



Martin O'Malley, Governor

Maryland Department of Natural Resources
Resource Assessment Service
MARYLAND GEOLOGICAL SURVEY
2300 St. Paul Street
Baltimore, Maryland 21218



John R. Griffin, Secretary

Fact Sheet 18c: Calvert Aquifer System Test Wells Located at Greensboro, Caroline County, Maryland

This fact sheet is one in a series presenting results of test-drilling activities conducted as part of the Maryland Coastal Plain Aquifer Study to fill key data gaps. The test wells will help to better understand the structure, flow system, water-bearing properties, and natural water quality of the Aquia-Hornerstown, Miocene-age, and Manokin aquifers on the Eastern Shore of Maryland. In addition, the test wells will provide long-term water-level monitoring for resource assessment and flow-model calibration. The Maryland Coastal Plain Aquifer Study is a long-term, multi-phase initiative for comprehensive regional aquifer assessment developed in response to recommendations of the 2004 Maryland Advisory Committee on the Management and Protection of the State's Water Resources (Wolman Commission). The study is being conducted by the Maryland Geological Survey and the U.S. Geological Survey (USGS), with funding support from the Maryland Department of the Environment (MDE).

Key Results

- Both wells at the Greensboro site flow naturally under artesian conditions at about 5 gallons per minute (gpm).
- Sands within the Calvert aquifer system at the site are hydraulically connected with moderate transmissivity (approximately 550 feet squared per day [ft²/day]).
- Water quality from the wells is generally good, with none of the U.S. Environmental Protection Agency's Primary Drinking-Water Standards exceeded in the analyses.

Introduction

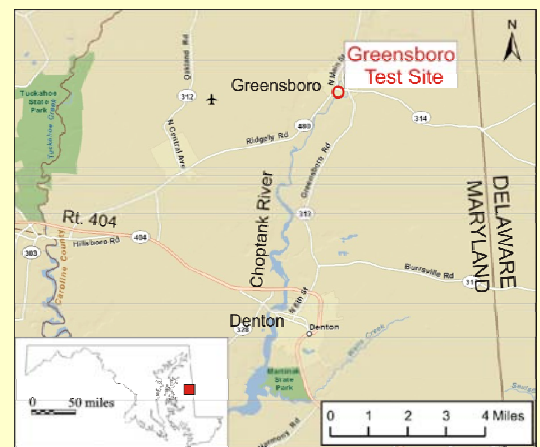
The Miocene-age Calvert aquifer system is an important water supply in the central Eastern Shore counties of Dorchester, Caroline, and Talbot, Maryland, as well as central Delaware. The Calvert aquifer system includes (from shallow to deep) the Frederica, Federalsburg, and Cheswold aquifers. These aquifers, more prevalent in Delaware, were described and mapped in Maryland by Cushing, Kantrowitz, and Taylor (1973); however, the borehole correlations and hydraulic properties were not thoroughly documented. No subsequent studies of the Calvert aquifer system have been conducted in Maryland. It is uncertain whether these units act as independent aquifers or as a single hydraulic unit, and whether they correlate with units mapped in Delaware. These considerations are important in determining whether the MDE groundwater appropriations should be issued for three individual aquifers or for a single composite aquifer. Test wells are needed to assess the hydraulic characteristics of the Calvert aquifer system, and to determine the connectivity of the individual units. Additionally, observation wells are needed to help determine hydraulic continuity of individual aquifer units, monitor water-level trends, and estimate available drawdown. The Greensboro test site is one of five drilled in the central Eastern Shore of Maryland as part of a systematic investigation of the Calvert aquifer system.

Well Construction and Testing



Split-spoon sampling

Test wells CO Cd 66 and 67 were drilled between June 11 and 15, 2010 to a depth of 240 and 168 feet (ft), respectively. Drill cuttings were collected at 10-ft intervals and gross lithologic descriptions were made. Three split spoon cores were also collected. Geophysical logs (gamma radiation, 16- and 64-inch resistivity, single-point resistivity, self-potential, and 6-ft lateral) were run in the open hole by the USGS Maryland Water Science Center. The holes were drilled to 9 5/8-inch diameter and well screens (4.5-inch diameter SDR-17 PVC; 0.02-inch slot) were installed from 175 to 190 ft in CO Cd 66, and 145 to 160 ft in CO Cd 67. Both wells include 5-ft cellars. The wells were cased to the surface with 4.5-inch SDR-17 PVC pipe. The wells were completed with valved threaded plugs housed in manholes flush with the land surface.



Flowing artesian conditions

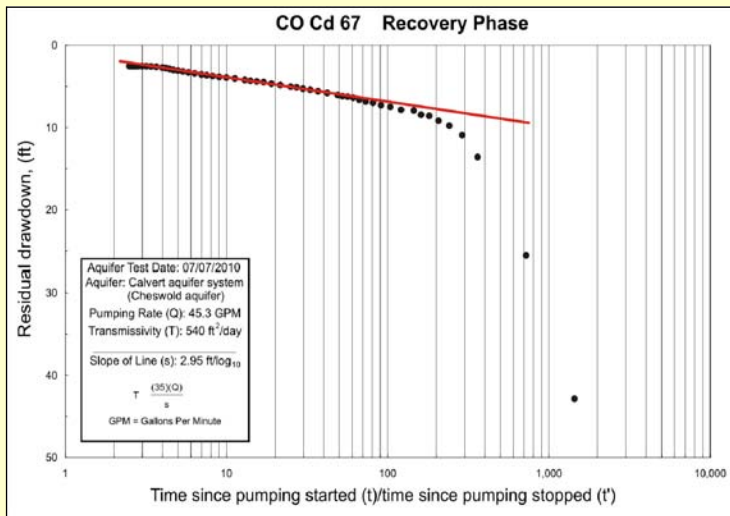
The deepest test well (CO Cd 66) penetrated the Surficial aquifer, the Calvert aquifer system, and a portion of the Calvert confining unit. The wells were screened in two intervals of the lowest sand of the Calvert aquifer system, which at this site consists of fine- to medium grained marine sand with abundant weathered shell material. Several feet of silty, dark green clay separates the two sand intervals.

