News Release

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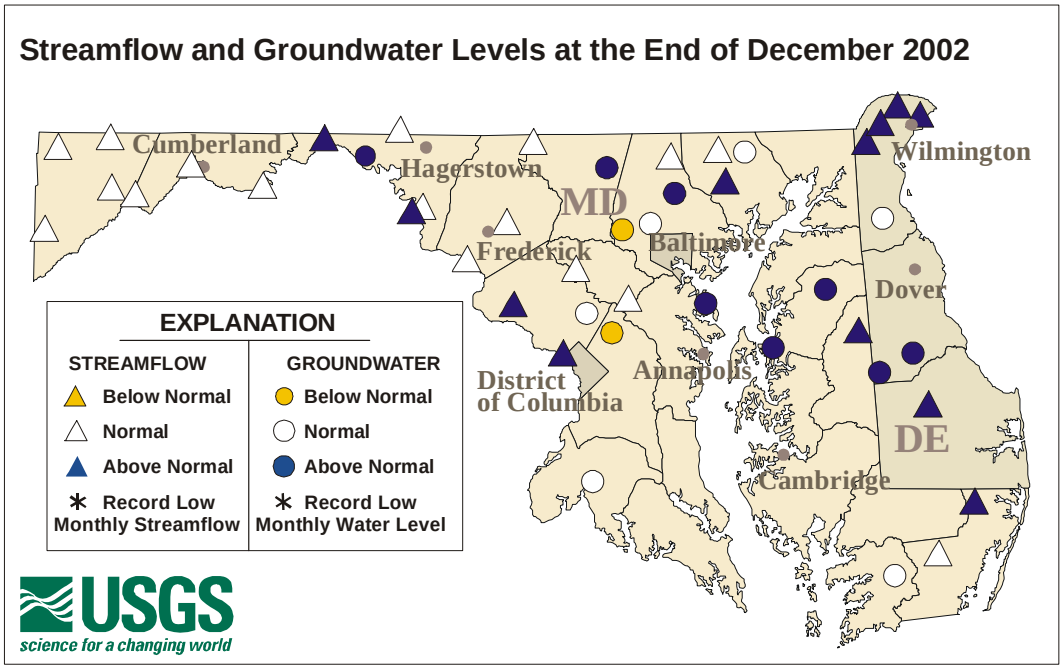
2002: A Record-Setting Year for Low Groundwater Levels

Water Levels Recover to Normal in December 2002

Above normal amounts of rain and snow during the past 3 months have brought groundwater and streamflow levels back to normal and above normal levels, ending the region's worst hydrologic (groundwater and streamflow levels) drought on record, according to hydrologists at the U.S. Geological Survey (USGS) in Baltimore. A water-supply drought still exists in Maryland and water restrictions are still in place because reservoir levels in the Baltimore area remain below the normal levels needed to meet the water-use demands for next summer.



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Recovery from severe hydrologic drought conditions has been quicker than expected. In September 2002, many wells and streamflow stations were setting all-time record lows; by December, most of the stations had returned to normal or above normal levels. The quick recovery is a function of the timing and nature of the precipitation. The rain has been steady and gradual and there have been several moderate snowfalls that have melted slowly, allowing aquifers to recharge. During this time of year, water demand is low and we typically get the recharging rains and snows that increase water levels sufficiently to get us through the following summer. Recharge did not occur in 2001 because the weather was unusually dry and warm, resulting in record-setting low groundwater and streamflow levels.

