# News Release

**U.S. Department of the Interior**
**U.S. Geological Survey**

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## Flow to Chesapeake Bay in Water Year 2003 Second Highest Since 1937

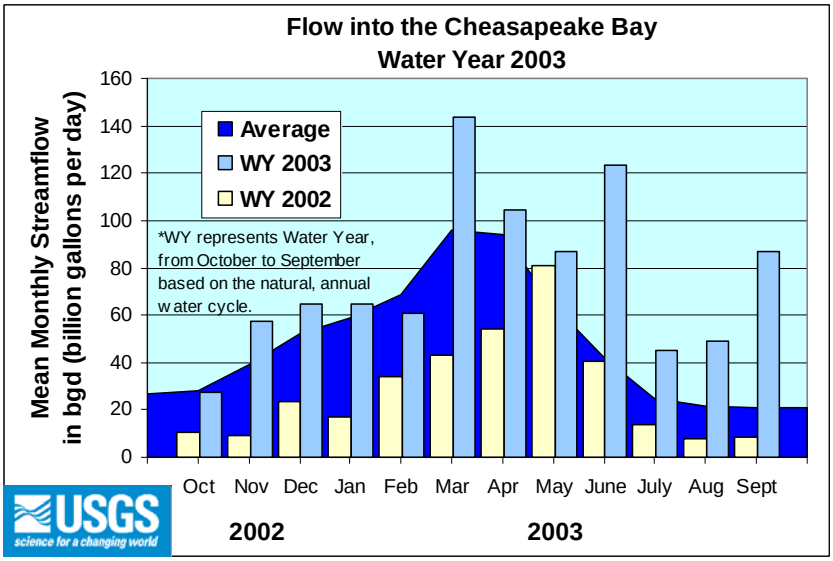
September 2003 was a month of excessively high rainfall and water levels throughout Maryland, Delaware, and Washington, D.C. Precipitation over the last 12 months has been far above normal levels, which has led to the highest September groundwater levels in 40 years, high streamflow levels and flooding, and near record-setting high flow into the Chesapeake Bay for the 2003 Water Year, according to hydrologists at the U.S. Geological Survey (USGS).

The water year (WY) is the natural, annual water cycle from October through September that is used by hydrologists. Streamflow and groundwater levels are generally at their lowest levels at the end of September and the recharge cycle begins again in October when water levels begin to rise because there is less demand for water from plants and people.

### High Flows to the Chesapeake Bay

The mean monthly flow to the Chesapeake Bay for the 2003 water year (October 2002 through September 2003) averaged 76.2 bgd (billion gallons per day), which is the highest level since record keeping began in 1937. The highest flow was during WY 1972 with 78.1 bgd. The average flow for a water year is 50.8 bgd. During WY 2002, the flow to the Bay was 28.6 bgd.

The graph below compares the mean monthly flow into the Bay during WY 2002 and WY 2003 to the long-term average level. The extreme lows to highs from one year to the next are unprecedented.



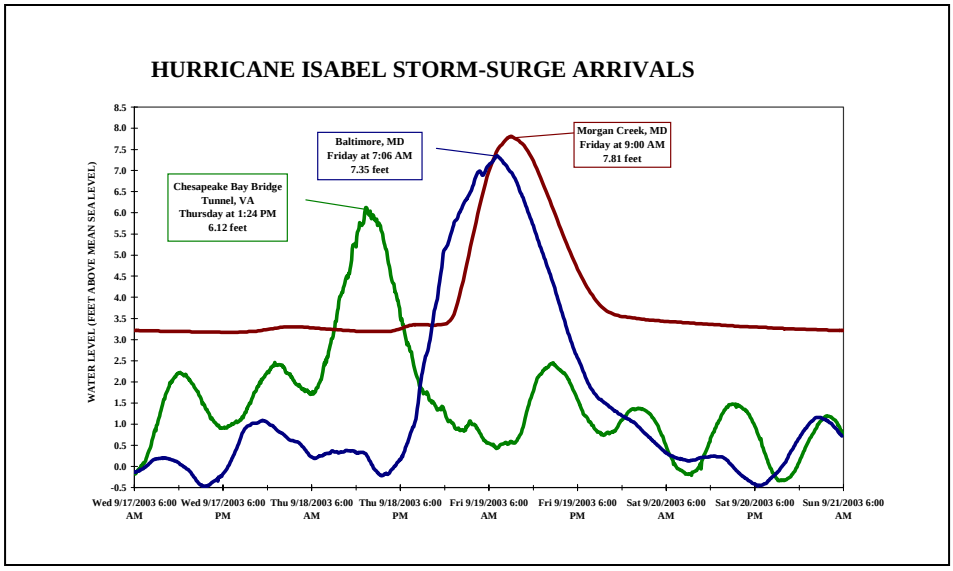

In WY 2002, the flow was below average every month except May and near-record low levels (based on 66 years of data) were set in August and September 2002. During WY 2003, 10 out of the 12 months were above average and flow in March, June, and September was especially high. Near record highs were set in June, July, August, and September. The flow to the Bay during September was about 4 times higher than average at 86.9 bgd, which was the third highest on record for September. The table below ranks the monthly flow values.

