

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

November 2016 Highlights: Record low November groundwater levels in Harford, Montgomery, and Washington Counties in Maryland. Fifty percent of groundwater levels and 30 percent of monthly mean streamflows were normal at sites monitored by the U.S. Geological Survey across Maryland, Delaware, and the District of Columbia.

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

USGS water data are 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 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 continues to collect water data and quality-assures the data using standardized techniques across the country. The uniformity of the dataset enables multi-state comparisons and other comparative statistical analyses that better inform policy makers of the possible water-resources conditions they might encounter in the future.

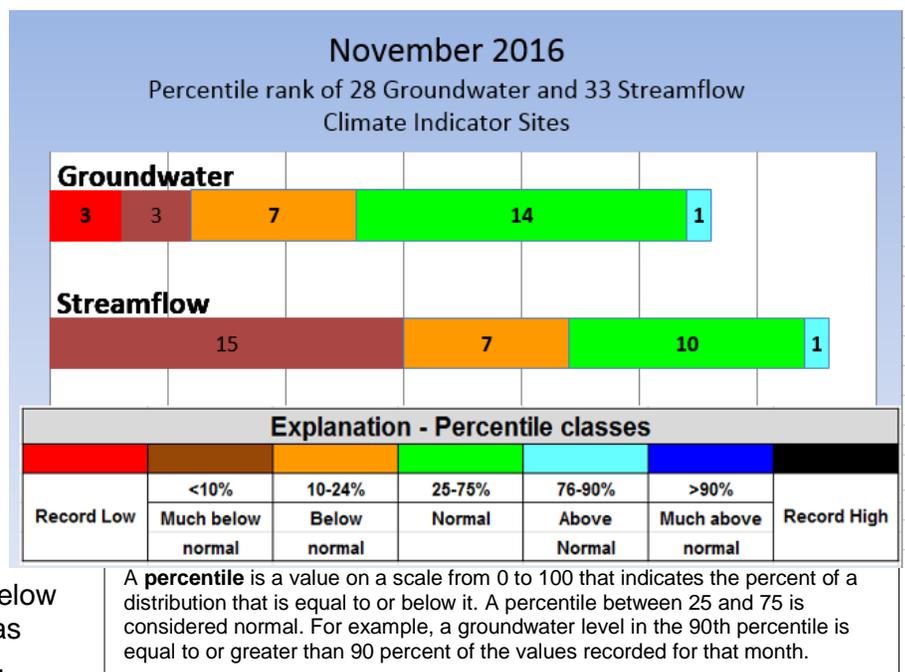
The sites used in this water summary were carefully selected to show the response of streamflow and groundwater levels to weather conditions. Ideally, these sites will show no effects from human influences. The streamflow and groundwater data are ranked in comparison to the historical record and summarized.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

USGS November 2016 Water Conditions Summary

Fifty percent of the groundwater levels and 30 percent of monthly mean streamflows were normal (25th-75th percentiles) in November at sites used to monitor the response of water resources to changes in climatic conditions in Maryland, Delaware, and the District of Columbia.

Groundwater levels were normal at 14 of the 28 USGS observation wells, and below normal at 13 wells, 6 of which were below the 10th percentile; 3 were at record November lows. The groundwater level was above normal at one USGS observation well.

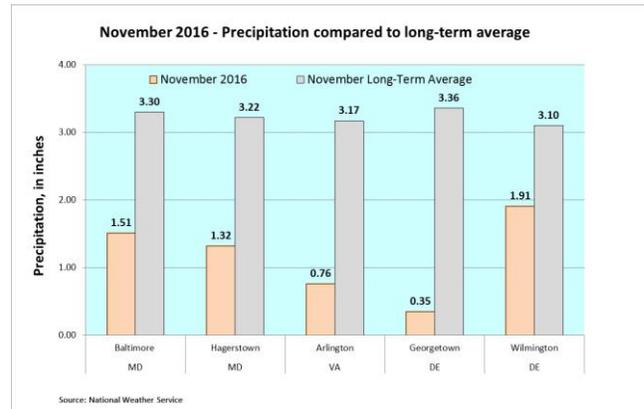
Monthly mean streamflow was normal at 10 of the 33 streamgages used to monitor climatic conditions. Streamflow was below normal at 22 streamgages, 15 of which were below the 10th percentile. Streamflow was above normal at one streamgage.



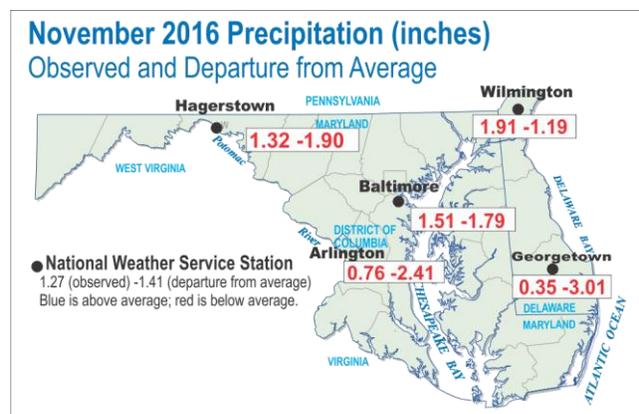
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November 2016 Precipitation and Weather

November precipitation was less than 2 inches and below the long-term average (shown as tan bars) at all five National Weather Service (NWS) Mid-Atlantic stations. Total November precipitation at the Georgetown, Delaware and Arlington, Virginia weather stations was below 1 inch, which is less than one-third the average monthly precipitation. Much of the rainfall fell during the last 2 days of the month; in Baltimore, 1.29 inches of the total 1.51 inches fell on November 29 and 30, 2016.



