U.S. Geological Survey (USGS) Maryland-Delaware-District of Columbia
Monthly Water Conditions Summary

November 2011

Why is it important for the USGS to collect and analyze water-resources data?

USGS water data is valuable to the public, researchers, water managers, planners, and agricultural users, especially during floods and droughts. These data can be used to assess how water resources respond to changes in climate. Scientists at the USGS have measured streamflow and groundwater levels in wells to assess water resources for over 125 years.

In addition to providing the most extensive set of historical streamflow and groundwater data available to the public, the USGS collects water data and quality-assures the data by employing standardized techniques across the country. The uniformity of the dataset allows for multi-state comparisons and other comparative statistical analyses that better inform policy makers of the possible water resource conditions they might encounter in the future.

The sites used in this water summary were carefully selected to show the response of streamflow and groundwater levels to precipitation. Ideally, these sites will show no effects from human influences. The streamflow and groundwater data are ranked in comparison to the historical record and summarized. Precipitation and reservoir data are also presented to give a more complete picture of the region's water resources.

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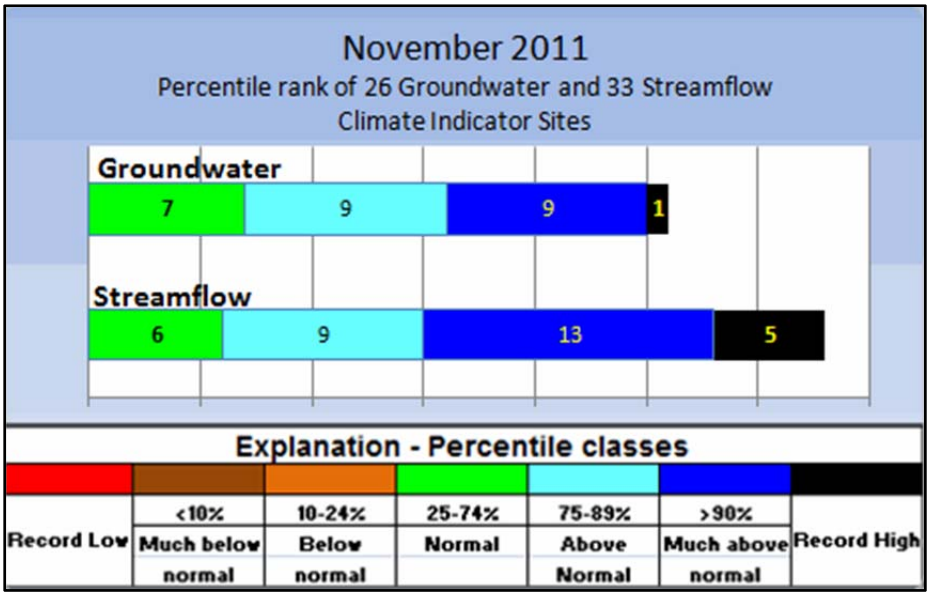
Although November rainfall was below normal in Baltimore and the District of Columbia, many streamflow and groundwater levels in the Mid-Atlantic region were still showing effects from the heavy rain and runoff from Hurricane Irene and Tropical Storm Lee in August and September.



Monthly mean streamflow set record highs at five sites and the groundwater level in one well was at a record high November level. Streamflow and groundwater levels in the remaining streams and wells were normal to above normal at all sites monitored by the USGS to assess the response to climatic conditions in Maryland, Delaware, and the District of Columbia region. This has been an unusually wet fall, requiring many more indirect (high-water) measurements than during most years.

A **percentile** is a value on a scale from 0 to 100 that indicates the percent of a distribution that is equal to or below it. For example, a groundwater level in the 90th percentile is equal to or greater than 90 percent of the values recorded for that month.