| Month | 2003 | 2002 |
|---|---|---|
| June | Second Highest | |
| July | Third Highest | |
| August | Fourth Highest | Third Lowest |
| September | Third Highest | Fifth Lowest |

## Tropical Storm Isabel and Storm Surge

Tropical Storm Isabel engulfed the Mid-Atlantic on September 18 and 19, 2003 and brought a storm surge to the Chesapeake Bay that caused flooding on the shores of the Bay. The graph below shows the tidal water-level fluctuations and the storm-surge peak. The surge arrived at the mouth of Chesapeake Bay in Virginia at 6:24 PM (green line) and was rose to 6.12 feet above sea level. The storm surge took more than 18 hours to travel from the mouth of the Chesapeake Bay to the Baltimore area (blue line), where the water level reached its maximum of 7.36 feet. The storm surge not only affected the Bay, but went up into the tributaries that drain to the Bay, which are not usually influenced by tides. For example, Morgan Creek (red line) on the Eastern Shore of Maryland experienced tidal effects from the surge.

This storm-surge arrival graph is based on data collected by the U.S. Geological Survey (Morgan Creek, USGS station 1492500) and the National Oceanic and Atmospheric Administration (Chesapeake Bay Bridge Tunnel, NOAA station 8638863 and Baltimore at Fort McHenry, NOAA station 8574680).

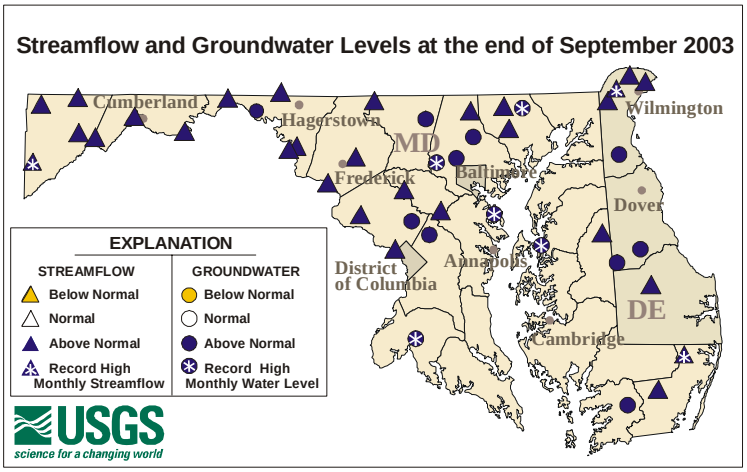



## Impacts of High Flows to the Chesapeake Bay

High river flow during 2003 has contributed large amounts of nutrients and sediment to the Bay causing near-record low dissolved-oxygen levels and the water is less clear. The low dissolved-oxygen levels have caused fish kills in some Bay tributaries. The increased amount of nutrient and sediment have also clouded the waters in the Bay and likely will cause a decrease in the amount of submerged grasses in the Bay next year. The grasses may also be impacted by additional sediment from shoreline erosion during tropical storm Isabel. The full extent of underwater grasses lost will not be known until next year when surveys are conducted. The grasses had shown an increase from 1999-2002 due to smaller amounts of nutrients and sediment entering the Bay. This smaller amount of nutrients and sediment was attributed to both the drought and management actions. More information about streamflow, water quality, and the Chesapeake Bay can be found at http://chesapeake.usgs.gov/ and www.chesapeakebay.net.

## Hydrologic Conditions in Maryland, Delaware, and Washington D.C.

Nearly twice the amount of normal rainfall fell in September. Rainfall at the Baltimore-Washington International (BWI) Airport from January to September 2003 was 14.96 inches above normal, and already exceeds the normal annual rainfall level (41.94 inches), according to the National Weather Service. Many months of above normal rainfall have led to above normal water levels and the ground is saturated. When it rains, the water has almost nowhere to go so it accumulates in depressions or becomes runoff, filling our waterways. The high water levels leave the region vulnerable to flooding. Above normal rainfall has left groundwater and streamflow levels across Maryland and Delaware at very high levels.



