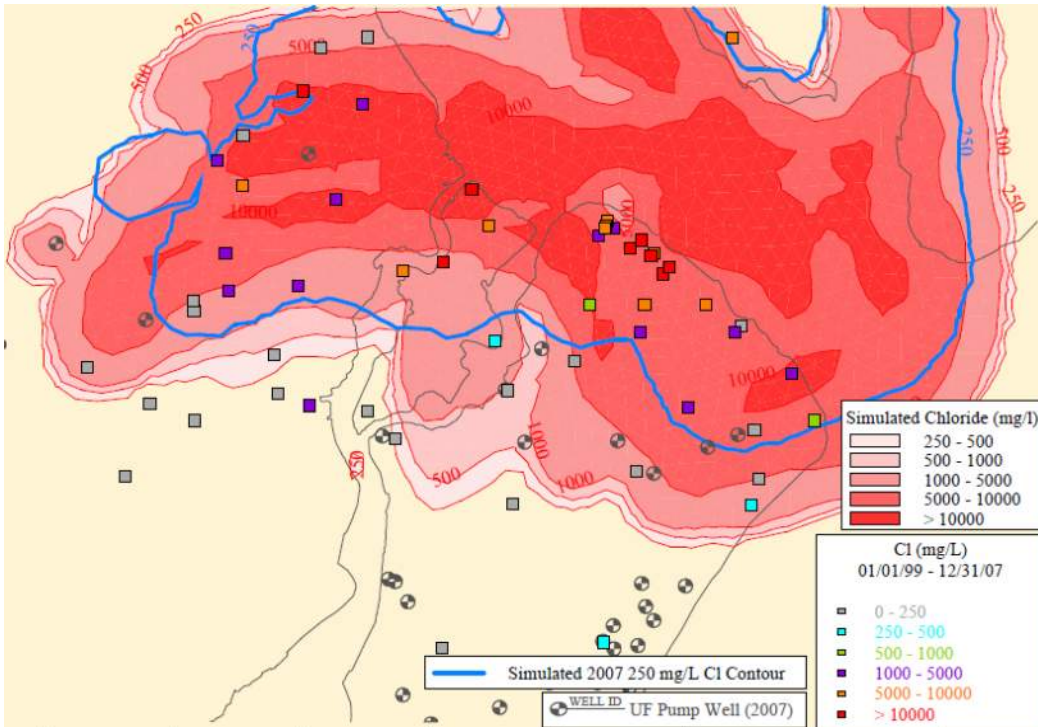
Savannah Area 69 MGD (2000)

Hilton Head Island 9 MGD (2007)



Reducing Withdrawals Would Not Eliminate Salt-Water Intrusion

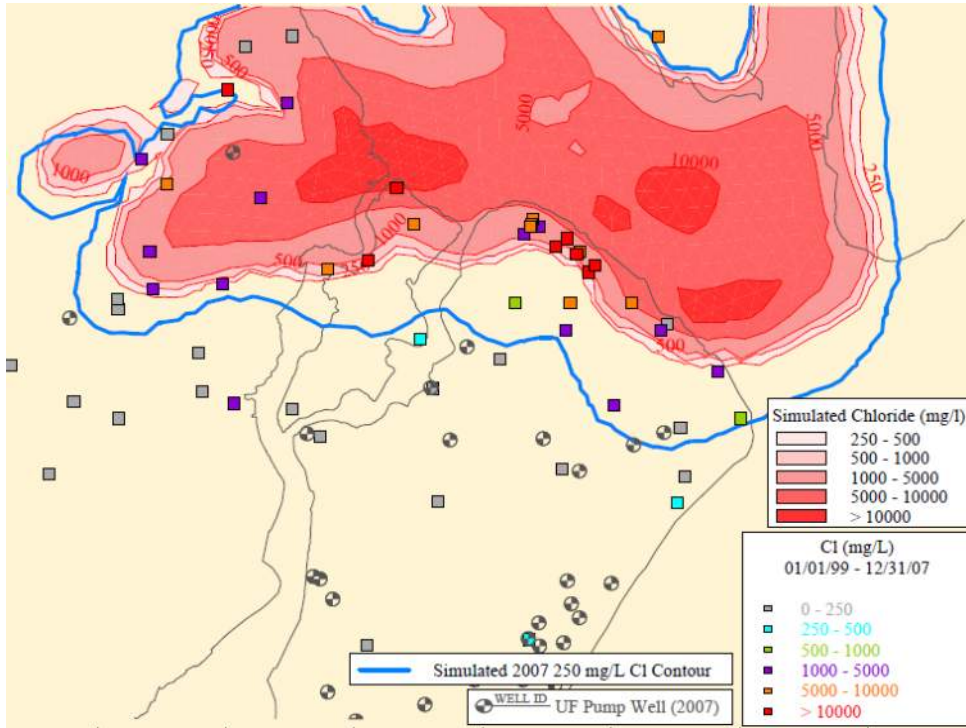
30 Years of Pumping with No Reductions in Savannah Area or Hilton Head Island Withdrawals



