Fort Stewart–Hunter Army Airfield Alternative Water Resources

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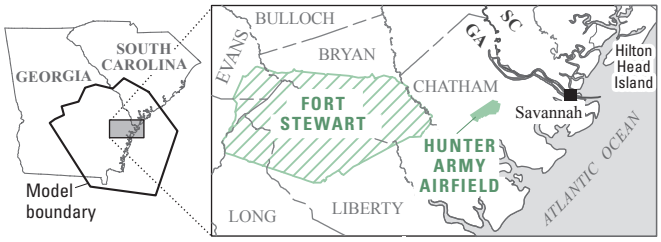
Cooperator U.S. Department of the Army

Year Started 2009



Problem

The U.S. Department of the Army Fort Stewart and Hunter Army Airfield (HAAF), Georgia, are home of the 3rd Infantry Division. These two sites are located in coastal Georgia near Savannah, where concern over saltwater intrusion at Hilton Head Island, South Carolina, has resulted in increased restrictions on groundwater withdrawals from the Upper Floridan aquifer by the Georgia Environmental Protection Division (GaEPD). To meet the growing water demand in Georgia's coastal area, the GaEPD has encouraged use of alternative water sources to the Upper Floridan, including streams, ponds, and wells completed in the Lower Floridan aquifer and shallower surficial and Brunswick aquifer systems.

To assess the water-resource potential of these various sources for potable supply and irrigation, the U.S. Geological Survey, in cooperation with the Department of the Army, is conducting detailed field investigations at HAAF and Fort Stewart.

Objectives

- Analysis of shallow alternative aquifers (surficial and Brunswick aquifer systems)—Conduct detailed site investigations in new and existing wells, including borehole geophysical logging and flowmeter testing, depth-integrated water sampling and analysis, and aquifer-performance testing to determine the drawdown and water-bearing capacity of the aquifer.
- Analysis of Lower Floridan aquifer—Conduct detailed site investigations, including borehole geophysical logging and flowmeter testing, depth-integrated water sampling and analysis, and aquifer-performance testing to determine the drawdown and water-bearing capacity of the Lower Floridan aquifer and interconnection (leakage) with the overlying Upper Floridan aquifer. Perform groundwater model analyses to further assess the effects of pumping on leakage between the Upper and Lower Floridan aquifers.
- Analysis of ponds—Conduct detailed site investigations of selected ponds to assess water-supply potential, including describing the local site setting and pond bathymetry, estimating the volume of water stored in the ponds over a range of stages, estimating net groundwater seepage derived from water-budget analyses and pond-discharge tests, and determining the suitability of pond water quality for irrigation purposes.

Progress and Significant Results, 2008–2009

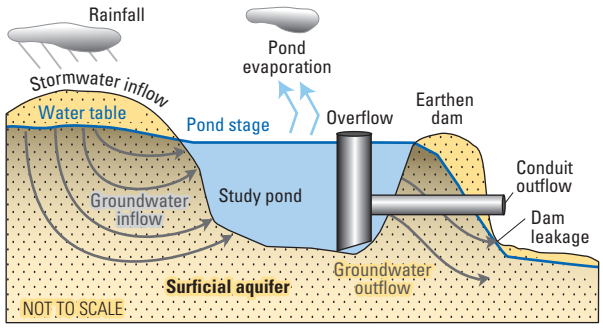
- Completed construction and field testing of new production well at HAAF completed in the Lower Floridan aquifer. Field testing included collection of drill cuttings, core, borehole geophysical logs and flowmeter data, conducting aquifer-performance tests in the Upper and Lower Floridan aquifers, collection and analysis of water samples from a variety of depths, conducting packer slug tests in the Lower Floridan confining unit, and laboratory analysis of core samples for determination of vertical hydraulic conductivity. Data were synthesized into an existing groundwater-flow model modified to assess interaquifer leakage between the Upper and Lower Floridan aquifers.
- Conducted evaluation of the hydrology, water-quality, and water-supply potential of four ponds at HAAF. This included determination of the volume of water stored in the ponds under a range of stage conditions; measurement of streamflow discharging from one of the ponds and development of a stage-discharge relation to determine flow rates over a range of climatic conditions; estimating net groundwater seepage by developing hydrologic budgets; and sampling and analysis to determine pond water quality. Results of the investigation are documented in a final report (Clarke and Painter, 2010).