The completed wells were developed using compressed air to remove drilling mud from the screen and gravel pack. Both wells are flowing artesian wells, indicating that the aquifer sands are confined by low permeability sediments, and that the recharge area is higher in altitude than the well site. Heads in both sands are approximately 11.5 ft above land surface.

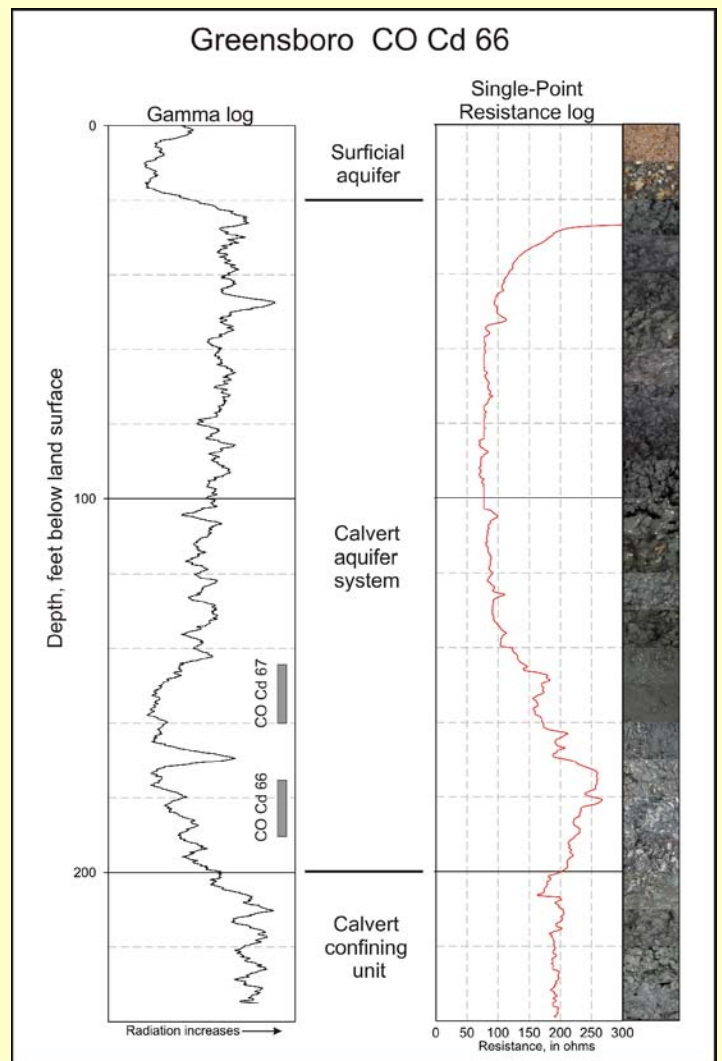
As a result of the flowing conditions, casing extensions and scaffolding had to be installed for 24-hour aquifer tests which were conducted for each well at constant rates of 66 gpm (CO Cd 66) and 45 gpm (CO Cd 67). During each test, water levels were measured in both wells. The static water level in CO Cd 66 and CO Cd 67 measured prior to the aquifer test was approximately 16 ft above sea level. Drawdown was observed in the observation wells during the tests, indicating hydraulic connectivity between sand intervals. Transmissivities were calculated using the Cooper-Jacob straight line method. Transmissivity values for the recovery phase of the aquifer tests were 575 ft²/day for CO Cd 66 and 540 ft²/day for CO Cd 67. Water levels in both wells show tidal fluctuations due to proximity of the tidal Choptank River.

Water samples from CO Cd 66 and 67 collected during the aquifer tests were analyzed for field parameters (pH, alkalinity, specific conductance, dissolved oxygen), major ions, nutrients, metals, and radionuclides. None of the U.S. Environmental Protection Agency's Primary Drinking-Water Standards were exceeded.

SUMMARY INFORMATION							
Well number	Permit number	Screened interval (feet below land surface)	Aquifer	Pumping rate (gallons per minute)	Transmissivity (feet squared per day)	pH	Total dissolved solids (residue on evaporation @ 180° C.) (milligrams per liter)
CO Cd 66	CO-95-0869	175 - 190	Calvert	66	575	8.3	253
CO Cd 67	CO-95-0870	145 - 160	Calvert	45	540	8.1	245



Water-quality sampling



Reference

Cushing, E.M., Kantrowitz, I.H., and Taylor, K.R., 1973, Water Resources of the Delmarva Peninsula: U.S. Geological Survey Professional Paper 822, 58 p.

For more information, contact Andrew W. Staley, Maryland Geological Survey, astaley@dnr.state.md.us
DNR Publication Number: 12-9192011-527, December, 2011

Other Contact Information: DNR: Toll free in Maryland: 1-877-620-8DNR; Maryland Geological Survey: 410-554-5500; TTY users call via the MD Relay
Internet Address: www.dnr.Maryland.gov Maryland Geological Survey: www.mgs.md.gov

- The facilities and services of the Maryland Department of Natural Resources are available to all without regard to race, color, religion, sex, sexual orientation, age, national origin or physical or mental disability.
- This document is available in alternative format upon request from a qualified individual with disability.