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

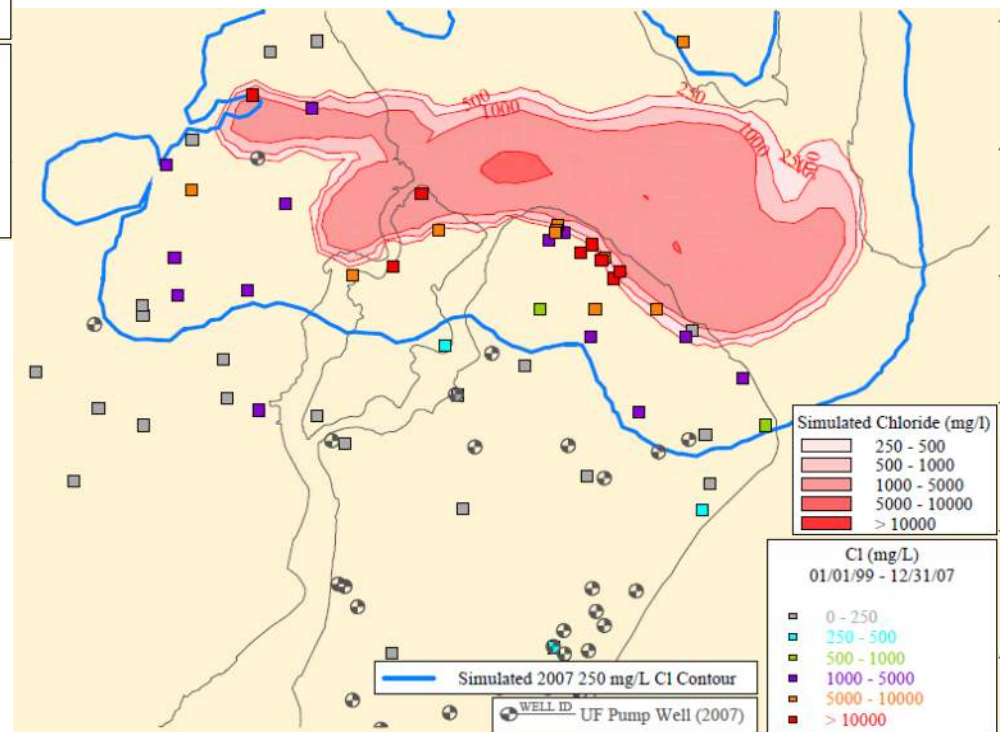


Withdrawals in Savannah and HHI Were Needed to Create the Plume



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

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





Results of Modeling Were Presented in a Memorandum Dated June 2010

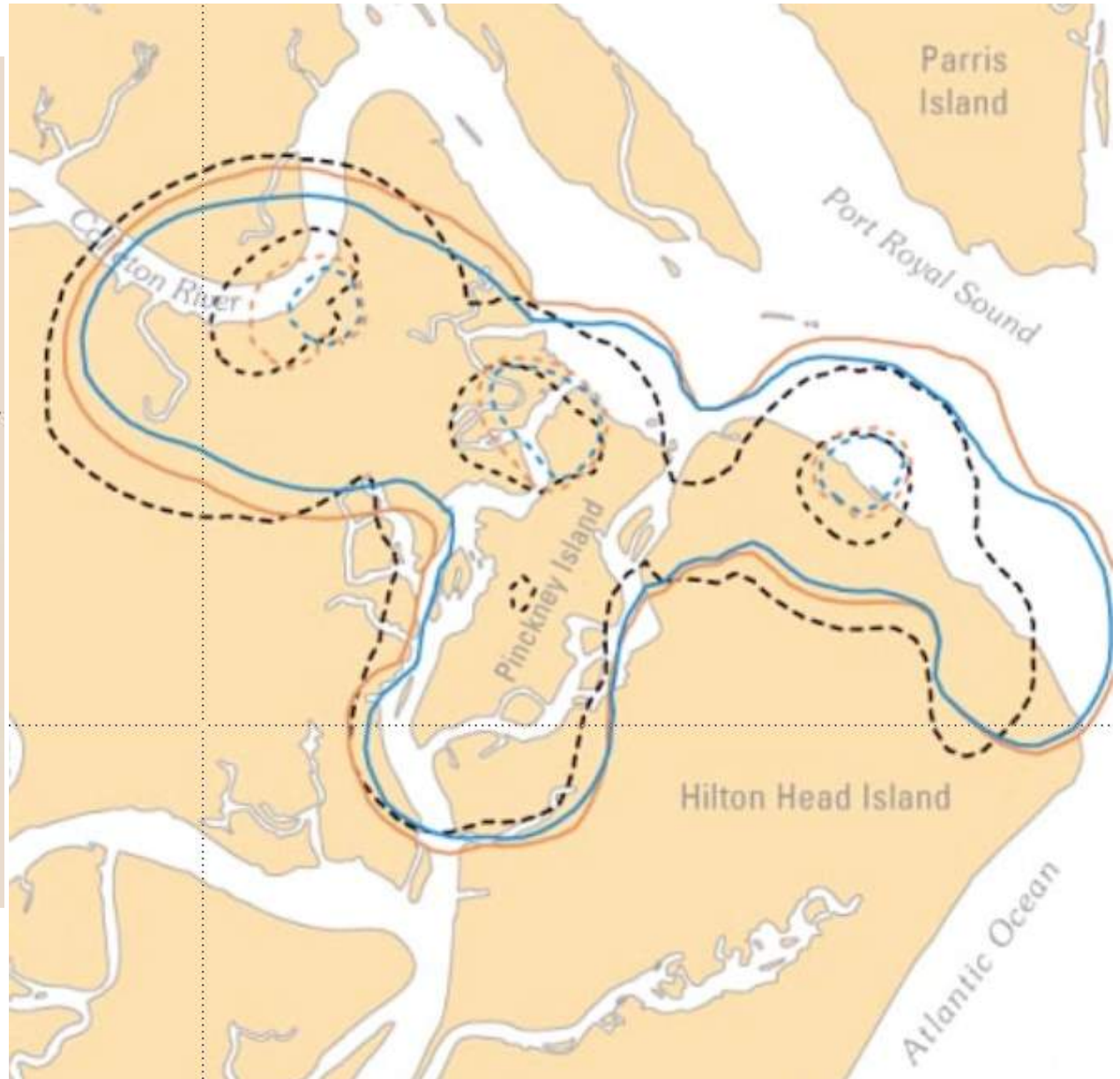
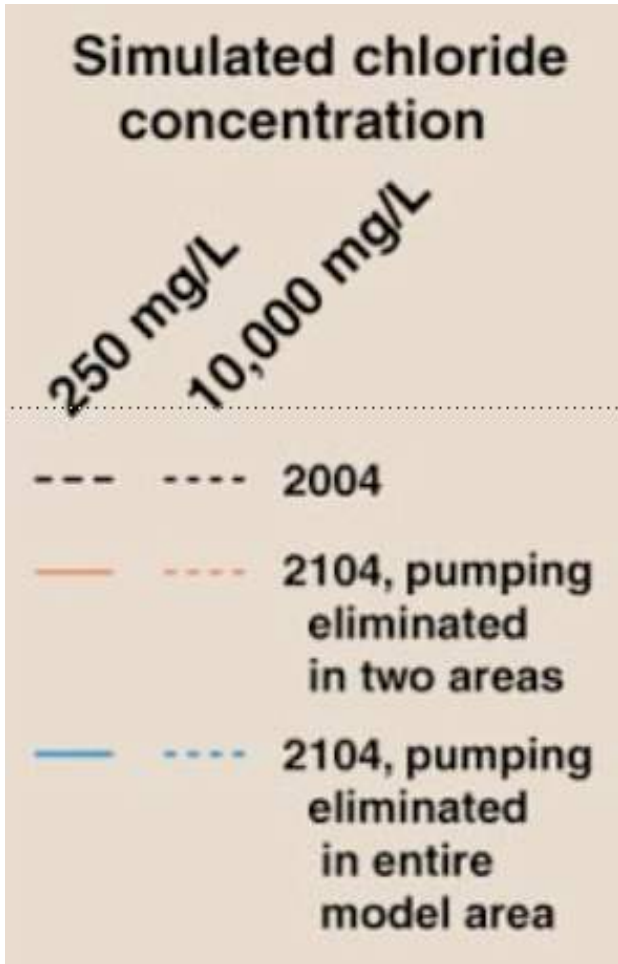
Coastal Sound Science Initiative Modeling of Salt Water Intrusion

***Conclusions
About Salt Water
Intrusion Into
The Upper Floridan
Aquifer in Coastal
Georgia and
South Carolina***





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
- Salt-water plumes would continue to exist well into the future even if all groundwater withdrawals were eliminated