References

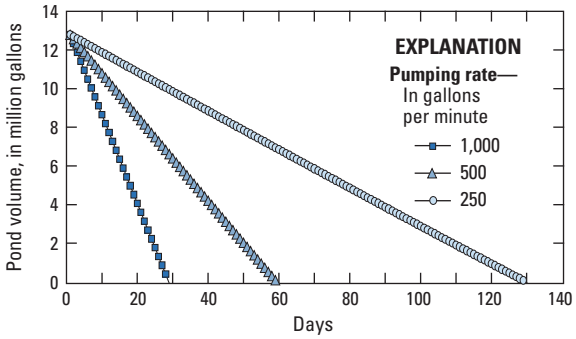
Clarke, J.S., and Painter, J.A., 2010, Hydrology, water quality, and water-supply potential of ponds at Hunter Army Airfield, Chatham County, Georgia, November 2008–July 2009: U.S. Geological Survey Scientific Investigations Report 2009–5265, 34 p.; available online at *http://pubs.usgs.gov/sir/2009/5265/*.

U.S. Environmental Protection Agency, 2009, Drinking water contaminants, accessed February 3, 2011, available online at *http://water.epa.gov/drink/contaminants/index.cfm*.

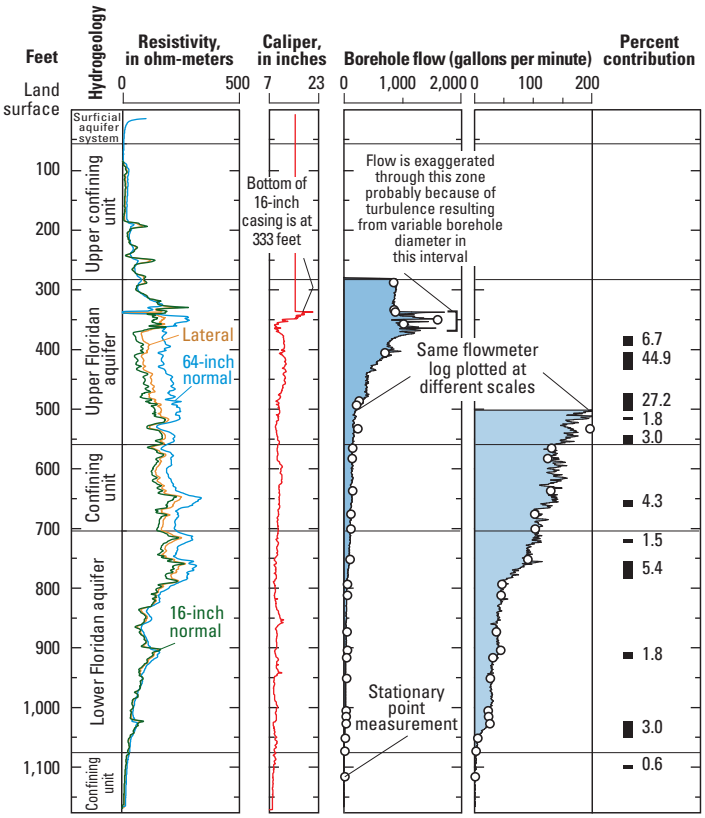
Williams, L.J., 2010, Summary of hydrologic testing of the Floridan aquifer system at Hunter Army Airfield, Chatham County, Georgia: U.S. Geological Survey Open-File Report 2010–1066, 30 p.; available online at *http://pubs.usgs.gov/of/2010/1066/*.