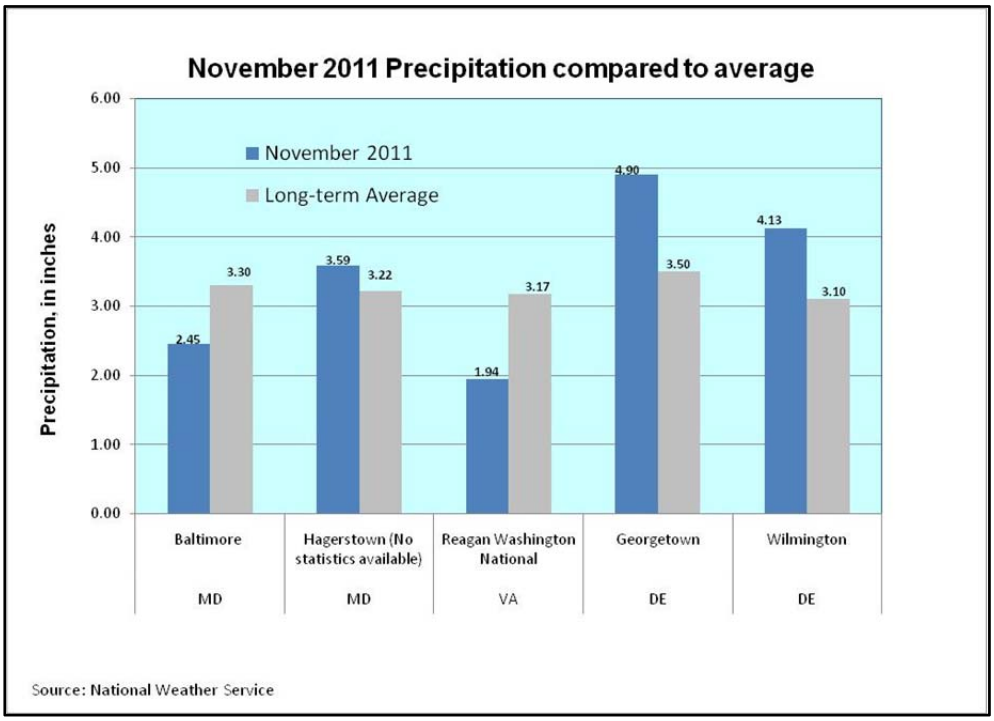
Precipitation

November rainfall was above the long-term average at National Weather Service (NWS) stations in Hagerstown, Maryland and the Georgetown and Wilmington weather stations in Delaware. Rainfall was 0.85 inches below normal at Baltimore/Washington International Thurgood Marshall Airport and 1.23 inches below normal at Ronald Reagan Washington National Airport weather station.

The Middle Atlantic River Forecast Center's 365-day precipitation data show that precipitation in all counties west of Anne Arundel and Baltimore Counties in Maryland was within the long-term normal range.

The following four counties in Maryland had precipitation above the normal range for the past 365 days: Anne Arundel, Baltimore, Harford, and Cecil Counties. Precipitation in New Castle County in Delaware was also above the long-term average as of November.

Cecil County has the highest precipitation surplus with 18.3 inches, and Worcester County has the largest precipitation deficit with 6.4 inches.



Note from the National Weather Service: September *2011 was the first month to incorporate the new 1981--2010 climate normals that were calculated by the National Climatic Data Center. The new normals replaced the 1971--2000 normals.*

Sources:
National Weather Service
MD and DC: http://www.weather.gov/climate/index.php?wfo=lwx
DE: http://www.erh.noaa.gov/phi/
Middle Atlantic River Forecast Center (MARFC): http://www.weather.gov/marfc/Precipitation/Departures

