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Fact Sheet 18d: Calvert Aquifer System Test Wells Located at Idylwild Wildlife Management Area, near Federalsburg, 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

- Each well at the Idylwild test site showed a small response when the others were pumped, indicating limited hydraulic connection between sands within the Calvert aquifer system.
- Transmissivities ranged from 52 to 440 feet squared per day (ft²/day).
- Sandy intervals within the Calvert aquifer system in these wells are not easily traceable throughout the study area.
- 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.

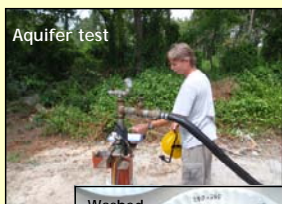
Introduction

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, Kantowitz, 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 monitor water-level trends, and estimate available drawdown. The Idylwild test site is one of five well clusters drilled in the central Eastern Shore of Maryland as part of a systematic investigation of the Calvert aquifer system.

Well Construction and Testing

Test wells CO Fd 41, 42, and 43 were drilled between June 21 and July 6, 2010 at Idylwild Wildlife Management Area, near Federalsburg, in southern Caroline County.

The wells were drilled to depths of 400, 341, and 279 feet (ft), respectively. Ditch samples were collected at 10-ft intervals and lithologic descriptions were made on washed samples. Split- spoon core samples were taken at specified intervals to provide high-quality lithologic samples, and for biostratigraphic and geochemical analyses. 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 USGS. The wells were cased to about 2 ft above land surface with 4.5-inch SDR PVC pipe, gravel-packed and grouted, and completed with steel protective casings and locking caps. Each completed well was developed using compressed air to remove drilling mud from the screen and gravel pack.



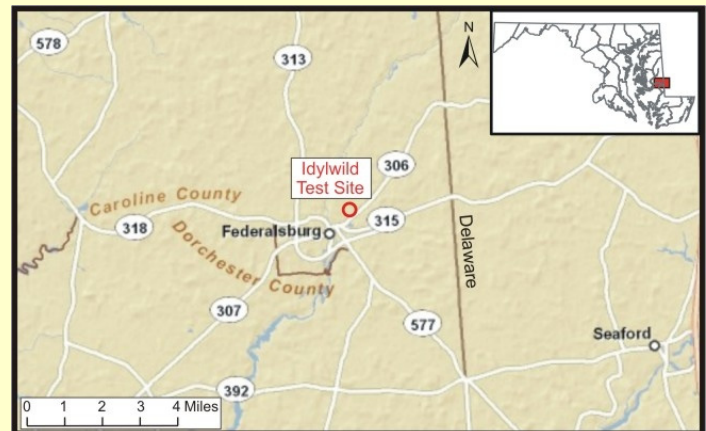
Aquifer test



Washed samples



Miocene shells

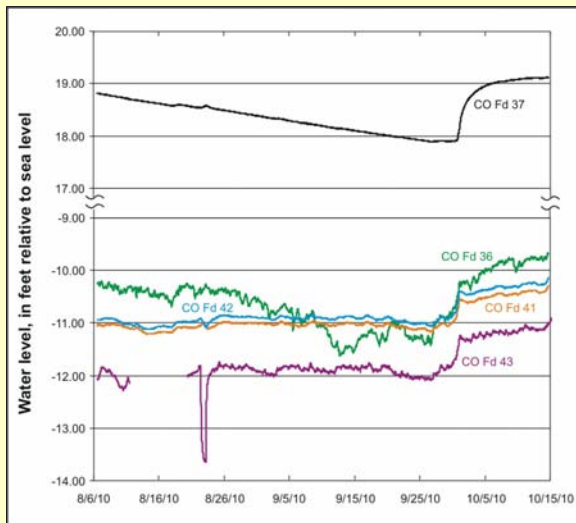


The deep test well penetrated the Surficial aquifer, the St. Mary's confining unit, the Choptank aquifer, and the Calvert aquifer system (Frederica, Federalsburg, and Cheswold aquifers). The Calvert aquifer system at the test site consists of fine to medium, shelly, gray quartz sand, interbedded with sandy, shelly gray clay.