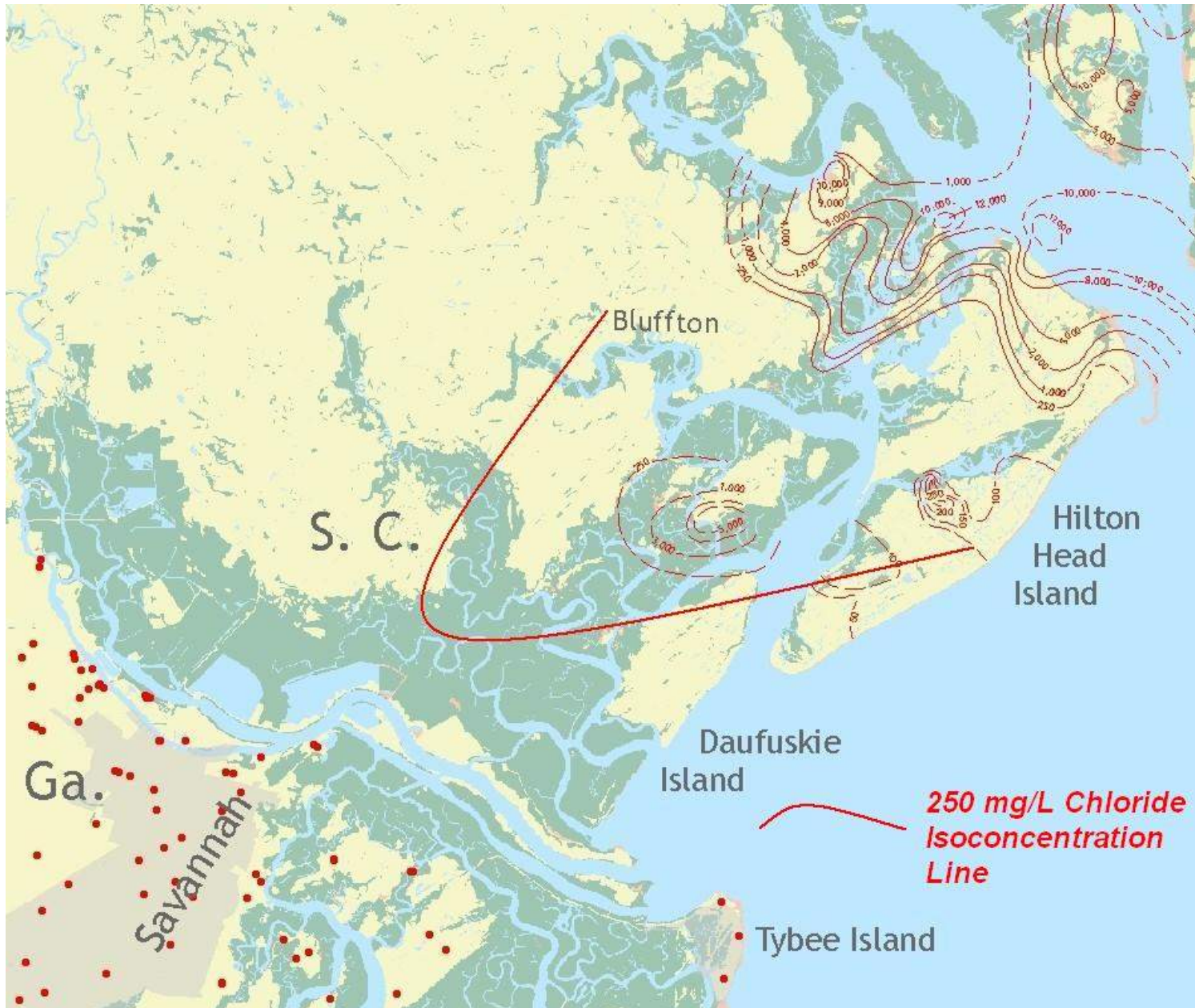


Inputs to BIOCHLOR Model Runs

Groundwater Flow Path	Starting Cl ⁻ (mg/L)	Portion of Flow Path	Distance (L ft)		Hydraulic Conductivity		Dispersivity (0.1 x L ft)	Hydraulic Head (ft)		Hydraulic Gradient	Seepage Velocity (ft/yr)
			Feet	Miles	(ft/day)	(cm/sec)		Upgrad.	Downgrad.		
A	8,000	Near Field	55,100	10.4	400	0.1411	5,510	-3	-15	0.000218	318
		Far Field	107,200	20.3	125	0.0441	16,230	-15	-98	0.000774	353
		Totals	162,300	30.7							
B	5,000	-	85,680	16.2	125	0.0441	8,568	-17	-98	0.000945	431
C	8,000	-	45,025	8.5	400	0.1411	4,503	-2	-17	0.000333	486
D	8,000	Near Field	36,960	7.0	400	0.1411	3,696	-5	-15	0.000271	396
		Far Field	78,960	15.0	125	0.0441	11,592	-15	-98	0.001051	480
		Totals	115,920	22.0							
E	0	-	137,425	26.0	125	0.0441	13,743	-10	-98	0.000640	236