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Streamflow

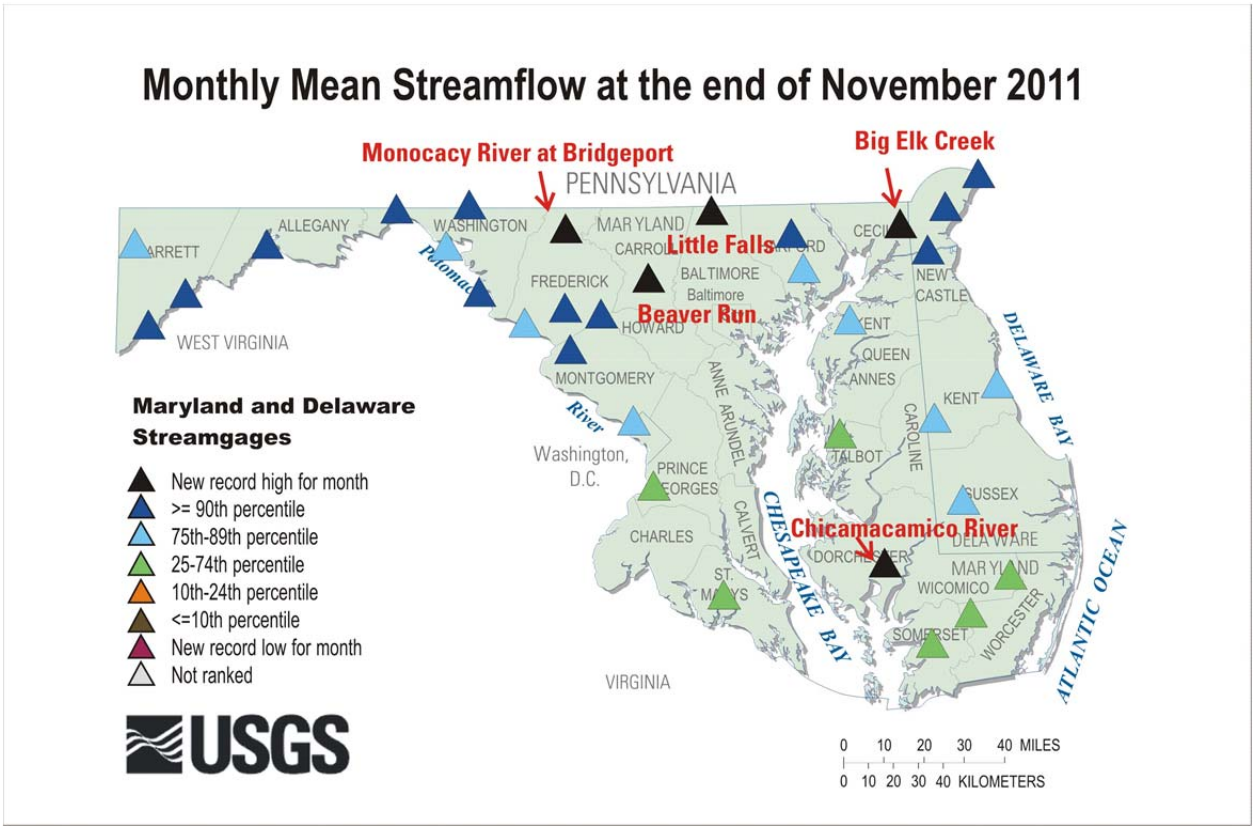
Streamflow data are used for many purposes. A few of the most obvious uses are to assess water supply and the risk of droughts and floods. Streamflow data are also used to calculate loads of chemical constituents and to assess how biological communities are affected by hydrologic conditions. The USGS operates the most extensive network of streamgages in the region.

The streamflow locations chosen for the monthly water summary were selected based on the following criteria:

- Minimum period of record is 10 years of continuous data;
- Watersheds greater than 5 square miles;
- Streamflow is not regulated, or has relatively natural flow;
- Streamflow data reflects climatic conditions; and
- The surrounding area and watershed are not urban.

Streamflow for November 2011

November monthly mean streamflow was above normal in 27 of the 33 sites used to monitor climatic response in Maryland, Delaware, and the District of Columbia. Five of these streams set record-high monthly mean streamflows for November and they are shown as black triangles on the map. Four of the five sites were in northern Maryland. The six streams in the normal range in November were in southern Maryland, the lower Delmarva Peninsula.