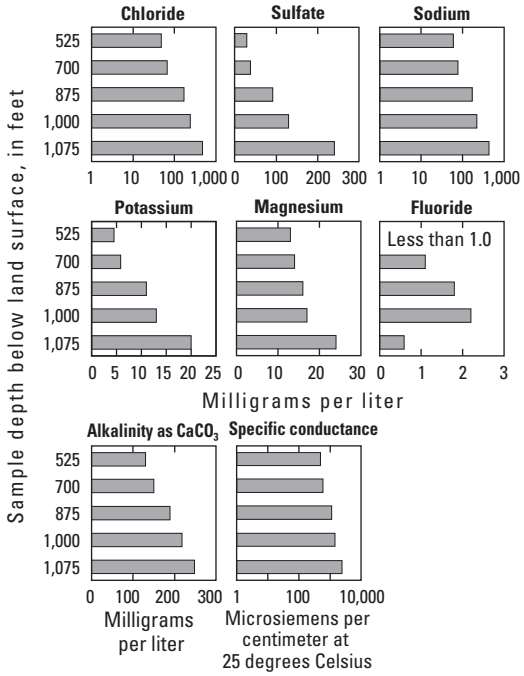
Conceptual model of pond-aquifer flow for a typical coastal area pond. Water supply from ponds is derived from the amount of available storage in the pond replenished by groundwater inflow and surface runoff. Evaporation, groundwater outflow, and leakage through earthen dams accounts for losses to pond storage. Field data including precipitation, evaporation, pond stage, and pond bathymetry were used to develop a hydrologic budget for three ponds at Hunter Army Airfield (HAAF) and assess their potential as sources of irrigation water supply (modified from Clarke and Painter, 2010).



At one of the ponds at HAAF, the total available volume was 12.8 million gallons and the average rate of net groundwater flow was 19 gallons per minute (gal/min). Assuming long-term average climatic conditions for July and an 8-hour-per-day pumping period, total depletion of pond volume would occur after 29 days at a pumping rate of 1,000 gal/min, after 60 days at a pumping rate of 500 gal/min, and after 130 days at a pumping rate of 250 gal/min. (modified from Clarke and Painter, 2010).



Geophysical logs and flowmeter data collected from a test boring open to both the Upper and Lower Floridan aquifers at HAAF were used to determine the relative flow contribution from water-bearing zones and to delineate the top and bottom of the Upper and Lower Floridan aquifers. While pumping at a rate of 847 gallons per minute (gal/min), flowmeter data indicated that the Upper Floridan aquifer, as a whole, produced 83.5 percent of the total flow with the remaining 16.5 percent derived from the underlying confining unit and the Lower Floridan aquifer. Two intervals in the Upper Floridan aquifer, 405–435 feet (ft) and 475–505 ft, produced the highest percentage of accumulated flow with an estimated 610 gal/min or 72 percent of the total pumping rate (modified from Williams, 2010).



Discrete water samples collected from the Upper and Lower Floridan aquifers indicate that constituent concentrations generally increase with depth and are within drinking-water standards, with the exception of the deepest sample at 1,075 feet (ft). Water from the 1,075-ft interval had a chloride concentration of 480 milligrams per liter (mg/L), which exceeds the U.S. Environmental Protection Agency (USEPA) Secondary Maximum Contaminant Level (SMCL) of 250 mg/L (U.S. Environmental Protection Agency, 2009). The sulfate concentration of water from the same interval (240 mg/L) is slightly below the USEPA SMCL of 250 mg/L (U.S. Environmental Protection Agency, 2009). Flowmeter testing in the completed Lower Floridan aquifer well indicates that water from the 1,075-ft zone contributes less than 2 percent of the total flow to the well, and therefore the relatively higher concentrations of chloride and sulfate do not adversely affect the overall water quality from the well.