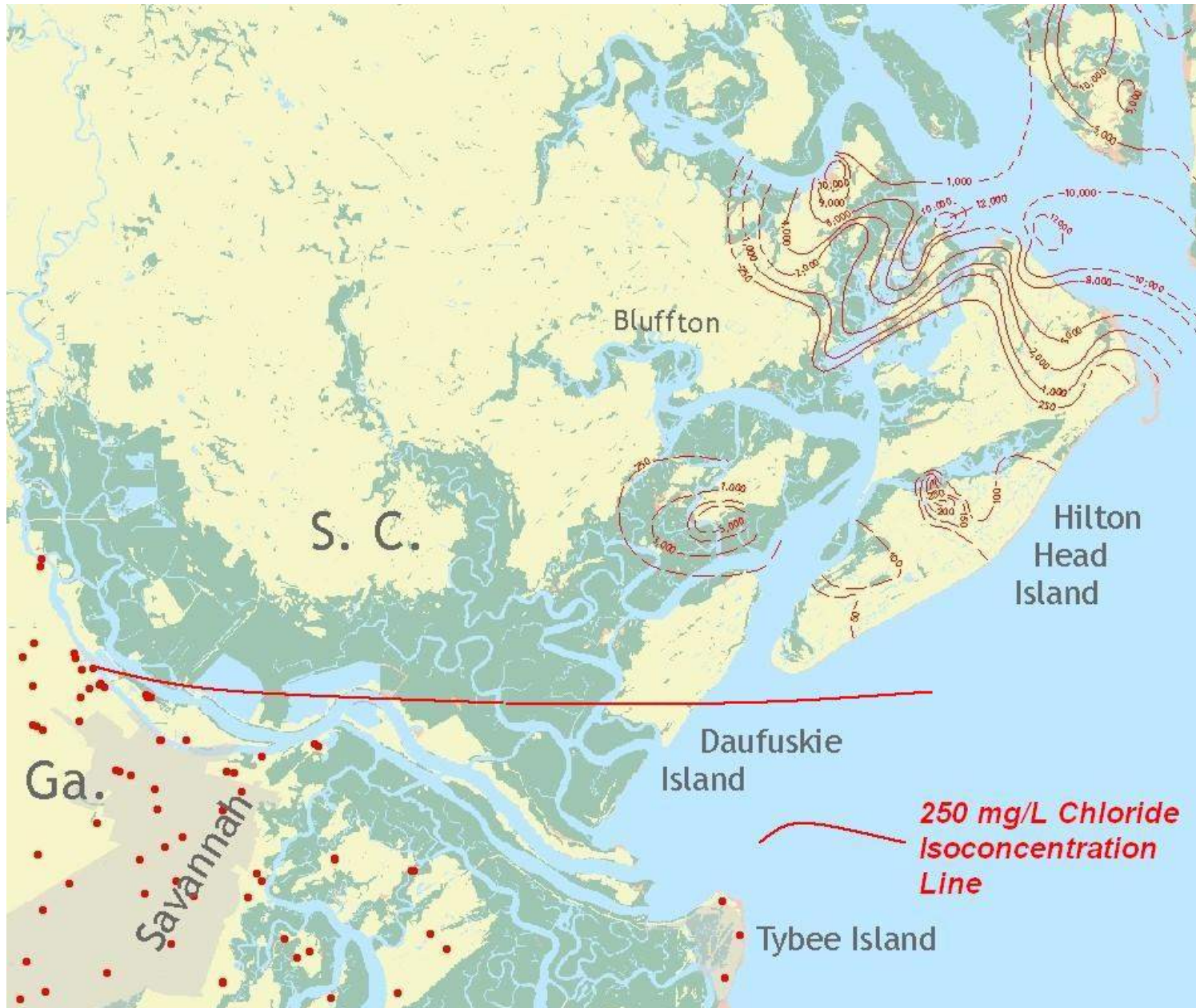


BIOCHLOR Modeled Plume Movement - 50 Years



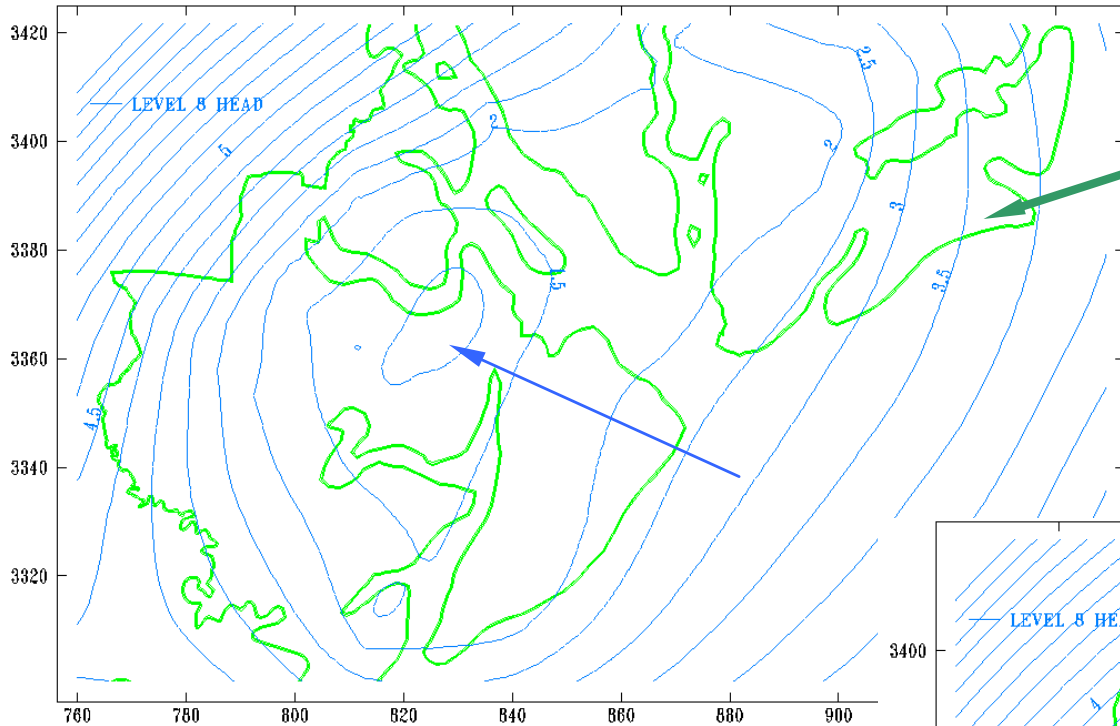


BIOCHLOR Modeled Plume Movement - 125 Years



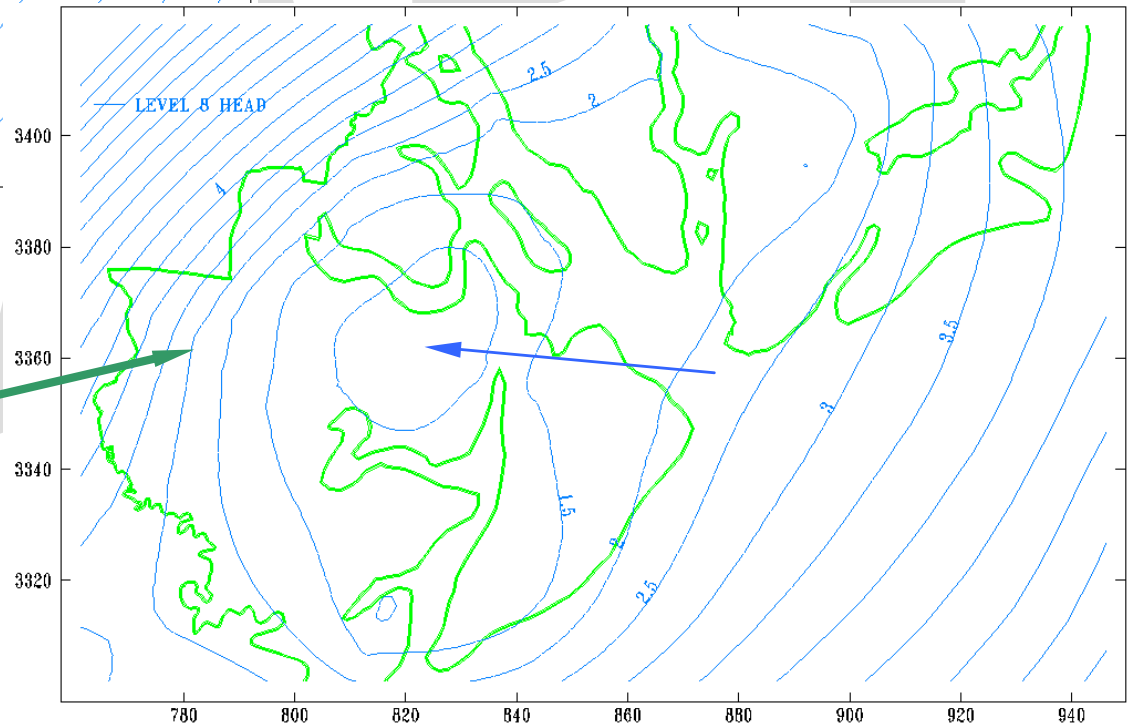


Withdrawal In the Savannah Area, Yellow Zone, and Hilton Head Island



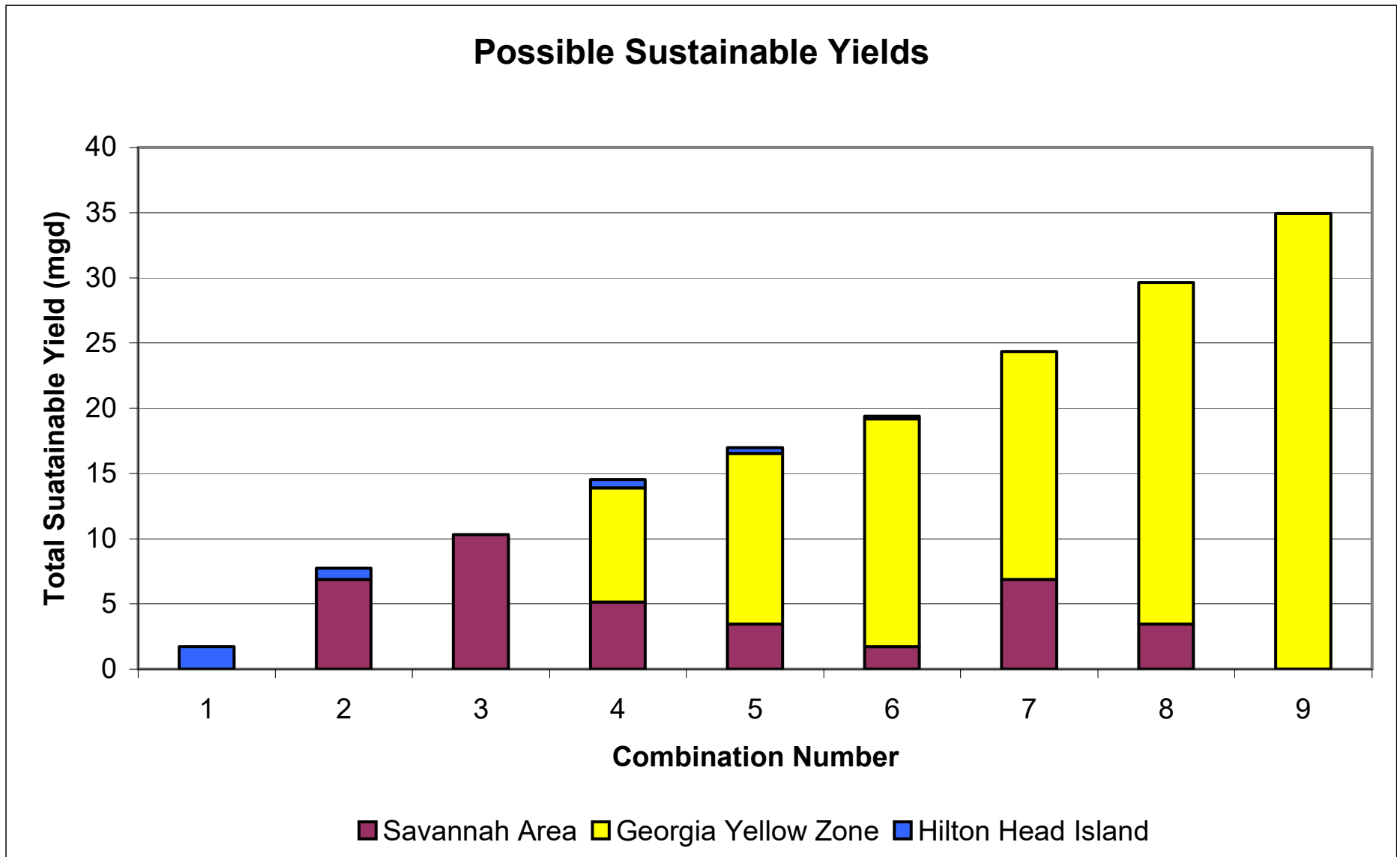
Respective Withdrawals of About 1.7, 17.5, and 0.22 MGD for a Possible Sustainable Yield of About 19.4 MGD

