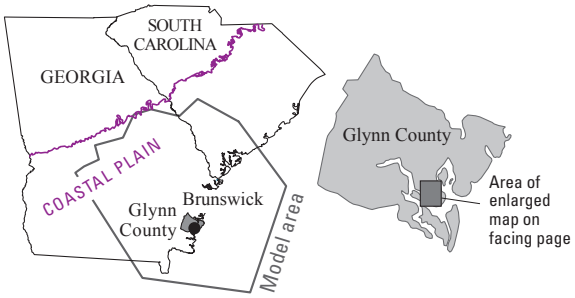
City of Brunswick and Glynn County Cooperative Water Program

Study Chief	Gregory S. Cherry
Cooperator	City of Brunswick, Glynn County Jekyll Island Authority
Year Started	1959



Problem

In the Brunswick area, saltwater has contaminated the Upper Floridan aquifer for more than 50 years. Currently within an area of 2 square miles in downtown Brunswick, the aquifer yields water with a chloride concentration greater than 2,000 milligrams per liter (mg/L), markedly higher than the State and Federal secondary drinking-water standard of 250 mg/L (Georgia Environmental Protection Division, 1997; U.S. Environmental Protection Agency, 2000). This chloride contamination has constrained further development of the Upper Floridan aquifer in the Brunswick area and stimulated interest in the development of alternative sources of water, primarily from the shallower surficial and Brunswick aquifer systems.

Objectives

- Define and simulate mechanisms of groundwater flow and the occurrence and movement of saltwater in the Floridan aquifer system.
- Assess alternative sources of water supply from the surficial and Brunswick aquifer systems and the Lower Floridan aquifer.
- Monitor long-term groundwater levels and quality including real-time monitoring of the spatial extent of chloride contamination in the Upper Floridan aquifer.
- Develop and maintain a comprehensive groundwater database.

Progress and Significant Results, 2008–2009

A network of 32 continuous groundwater-level monitoring wells was operated—12 wells in the Upper Floridan aquifer, 8 wells in the Lower Floridan aquifer, 7 wells in the Brunswick aquifer system, and 5 wells in the surficial aquifer system (*C,* facing page). Of these 32 wells, 20 are funded by the Georgia Environmental Protection Division through the Coastal Georgia Sound Science Initiative.

Potentiometric surfaces of the Upper Floridan aquifer were mapped as follows:

- July 2008—mapping was based on water-level measurements made in 35 wells (Brunswick area only).
- August 2009—mapping was based on water-level measurements made in 52 wells (all of Glynn County).
- Chloride concentration of the Upper Floridan aquifer was mapped as follows:
- July 2008—mapping was based on analyses of samples collected from 67 wells.
- July–August 2009—mapping was based on analyses of samples collected from 60 wells.

A regional MODFLOW model of coastal Georgia and adjacent parts of Florida and South Carolina (Payne and others, 2005) was refined with higher resolution near the area of chloride contamination at Brunswick. The revised model is being used to assess the effects of pumping on hydraulic gradients along the outer margin of the contaminated area.

Real-time monitoring systems were installed in wells completed in the upper and lower water-bearing zones of the Upper Floridan aquifer that surround the area of chloride contamination. The following continuous data were collected:

- Water levels at Southside Baptist Church (wells 34H504 and 34H505), Perry Park (well 34H514), and Georgia–Pacific Cellulose (wells 33H324 and 33H325).
- Specific conductance at Southside Baptist Church (well 34H505), Perry Park (well 34H514; hydrograph, facing page), Georgia–Pacific Cellulose (well 33H325), and Brunswick Villa (well 34H134).

Information from the real-time groundwater-monitoring sites can be accessed at *http://waterdata.usgs.gov/ga/nwis/current/?type=quality&group%20Key=basin%20cd* and *http://waterdata.usgs.gov/ga/nwis/current/?type=gw&group_key=county_cd*.

References

Cherry, G.S., Peck, M.F., Painter, J.A, and Stayton, W.L., 2010, Groundwater conditions and studies in the Brunswick–Glynn County area, Georgia, 2008: U.S. Geological Survey Open-File Report 2009–1275, 54 p.; available online at *http://pubs.usgs.gov/of/2009/1275/*.

Georgia Environmental Protection Division, 1997, Secondary maximum contaminant levels for drinking water: Environmental Rule 391-3-5-19, revised October 1997: Official Code of Georgia Annotated Statutes, Statute 12-5-170 (Georgia Safe Drinking Water Act), variously paginated.

Payne, D.F., Rumman M.A., and Clarke J.S., 2005, Simulation of groundwater flow in coastal Georgia and adjacent parts of South Carolina and Floridan Predevelopment, 1980, and 2000: U.S. Geological Survey Scientific Investigations Report 2005–5089, 91 p.; available online at *http://pubs.usgs.gov/sir/2005/5089/*.

U.S. Environmental Protection Agency, 2000, Maximum contaminant levels (Part 143, National Secondary Drinking Water Regulations): U.S. Code of Federal Regulations, Title 40, Parts 100–149, rev. July 1, 2000, p. 612–614.