A 24-hour pumping test was conducted on each well, followed by a 24-hour recovery test. Water levels were measured in all wells during each test using hand-held electric tapes and pressure transducers. Water levels were also measured during the tests in three other wells on the site, CO Fd 36 (Choptank aquifer), CO Fd 37 (Surficial aquifer), and CO Fd 44 (Calvert aquifer). Well CO Fd 41 was pumped at a rate of 12 gallons per minute (gpm), CO Fd 42 was pumped at 61 gpm, and CO Fd 43 was pumped at 66 gpm. The observation wells in the Calvert aquifer system for each pumping test showed small water-level responses, indicating limited hydraulic connection between the sands within the aquifer. Preliminary transmissivities, calculated using the Cooper-Jacob method on recovery-test data, are 52, 330, and 440 ft²/d, for CO Fd 41, 42, and 43, respectively. Near the end of the pumping phase of each test, a water sample was collected and analyzed for major ions, field parameters (pH, alkalinity, specific conductance, dissolved oxygen), nutrients, metals and radionuclides. None of the U.S. Environmental Protection Agency's Primary Drinking-Water Standards were exceeded.

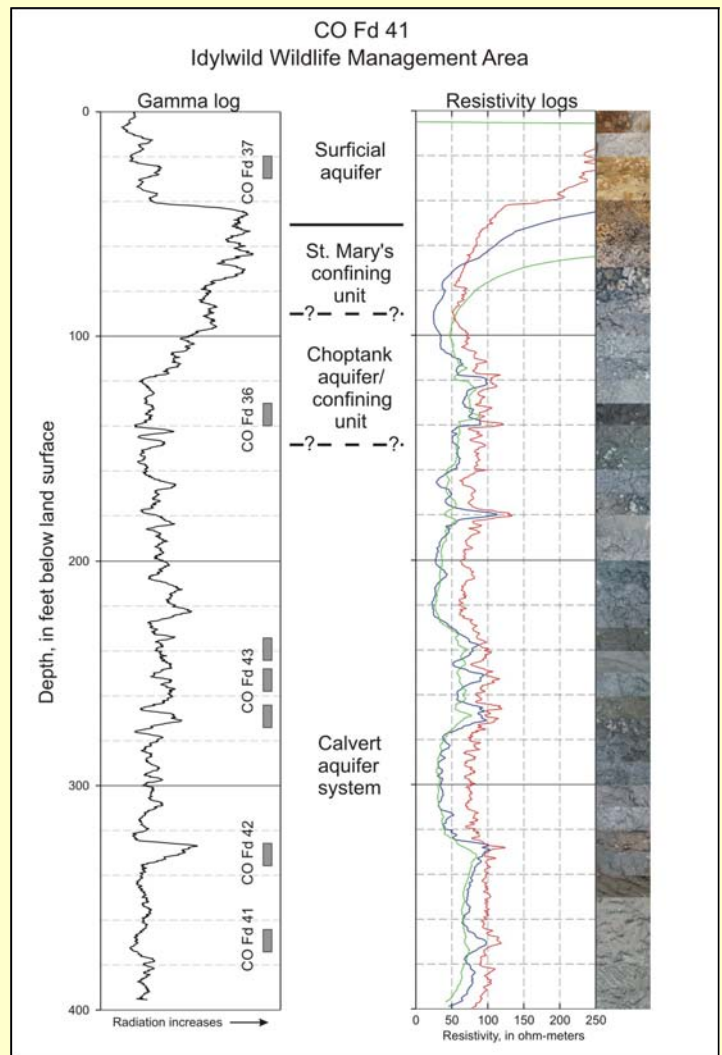
SUMMARY INFORMATION							
Well number	Permit number	Screened interval (feet below land surface)	Aquifer	Pumping rate (gallons per minute)	Transmissivity (feet squared per day)	pH	Total dissolved solids (residue on evaporation at 180° C.) (milligrams per liter)
CO Fd 41	CO-95-0864	364 - 374	Calvert	12	52	7.6	225
CO Fd 42	CO-95-0865	326 - 336	Calvert	61	330	7.9	217
CO Fd 43	CO-95-0866	234 - 244, 248 - 258, 264 - 274	Calvert	66	440	7.9	239

After the aquifer tests were completed, pressure transducers were installed in the five wells (including the previously drilled CO Fd 36 and 37) to continuously record water levels. Water levels were recorded at 1-minute intervals, between August 6, through October 18, 2010. Water-levels in wells CO Fd 41, 42, and 43 show very similar trends, although the head in Fd 43 is slightly lower than the other two wells. The water level in Fd 43 shows a drawdown/recovery cycle of about 2 ft on August 22-23, which was probably caused by pumpage from the facility well (CO Fd 44) which is screened in approximately the same interval as CO Fd 43. Wells CO Fd 41 and 42 show smaller declines during that period. Hydrographs for CO Fd 36 and 37 show somewhat different trends, indicating that the Surficial and Choptank aquifers are hydraulically separated from the Calvert aquifer system.



Reference

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



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 DNR Publication Number: 12-9192011-527, December, 2011

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