Respective Withdrawals of About 5.2, 8.7, and 0.65 MGD for a Possible Sustainable Yield of About 14.5 MGD





Combinations of Withdrawals That Do Not Cause the Plume to Move Further Inland





EPD Permitting and the Coastal Georgia Regional Water Plan

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GEORGIA
DEPARTMENT OF NATURAL RESOURCES

ENVIRONMENTAL PROTECTION DIVISION

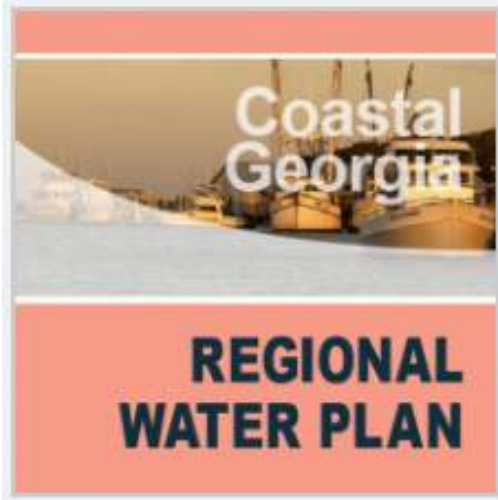
EPD Permitting and the Coastal Georgia Regional Water Plan