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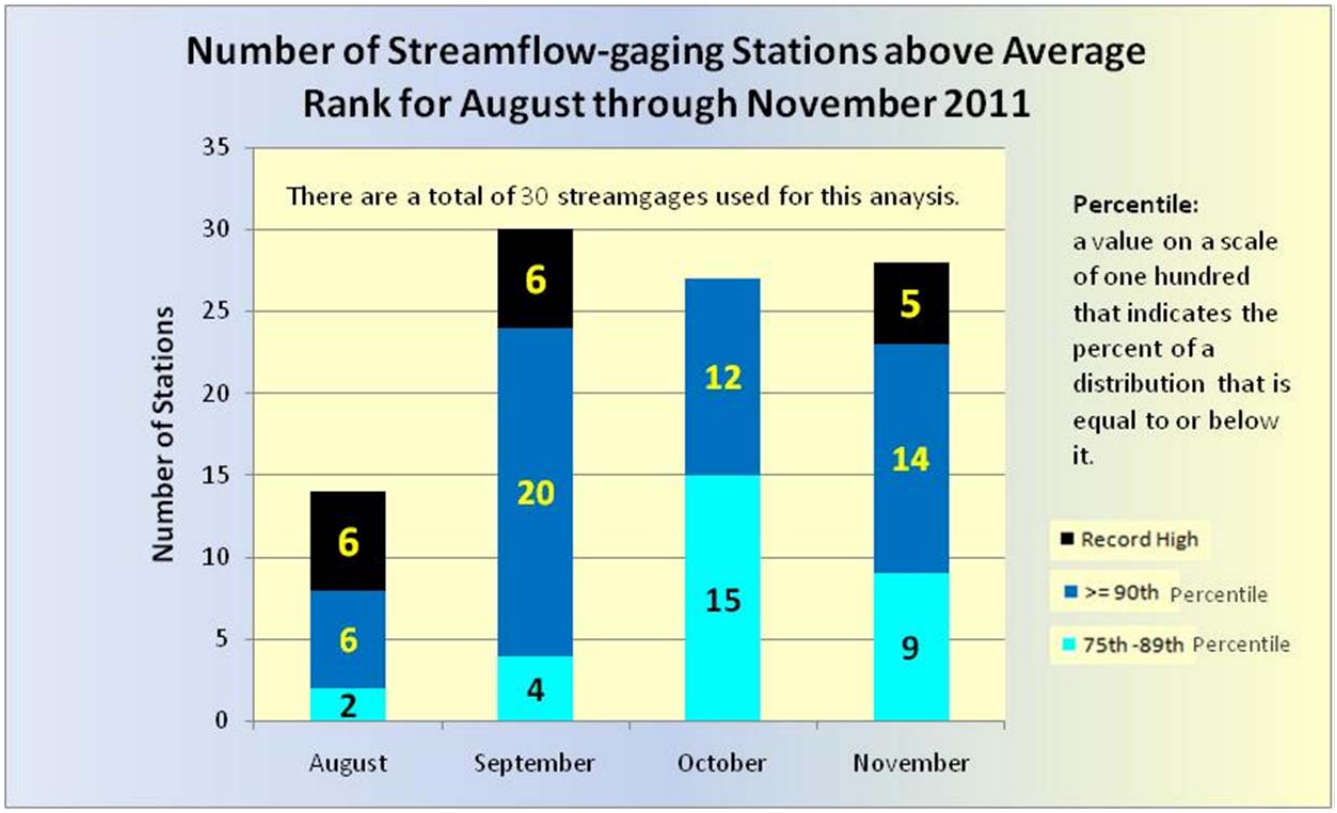
The table lists the five streamgage sites with record-high November monthly mean streamflow. Sites highlighted in yellow also set record-high monthly mean streamflow levels in September. The number of years of data collected is shown in the table, indicating that the November 2011 monthly mean streamflow was the highest November flow in that number of years.