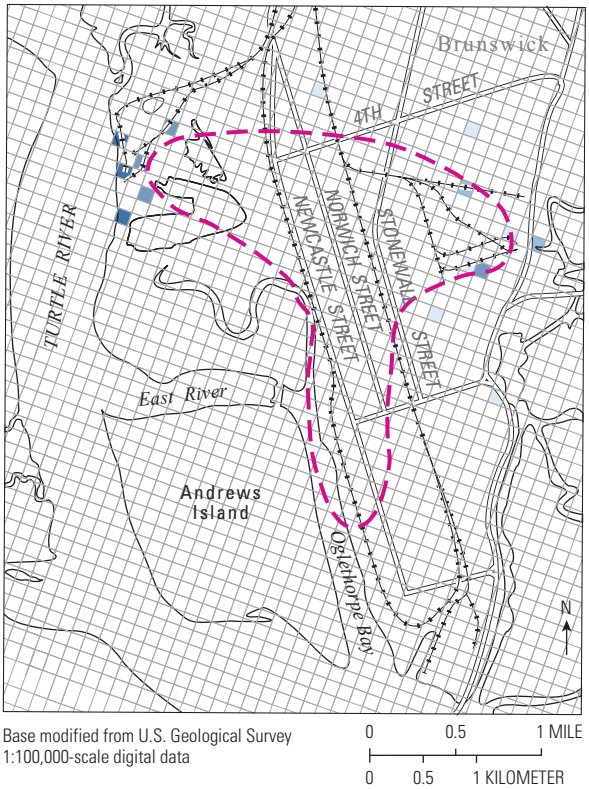
A. **Hydrogeologic units and model layers**

Hydrogeologic unit (Savannah / Brunswick)	Aquifer system	Model layer: Payne and others, 2005	Model layer: Revised model
Water-table zone	SURFICIAL AQUIFER SYSTEM	GHB (not modeled)	GHB (not modeled)
Confining unit: Upper water-bearing zone; Lower water-bearing zone	SURFICIAL AQUIFER SYSTEM	1	1
Confining unit: Upper Brunswick aquifer	BRUNSWICK AQUIFER SYSTEM	2	2
Confining unit: Upper Brunswick aquifer	BRUNSWICK AQUIFER SYSTEM	3	3
	BRUNSWICK AQUIFER SYSTEM	3	4
Confining unit: Lower Brunswick aquifer	BRUNSWICK AQUIFER SYSTEM	3	5
Upper Floridan confining unit		4	6
Upper Floridan aquifer: Upper water-bearing zone	FLORIDAN AQUIFER SYSTEM	5	7
Upper Floridan aquifer: Upper Floridan semi-confining unit	FLORIDAN AQUIFER SYSTEM	5	8
Upper Floridan aquifer: Lower water-bearing zone	FLORIDAN AQUIFER SYSTEM	5	9
Lower Floridan confining unit	FLORIDAN AQUIFER SYSTEM	6	10
Lower Floridan aquifer: Confining unit; Fernandina permeable zone	FLORIDAN AQUIFER SYSTEM	7	11
Confining unit		Not modeled	Not modeled

[GHB, general-head boundary]

A digital model is being developed to simulate groundwater flow in the vicinity of the chloride plume at Brunswick. The model is based on a regional model developed by Payne and others (2005) as part of the Coastal Sound Science Initiative. A greater number of model layers *(A)* and finer grid resolution *(B)* are being applied to enable more detailed simulations in the vicinity of the chloride plume, including assessment of the effects of pumping on the hydraulic gradients near the plume. A groundwater-level monitoring network *(C)* helps assess current hydrologic conditions and the effectiveness of water-management practices.

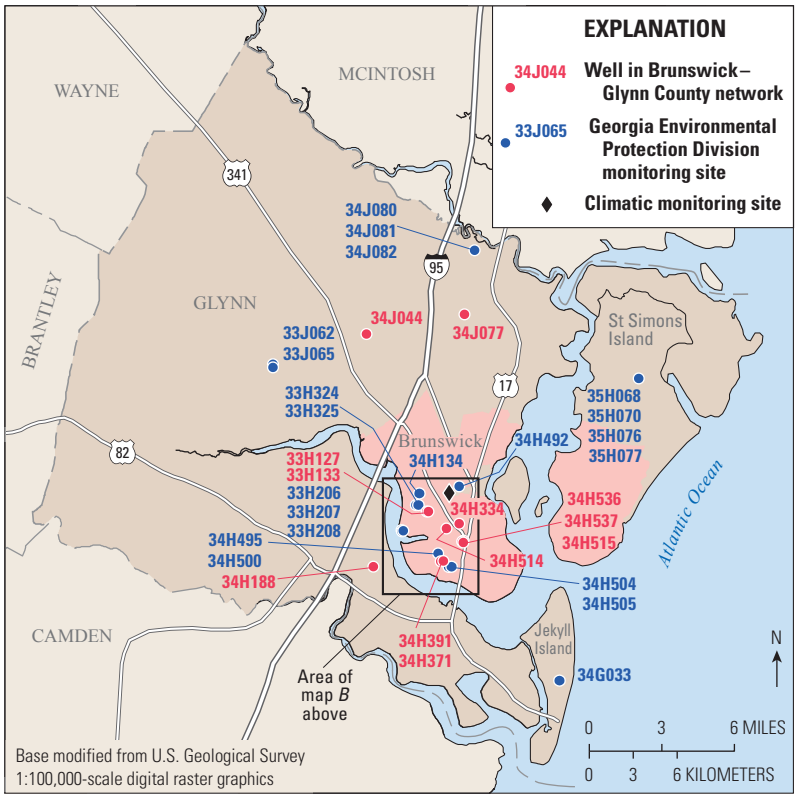
B. **Hydrogeologic units and model layers**



EXPLANATION

Total estimated pumping per grid cell— In million gallons per day, during 2004, layers 7 and 9 (Upper Floridan aquifer)

- No pumping
- 0.01 to 0.99
- 1.00 to 2.99
- 3.00 to 4.99
- 5.00 to 6.79

Approximate boundary of 2005 chloride plume (Cherry and others, 2010)

C. **Groundwater-level monitoring network**