Jennifer Welte

Regional Water Planning Project Manager



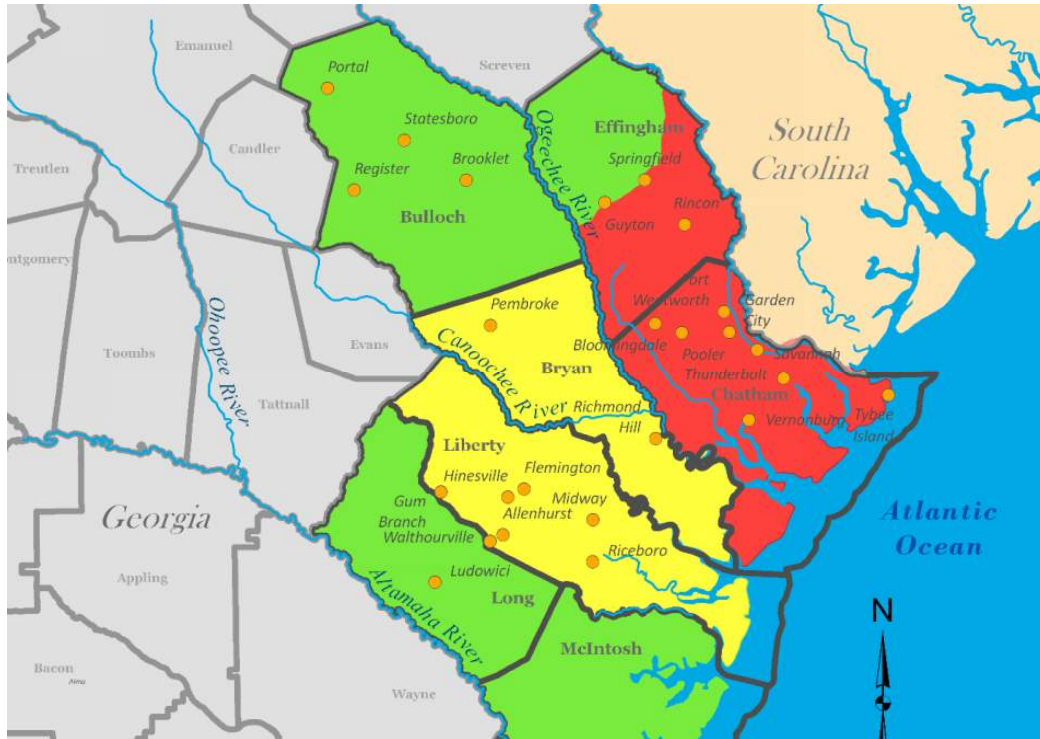
COASTAL GEORGIA REGIONAL WATER PLAN



“During the original water plan development that was completed in 2011, the Coastal Council’s efforts in developing management practices were significantly informed and guided by the scale and complexity of the groundwater resource issues evaluated through the Bi-state Salt Water Intrusion Stakeholder Process in the Savannah/Hilton Head Region, and the Savannah River Harbor TMDL/5R Stakeholder Process. During the 2016–2017 plan update process, the Coastal Council reviewed the management practices to ensure they were in alignment with developments related to these activities...”



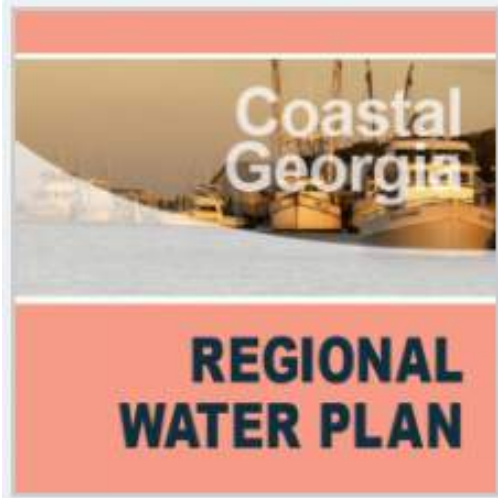
COASTAL PERMITTING MEASURES IN RESPONSE TO SALTWATER INTRUSION



- 2006: Coastal Permitting Plan
 - Reductions to 2004 levels
- 2013: EPD moratorium
- 2015: EPD will reissue groundwater withdrawal permits with gradual reductions
 - 15 MGD in Red Zone
 - 1 MGD in Yellow Zone



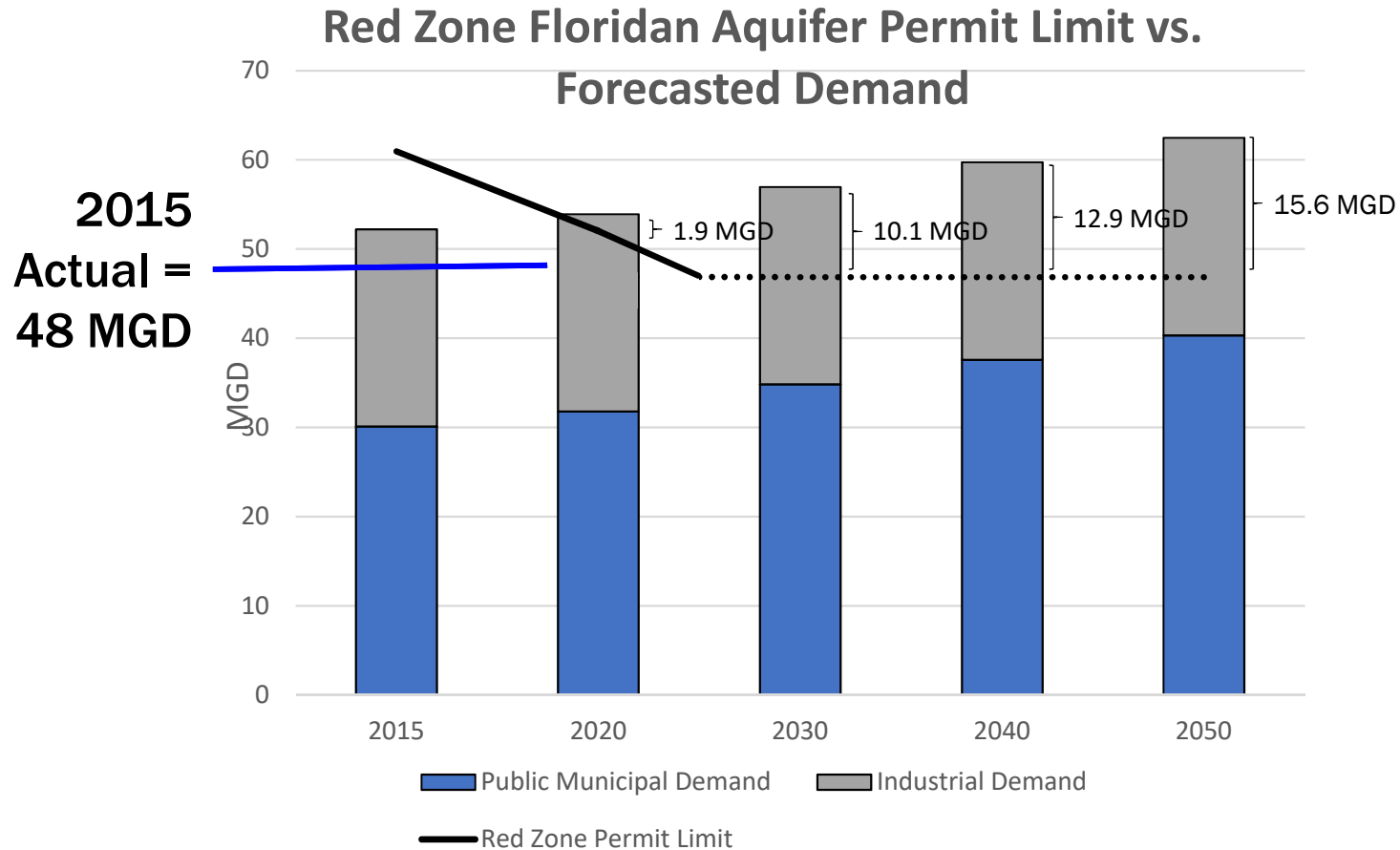
COASTAL GEORGIA REGIONAL WATER PLAN



“The Coastal Council’s efforts in developing management practices were significantly informed and guided by the scale and complexity of the bi-state discussions regarding saltwater intrusion in the Hilton Head Island region of South Carolina, and by the 2015 Georgia stakeholder process for implementing additional groundwater withdrawal reductions in the Red and Yellow Zones.” – *Executive Summary, p. ES-11*