November 2011 Record-High Monthly Mean Streamflows in Maryland-cubic feet per second (ft^3/s)							
Streamgage Number	Streamgage Site Name	County	November 2011 record high monthly mean streamflow (ft^3/s)	Previous November record high monthly mean streamflow (ft^3/s)	Year of previous November record high	Normal range of November monthly mean streamflow (ft^3/s)	Number of years of data
1586210	Beaver Run near Finksburg	Carroll	29.4	28.8	2006	9 - 17	29
1495000	Big Elk Creek at Elk Mills	Cecil	128	125	1996	37 - 70	79
1490000	Chicamacomico River near Salem	Dorchester	81.9	45.2	2003	9 - 20	40
1582000	Little Falls at Blue Mount	Baltimore	132	129	1971	37 - 70	67
1639000	Monocacy River at Bridgeport	Frederick	580	513	1985	53 - 309	69

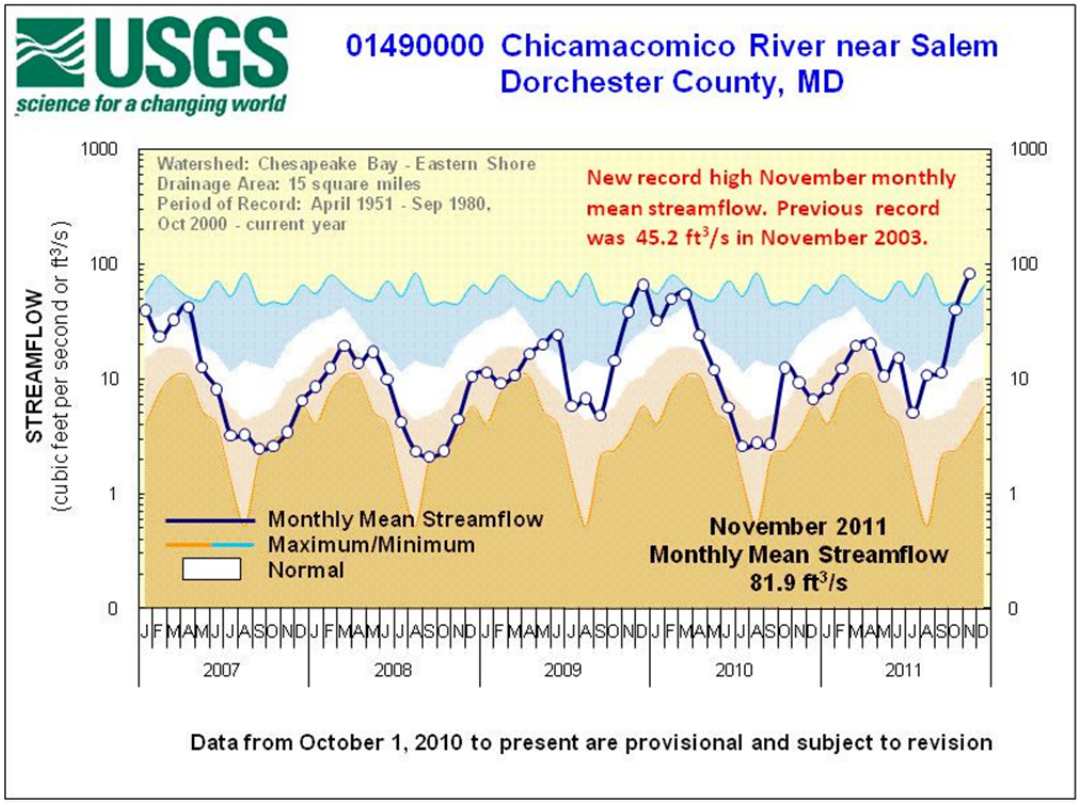
The bar graph shows the number of stations with record highs and high flows out of the total 30 streamflow stations used to monitor climatic conditions. Since August, with Hurricane Irene followed by Tropical Storm Lee, there have been an unusual number of high flows, with a total of 17 record high monthly mean streamflows.