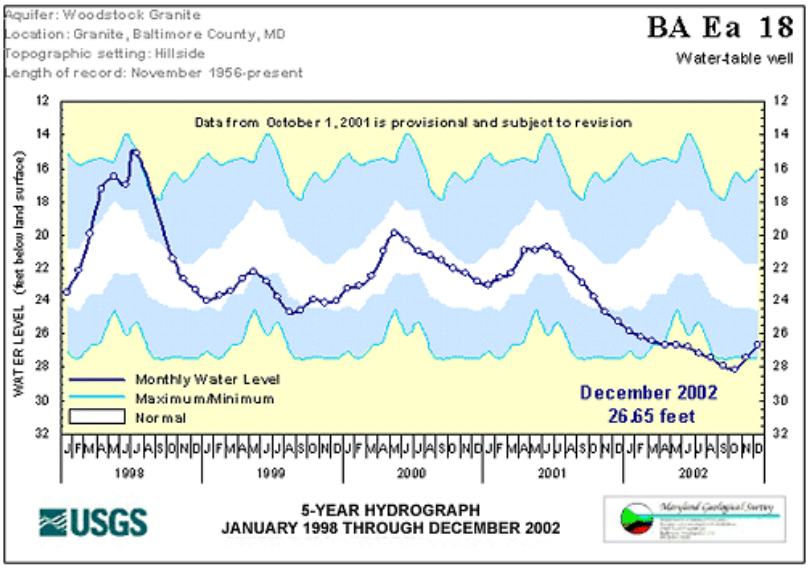
Groundwater is the last hydrologic element to recover from drought conditions because it takes a number of months to recharge aquifers. Groundwater levels have increased across Maryland and Delaware, many to normal levels and some to above normal levels at the end of December (see graphs at http://md.water.usgs.gov/groundwater/.) Streams continued to flow at normal to above normal levels at the end of December, which indicates that groundwater recharge has occurred, but streamflow can fall off quickly during periods of no rainfall. Groundwater keeps streams flowing between rain events. To keep groundwater and streamflow at normal levels, we need more recharge to get us through next summer. This means several more months of normal to above normal precipitation are necessary.

In September 2002, 9 of the 16 wells used by the USGS to assess water resources across Maryland and Delaware set monthly record lows; 7 were all-time records (shown in orange in the table to the right). This table shows how water levels have responded to precipitation and increased over the last 3 months. Rising water levels indicate that aquifers are being recharged and the hydrologic drought has ended. The largest increase was in Carroll County (10.26). Only two of the nine wells had below normal levels at the end of December.

Monthly Groundwater Level Comparison in Maryland
September 2002 (record low) and December 2002 (near normal)
[Water levels are in feet below land surface]

County	Well Name	September Water Level	December Water Level	Status at the end of December	3-Month Water Level Increase (feet)
Baltimore	BA Ce 21	22.48	17.67	Above Normal	+4.81
Baltimore	BA Ea 18	27.91	26.65	Below Normal	+1.26
Charles	CH Ee 16	16.74	14.56	Normal	+2.18
Carroll	CL Bf 1	75.76	65.50	Above Normal	+10.26
Harford	HA Bd 31	20.25	13.47	Normal	+6.78
Montgomery	MO Eh 20	18.03	13.19	Normal	+4.84
Prince Georges	PG Bc 16	25.91	24.84	Below Normal	+1.07
Queen Annes	QA Cg 1	6.49	3.03	Above Normal	+3.46
Somerset	SO Cf 2	6.55	2.03	Normal	+4.52

Water levels in a deep, bedrock well in Baltimore County, Maryland dropped for 15 months until they finally responded to precipitation and began to rise in mid-November. The groundwater level remains below normal, but the water level has risen about a foot in the last month and continues to rise, indicating the bedrock aquifer is being recharged.



The 5-year hydrograph to the left shows the groundwater level as depth below land surface for a deep (250 feet), bedrock well in Baltimore County, Maryland. Water levels typically follow a seasonal variation, reaching their lowest point in late fall and their highest levels in early summer. Because the well is deep and the water source is from a bedrock aquifer, response to precipitation is slow. For example, during the drought of 1999, the groundwater level did not drop much below normal, while other nearby wells were setting record monthly lows. The response in the well to Hurricane Floyd was a slow rise to normal levels. The water levels remained at normal levels until late 2001.

For 15 months, starting in the summer of 2001, the water levels in this well dropped because of the abnormally warm and dry winter (when recharge typically occurs). After several weeks of normal rainfall, the water level began to rise in mid-November 2002. In the last 3 months in 2002, the water level has rose 1.66 feet and continues to rise, indicating that recharge is finally occurring.

The abundant rain and snow have led to above normal streamflows, which in turn have helped to refill reservoirs slightly, but not enough to lift the water restrictions in the area served by the reservoirs. Storage in the Baltimore Reservoir System increased 7 percent to 59 percent of capacity at the end of December, and the contents of the Triadelphia and Duckett Reservoirs on the Patuxent River increased 23 percent to 80 percent of capacity. Reservoirs in the region are typically about 90 percent of capacity at this time of year.