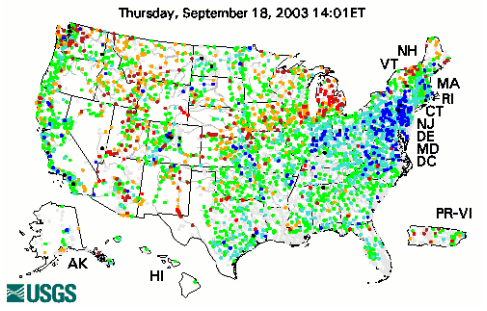

This map shows that at the end of September, all wells and streams measured by the USGS are at above normal levels (dark circles and triangles). Many of these streams and wells have been above normal for many months. Five wells are at their highest levels for September in 40 years (represented by an asterisk). Three streams had the highest monthly flow since record-keeping began.

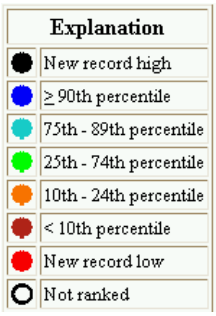
For news release and images, go to http://md.water.usgs.gov/publications/press_release/current/

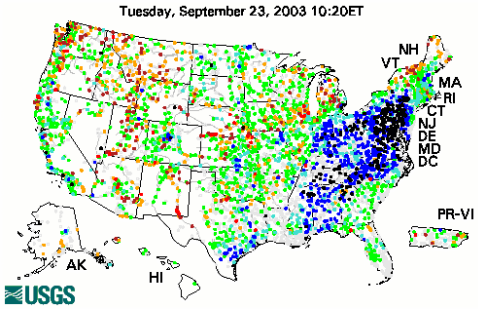
## Streamflow

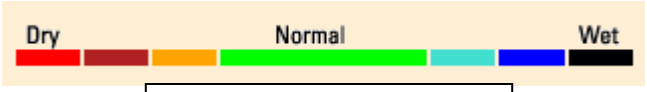
Streamflow across Maryland and Delaware has been above normal for many months. Several rivers reached flood stage during September, including the Potomac and Monocacy Rivers. Monthly record highs were set in Maryland on the Youghiogheny River in Garrett County, and the Choptank River and Pocomoke River on Maryland's Eastern Shore, and White Clay Creek in New Castle County, Delaware. Five-year monthly streamflow hydrographs from the USGS stream-gaging network can be viewed on the USGS website at http://md.water.usgs.gov/surfacewater/streamflow/.

The maps below show the status of real-time streamflow measurements before and after tropical storm Isabel (September 18) and the rainfall on September 22. The colors represent the percentile where the recent data fall in comparison to the historical record. Green is normal; blue and black are above normal. Black is a new daily high streamflow. Notice the change in streamflow ranking from before and after tropical storm Isabel and the September 22 rainfall. Current and historical streamflow data can be monitored on the web at http://waterdata.usgs.gov/nwis/rt.



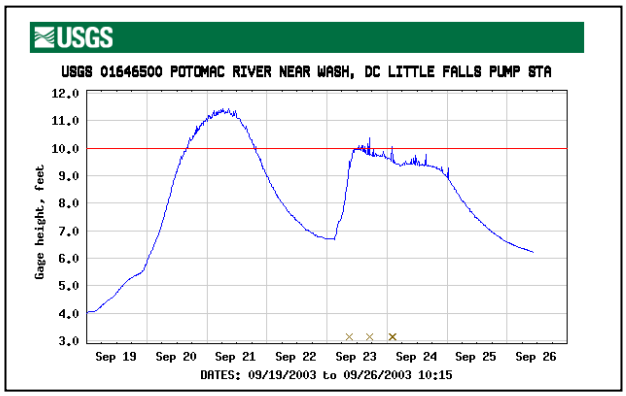




http://waterdate.usgs.gov

## Potomac River

The Potomac River Basin experienced 2 to 3 times the normal amount of rainfall in September, which resulted in 10 times the normal streamflow for September. The average monthly streamflow for September 2003 near the Potomac River near Washington, D.C. was 21.3 bgd, which is far above the normal streamflow of 2.2 bgd.