The high flows have required an unprecedented amount of high-water-mark flagging measurements and computation of peak flows by indirect methods. Some of the high-flow activities over this 4-month period include:

- High-water-mark flagging (nearly 35 streamgages, some for multiple storms);
- Nearly 40 indirect discharge measurement surveys (in reaches where hydraulic computations can be done to determine peak flows);
- Redrawn and (or) extended stage-discharge ratings at stations based on direct and indirect discharge measurements;
- Direct discharge measurements and water-quality sampling during storms (Irene and Lee);
- Repairs to several damaged and flooded streamgages.

The November 2011 monthly mean streamflow on the Chicamacomico River on the Delmarva Peninsula set a record high at 81.9 ft^3/s (cubic feet per second). The previous November record was 45.2 ft^3/s in November 2003. Mean monthly streamflow in November 2011 was the highest November flow since record-keeping began at this site in 1951. The November monthly mean streamflow was close to the all-time highest monthly mean flow set in August of 1973 at 83 ft^3/s.



Five-year hydrographs can be viewed at:
http://md.water.usgs.gov/surfacewater/streamflow/

The dark line in the 5-year hydrograph represents the current monthly mean streamflow and the white band shows the normal range (25th to 74th percentile) based on the period of record. The maximum monthly mean streamflow is at the top of the blue shaded section, and the lowest monthly mean streamflow is at the top of the dark orange area.

Groundwater

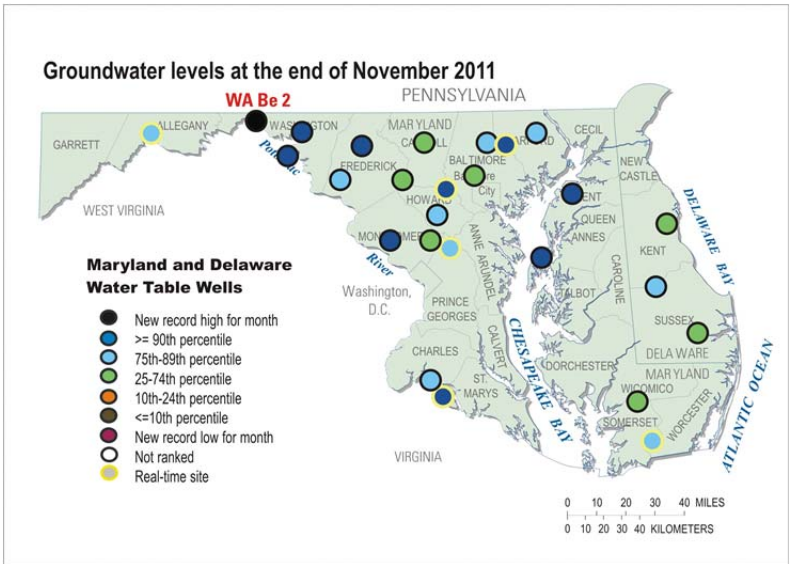
The USGS monitors groundwater levels in unconfined aquifers, providing observations that can be compared to both short-term and long-term changes in climatic conditions. Twenty-six groundwater wells were selected based on the following criteria:

- Located in an unconfined (water-table) aquifer;
- Open to a single, known hydrogeologic unit/aquifer;
- Groundwater hydrograph reflects changes in climatic conditions;
- No indicated nearby pumpage and likely to remain uninfluenced by pumpage, regulated streamflow or changes related to human activities;
- Minimum period of record is 10 years of continuous/monthly records;
- Minimally affected by irrigation, canals, drains, pipelines, and other potential sources of artificial recharge;
- Well has casing--dug wells not used;
- Water levels show no apparent hydrologic connection to nearby streams;
- Well has never gone dry; and
- Long-term accessibility likely.

November 2011 Groundwater Levels

Groundwater levels were normal to above normal throughout Maryland and Delaware in November. The groundwater level in one monitoring well in Washington County, Maryland was at the highest November level since record-keeping began in 1949.

Another nine wells had groundwater levels in the highest 90th percentile. Across Maryland and Delaware, 73 percent of groundwater levels (19 of the 26 wells) used by the USGS to assess climatic conditions in the region had above normal water levels. There were no below normal groundwater levels in November 2011.