Streamflows during the last 7 days of December and monthly streamflow ranged from normal to above normal at streamflow stations across Maryland and Delaware. Piscataway Creek in Maryland set a monthly record high in December. All 30 stations used to monitor average monthly streamflow conditions by the USGS were normal to above normal. Five-year monthly streamflow hydrographs can be viewed on the USGS website at: http://md.water.usgs.gov/surfacewater/streamflow/.

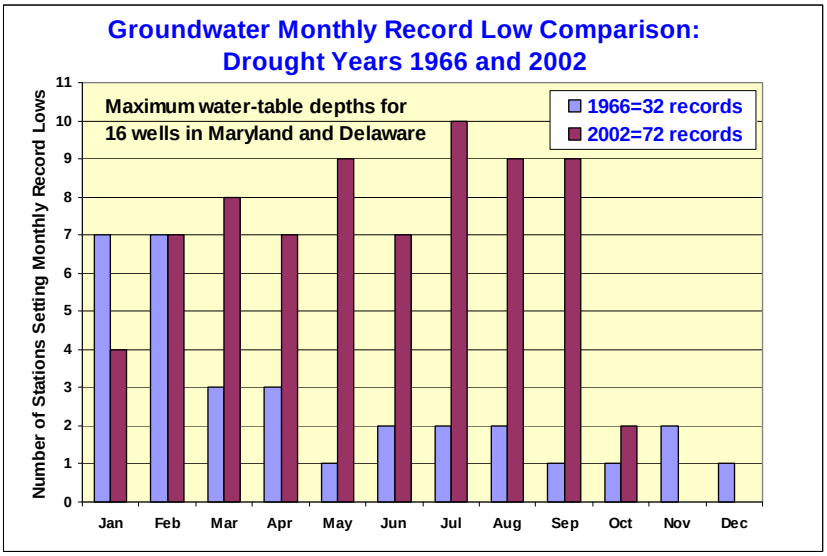
Average monthly streamflow at the Potomac River near Washington, D.C. was at 44 percent above normal (see graphs at http://md.water.usgs.gov/monthly/poto.html. Total flow into the Chesapeake Bay during December averaged 64.6 bgd (billion gallons per day), which is 23 percent above average. During 2002, total streamflow into the Chesapeake Bay was 24 percent below average. More information about water and the Chesapeake Bay can be found at http://chesapeake.usgs.gov/.

Was the hydrologic drought of 2002 worse than the 1960s drought?

In 2002, the drought was so severe that water restrictions were in place for most of the year in Maryland and many new domestic wells drilled. In some communities, water was hauled into their region to meet water supply needs, as many reservoirs reached very low levels. Delaware also experienced the strain of drought conditions. During the 2002 drought, it was possible to monitor groundwater and streamflow conditions using real-time data. This technology enabled managers of water-supply operations to make timely decisions.

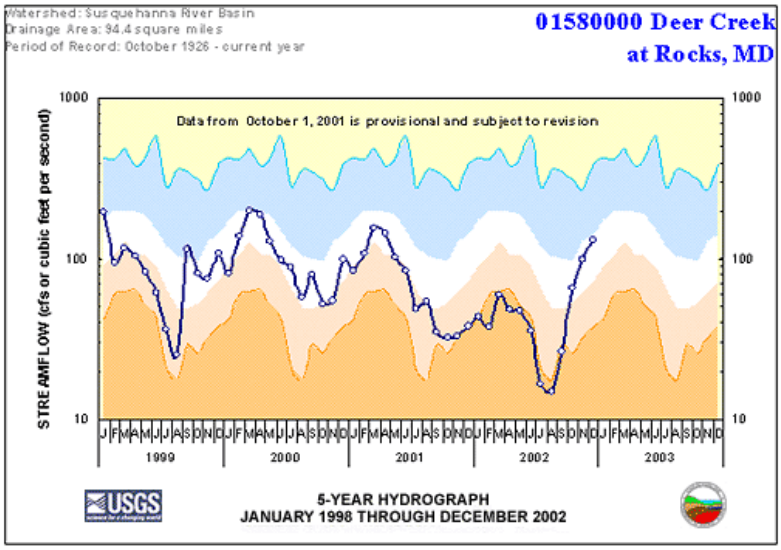
Groundwater:

Since the USGS began measuring wells in Maryland and Delaware, never before has there been so many wells breaking monthly record lows for such a long time. The number of monthly record lows exceeded those set during the 1960s drought. The graph at the right shows the number of monthly record low groundwater levels that were set for the 16 wells the USGS uses to track water conditions. More than twice the number of records were set in 2002 than 1966. In 2002, 72 monthly record lows were set, while in 1966, only 32 monthly record lows were set. The water levels ranged from 1 to 6 feet below normal levels and many exceeded the previous record by about 1 foot.