PERMITTED VS. DEMANDS IN RED ZONE

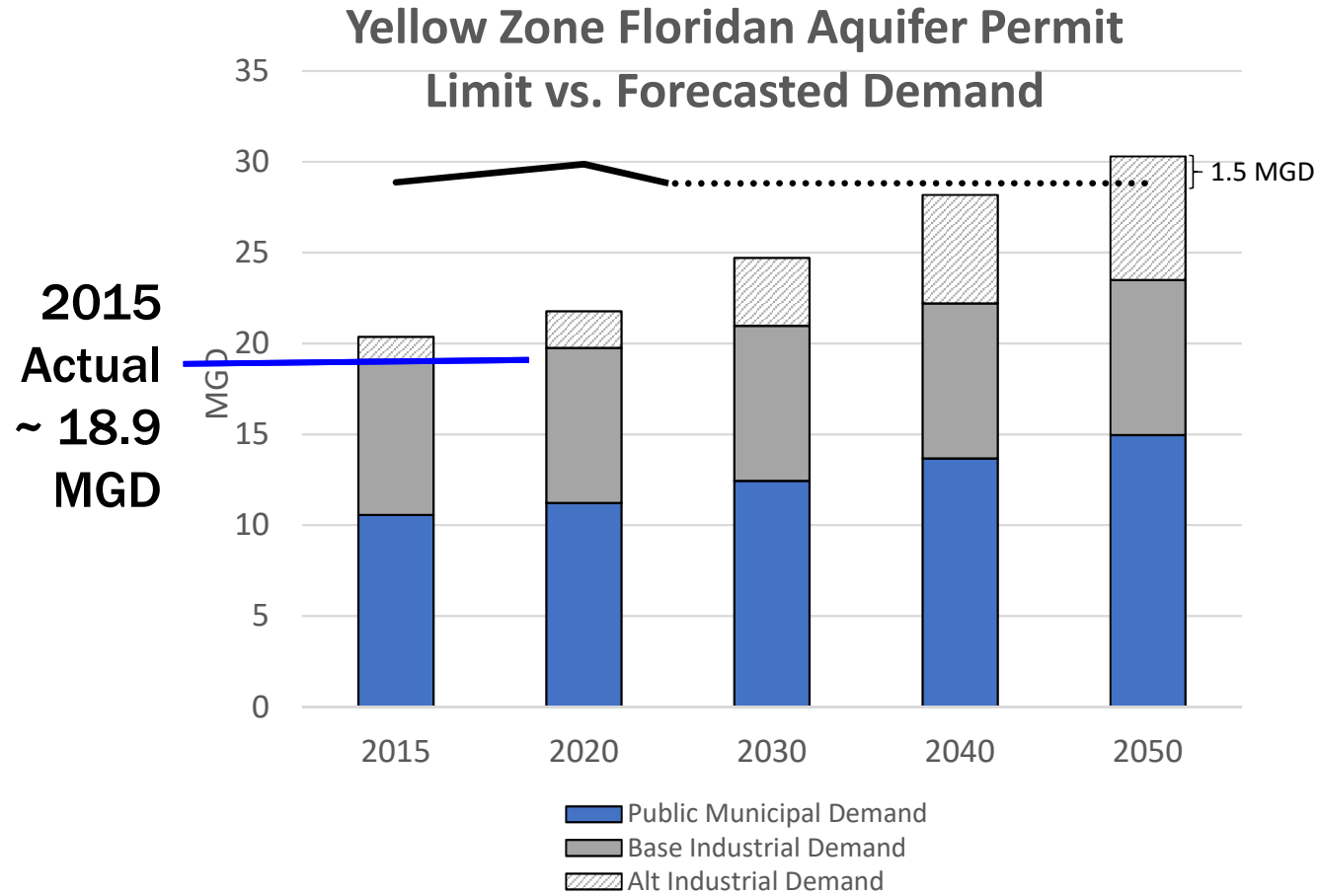


Note:

Fifty percent of the Effingham County municipal and industrial demands are assumed to come from the Red Zone.