To access the clickable groundwater map, go to:
http://md.water.usgs.gov/groundwater/web_wells/current/water_table/counties/index.html

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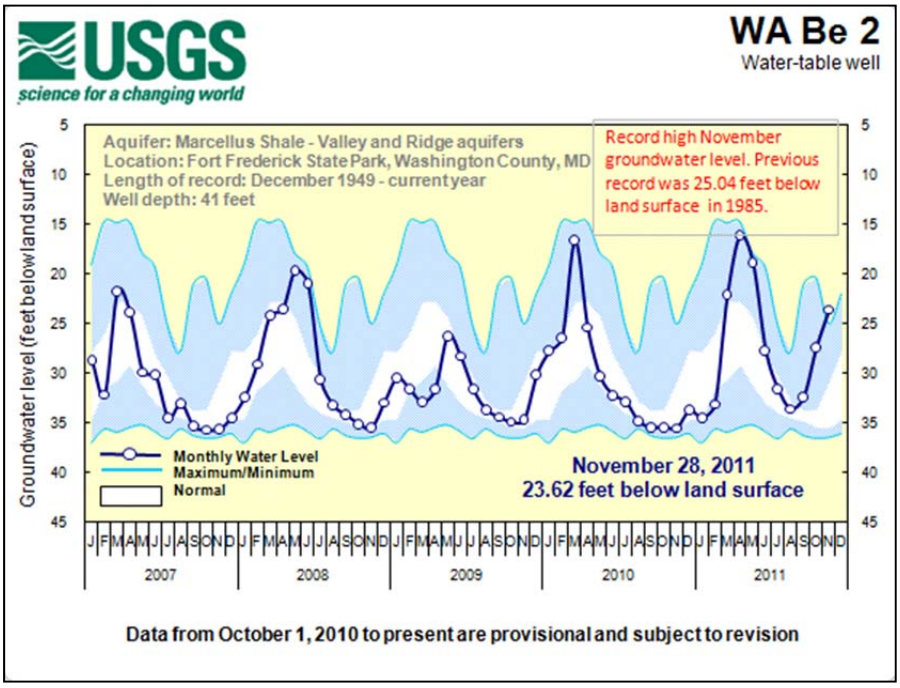
Rainfall during the wet autumn, which included abundant rain from Hurricane Irene and Tropical Storm Lee, has contributed to high groundwater levels. Observation well WA Be 2 in Washington County, Maryland reached a record high November water level of 23.62 feet below land surface this November. The previous record high of 25.04 feet was set in 1985. Data collection began at this well in 1949.



Five-year groundwater hydrographs can be viewed at:
http://md.water.usgs.gov/groundwater/web_wells/current/water_table/counties

The 5-year hydrograph shows groundwater levels as a dark line, the maximum and minimum monthly values, and the normal range (between the 25th and 74th percentiles) as a white band based on the period of record. The maximum water level is at the top of the blue section and the minimum water level is at the bottom of the blue section in the graph.

Reservoir Levels

All regional reservoirs were full at the end of November 2011. Storage in the Baltimore reservoirs (Loch Raven, Liberty, and Prettyboy) was at 100 percent of available storage capacity, or 75.85 billion gallons.

Storage in the Triadelphia and Duckett Reservoirs, which serve parts of Howard, Montgomery, and Prince George's Counties in suburban areas around the District of Columbia, remains at 100 percent of normal storage capacity, with 11.28 billion gallons of water at the end of November.

November 2011	Percent available/ normal storage	Volume (billion gallons)	Source
Baltimore Reservoirs			**Baltimore City – Environmental Services Division**
Liberty	100%	36.80	
Loch Raven	100%	21.20	
Prettyboy	100%	17.85	
Total	100%	75.85	

Patuxent Reservoirs			**Washington Suburban Sanitary Commission (WSSC)**
Triadelphia	100%	6.03	
Duckett	100%	5.25	
Total	100%	11.28	