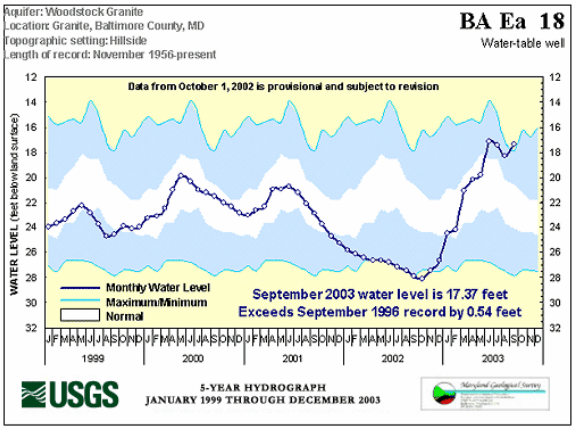
During WY 2003, average streamflow at the Potomac River near Washington, D.C. was the second highest since record-keeping began in 1930. The previous water year, WY 2002, had the lowest streamflow on record. Streamflow on the Potomac River at Paw Paw was the highest water year flow since 1938.




The Potomac River level exceeded flood stage (red line) during tropical storm Isabel and neared the flood stage with subsequent rainfall 4 days later. Streamflow has been above average every day since February 2003.

## Groundwater

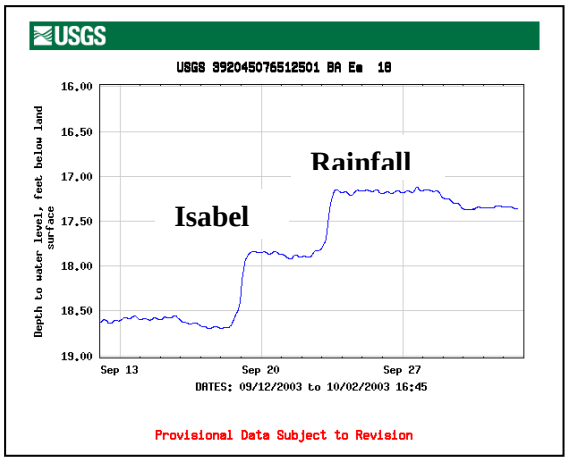
Groundwater levels are usually at their lowest levels near the end of September (end of the water year), yet the current water levels are at levels typically seen during spring. The water levels are elevated from the abundant rainfall this year. Groundwater levels in wells used by the USGS to monitor climatic conditions in the bi-state region were all at above normal levels, and wells in Anne Arundel, Baltimore, Charles, Harford, Prince George's, and Queen Anne's Counties, Maryland reached the highest September level in 40 years. Last September, nine wells had set new monthly low records and seven of these were all-time record lows.




The hydrograph for a well in Baltimore County shows how the water level in the well, measured in depth below land surface, went from record-setting low levels in 2002 to record-setting highs only 1 year later. Recharge to this well has been remarkable. For 5-year hydrographs of groundwater levels for the climatic indicator wells, visit: http://md.water.usgs.gov/groundwater/.

Notice the groundwater response at this same well in Baltimore County to rainfall in the graph to the right. To monitor USGS real-time groundwater levels, visit the USGS NWISWeb site at: http://waterdata.usgs.gov/usa/nwis/rt

Select groundwater from the data category, then real-time, then your region of interest, such as Maryland. The USGS has recently equipped wells in Frederick and Washington Counties in Maryland with real-time data collection.



High groundwater levels and above normal rainfall helped to keep reservoir storage levels in the Baltimore reservoir system and in the Triadelphia and Duckett Reservoirs on the Patuxent River near capacity in September.

Streamflow and groundwater levels are used to assess the current water conditions and can be used to predict the potential for flooding and drought conditions. These USGS data have been provided to State and local water resource managers and are critical for making appropriate decisions on water regulation. For more information on streamflow and groundwater levels in Maryland and Delaware, see Water Watch at: http://md.water.usgs.gov/waterwatch/.

The Water Resources Discipline of the USGS, in cooperation with Federal, State, and local agencies, collects and publishes a large amount of data pertaining to the water resources of Maryland, Delaware, and Washington D.C. each water year (October 1 to September 30). The resulting annual report documents hydrologic data gathered from the USGS's surface-water and groundwater data-collection networks in each state. These data, accumulated during many water years, constitute a valuable database that can be used to develop an improved understanding of the water resources of the region. The water resource data are published annually in two volumes (surface water and groundwater) and data for the 2002 Water Year is now available at http://md.water.usgs.gov under "publications".

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, Baltimore County, and other agencies. The observation wells used in this analysis are operated in cooperation with the Maryland and Delaware Geological Surveys. The real-time wells are operated in cooperation with the Maryland and Delaware Geological Surveys and the Interstate Commission on the Potomac River Basin. The USGS publishes data for 137 streamflow stations and 379 observation wells across Maryland and Delaware.

The USGS serves the Nation by providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.

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