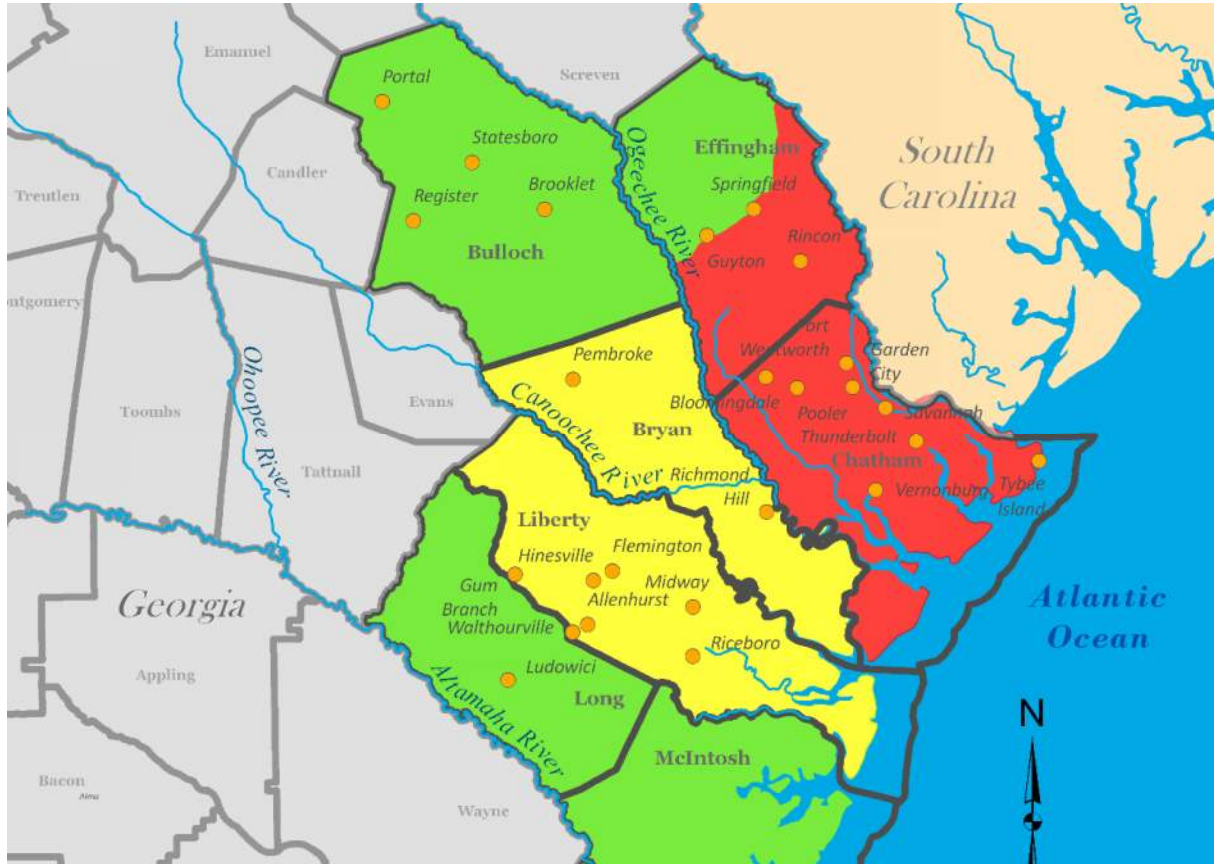


PERMITTED VS. DEMANDS IN YELLOW ZONE





COASTAL PERMITTING PLAN



- Water conservation requirements
- Alternate Sources
 - Surface water
 - Reclaimed water
 - Other aquifers
- Withdrawals from Green Zone





SAVANNAH RIVER BASIN 5R PROCESS

- Several years of work with South Carolina, EPA, and permit stakeholders from both sides of river, to address dissolved oxygen levels in the Savannah Harbor
- Through modeling and the stakeholder process, loading was distributed among existing NPDES dischargers that would protect both South Carolina and Georgia's dissolved oxygen standards
- Loading has been agreed to and EPA has approved the plan
- Both states can move forward with issuance of administratively extended NPDES permits



SAVANNAH RIVER BASIN 5R PROCESS

- Savannah River and Harbor Models
 - Dynamic 3D model
 - Actual flows and tides
 - Informed by technical advisory group
 - Incorporates variable discharger loading approach
- Modeling accounts for allowable DO deficit
- Savannah River and Harbor DO Calculator used to determine allocation between dischargers
- EPD implementation through permitting



5R IN THE REGIONAL WATER PLANS



“The Council further supports State implementation of the 5R plan for NPDES permitting to restore water quality in the Savannah River Basin and Harbor.”

“An additional significant bi-state issue informing the council discussions was the 5R process involving NPDES permitted wastewater treatment facilities from both Georgia and South Carolina.”

“Support on-going stakeholder process associated with implementation of the Savannah Harbor 5R plan approved by EPA in 2016.”





Implementation and Continued Regional Water Planning

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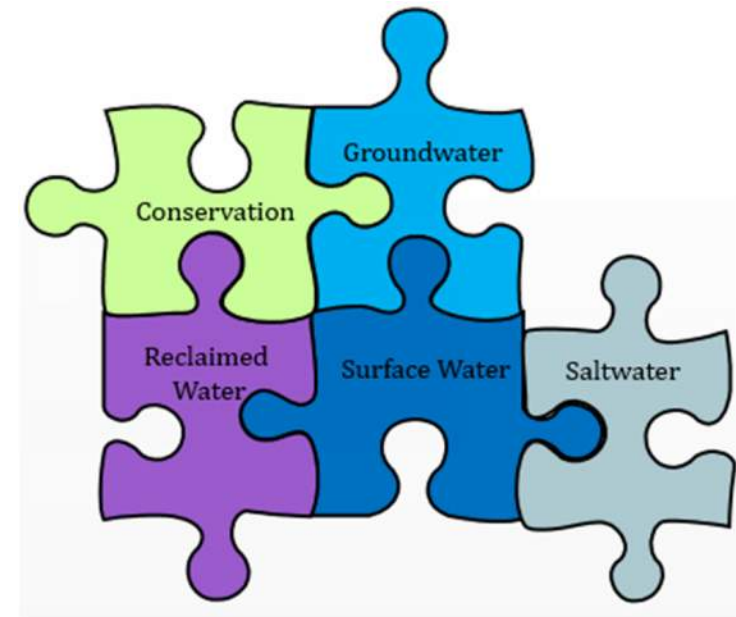
Regional Water Plan Implementation

6.	Addressing Water Needs and Regional Goals	6-1
6.1.	Identifying Water Management Practices	6-1
6.2.	Selected Water Management Practices for the Coastal Georgia Region	6-2
7.	Implementing Water Management Practices	7-1
7.1.	Implementation Schedule and Roles of Responsible Parties	7-1
7.2.	Fiscal Implications of Selected Water Management Practices	7-21
7.3.	Alignment with Other Plans	7-35
7.4.	Recommendations to the State	7-35
8.	Monitoring and Reporting Progress	8-1
8.1.	Benchmarks	8-1

Portfolio of Management Practices for Consideration

The Coastal Georgia RWP outlines a total of 86 Management Practices (MPs)

- Water Conservation
- Water Supply and Management
 - Additional Surface Water Use
 - Green Zone Groundwater
 - From Other Aquifers
 - Brackish or Saline Water Sources
- Wastewater and Water Quality
- Information Needs



Portfolio of Management Practices for Consideration

NON-STRUCTURAL

Data Collection/Sound Science

Water Conservation (WC)

Institutional Options for Regional Cooperation/
Water System Optimization Green Zone

Institutional Options for Regional Cooperation/
Water System Operation Red and Yellow Zones

STRUCTURAL

Additional Surface Water Existing Facilities

Additional Groundwater

Additional Surface Water New Sources

Floridan Aquifer in Green Zone

Reverse Osmosis Desalination

Additional/
Alternative Aquifers in Red and Yellow Zones

Aquifer Storage and Recovery

Reuse

Highlight Recent and On-Going Implementation

- EPD Seed Grants have help fund \$210,000 of projects since 2015 in the Coastal Region
 - University of Georgia (UGA) Study of Coastal Estuaries and Water Quality
 - UGA Extension working jointly with Coastal, Altamaha and Savannah-Upper Ogeechee on both Ag and Urban Water Conservation and Water Quality MPs, including outreach and education
- GEFA has helped fund over \$95.3M of projects in Chatham, Bryan and Effingham counties since 2010
 - \$65M Clean Water Fund, \$3.9M Drinking Water, \$26.3M Georgia Fund, \$100K Water Reuse



Highlight Recent and On-Going Implementation



City of Richmond Hill
Sterling Creek WRF



City of Rincon Reclaimed Water Project



City of Pooler WWTP
Membrane Bioreactor
Upgrades



Savannah Raw Water
Storage Impoundment



Savannah River
Dissolved Oxygen Facility

Continued Regional Water Planning and Outreach

- This was our 4th outreach meeting across the Coastal Region
- Upcoming Coastal Georgia Water Council Meeting in Summer/Fall of 2019
- EPD Seed Grant period will open in July 2019 (deadline in October)
- Technical work items up coming
 - Industrial Water Demand Forecast Working Group
 - Updated Population Projections
 - On-going updates and refinements to the resource assessments
- Next Round of RWP Updates scheduled for 2020/2021



Georgia's
State Water Plan

Q&A

www.georgiawaterplanning.org