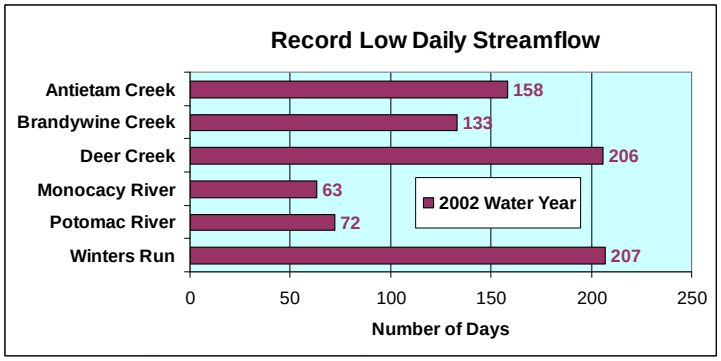
Streamflow:

Streamflow also showed the effects of the hydrologic drought. Many daily low streamflow and average monthly streamflow records were set across Maryland and Delaware. Streams respond to climatic conditions more quickly than groundwater levels. This is because runoff will readily flow down slope until it reaches a low spot, such as a creek or river. Groundwater contributes much of the flow to streams, called baseflow, between rain events. Since groundwater levels were low, so were streamflow levels. Groundwater recharge occurs more slowly because of the time it takes for water to infiltrate through the grains of sediment or through the cracks or fractures in the bedrock.



At Deer Creek in Harford County, Maryland, the monthly streamflow was at record lows for more than a year (see 5-year hydrograph to the left). Streamflow was below normal from August 2001 to November 2002 and set 8 consecutive new monthly record lows. Notice that streamflow was also below normal during the drought of 1999. By October 2002, the streamflow in Deer Creek returned to normal levels because of the abundant rainfall during the fall.

Deer Creek also set daily record lows for more than half the year (206 days) in 2002, and 18 days in September 2002 at the end of the water year (October 1 through September 30). Other streams that set daily record lows are shown in the graph below, such as the Potomac River, which set new daily record lows for 72 days during 2002. Flow in the Potomac is regulated by reservoir releases to maintain a minimum flow over the dam at Little Falls near Washington, D.C. to ensure habitats are preserved downstream. For calendar year 2002, the flow on the Potomac River was 64 percent below average. Preliminary calculations of lowest natural daily flow (without diversions) done by the Interstate Commission on the Potomac River Basin (ICPRB) show that the lowest streamflow of the year was 546 cfs (cubic feet per second) on September 19, 2002. This low flow value was approximately as extreme as the low daily flow of 543 cfs set on September 10, 1966.



to gaug
affecting streamflow and groundwater levels in Maryland and Delaware, see Drought Watch at: http://md.water.usgs.gov/drought/. Additional groundwater levels, streamflow, and water-quality data can be obtained from the **USGS National Water Information System Web site (NWISWeb)** at http://waterdata.usgs.gov/nwis/.

The real-time streamflow stations used in this analysis are operated in cooperation with the Maryland and Delaware Geological Surveys, the Maryland State Highway Administration, the U.S. Army Corps of Engineers, the Maryland Department of Natural Resources, the Maryland Department of the Environment, and other agencies. The observation wells used in this analysis are operated in cooperation with the Maryland and Delaware Geological Surveys. The USGS publishes data for 128 streamflow stations and 379 wells across Maryland and Delaware.

The USGS, a Bureau within the Department of the Interior, is the Nation's largest water, earth and biological science, and civilian mapping agency providing reliable, impartial scientific information to resource managers, planners, and other customers. This information is gathered in every state by USGS scientists to minimize the loss of life and property from natural disasters, contribute to the sound conservation and the economic and physical development of the Nation's natural resources, and enhance the quality of life by monitoring water, biological, energy, and mineral resources.

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