November precipitation was lowest at Georgetown, Delaware with 0.35 inches. The long-term average for November is 3.36 inches. Precipitation was 1.91 inches in Wilmington, Delaware, in November, which was the highest of the five weather stations.



National Weather Service Stations

- Baltimore =**
Baltimore/Washington International Thurgood Marshall Airport (BWI)
- Georgetown =**
Georgetown, Sussex County Airport
- Hagerstown =**
Hagerstown Regional Airport
- Arlington =**
Ronald Reagan Washington National Airport
- Wilmington =**
New Castle Airport

The Middle Atlantic River Forecast Center's (MARFC) 365-day precipitation totals for the District of Columbia and all counties in Maryland and Delaware were average to above average, except for Washington County, which was below average. Precipitation in 14 of the 26 counties in Maryland and Delaware were between the 10 percent above or below average. The Eastern Shore of Maryland and counties on the Delmarva Peninsula had precipitation ranging from 2.8 to 14.7 inches above average.

November temperatures were above average at all five Mid-Atlantic weather stations. The temperature range was 1.3 degrees Fahrenheit to 3.0 degrees above average at the five Mid-Atlantic NWS stations. The largest departure from average for the fifth consecutive month was at the weather station in Hagerstown, Maryland, where the average temperature was 48.3 degrees, or 3.4 degrees above average. The average temperature at this weather station was the lowest of the five weather stations at 48.3 degrees. The highest average November temperature was 52.5 degrees in Arlington, Virginia.

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

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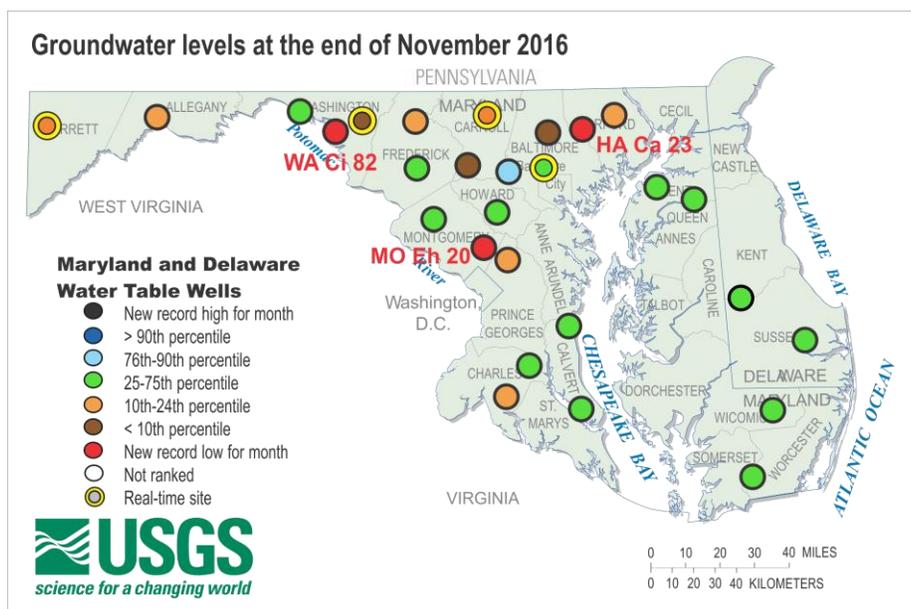
Groundwater

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. The groundwater wells used for the monthly water summary 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 a casing – dug wells are generally not used;
- Water levels show no apparent hydrologic connection to nearby streams;
- Well has never gone dry; and
- Long-term accessibility likely.

November 2016 Groundwater Levels

Fifty percent (14 of 28 wells) of the groundwater levels were in the normal range (25th-75th percentiles). Groundwater levels in USGS observation wells were at record November lows at three observation wells in Harford, Montgomery, and Washington Counties, Maryland. Groundwater was above normal at an observation well in Baltimore County, Maryland. There were six wells with groundwater levels below the 10th percentile in central Maryland. Groundwater levels on the Delmarva Peninsula were in the normal range.

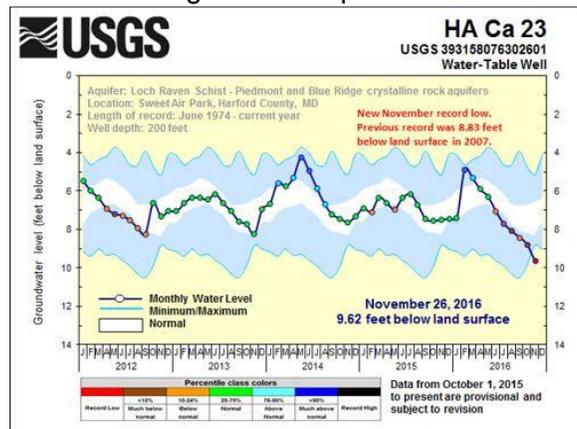


To access the clickable groundwater map, go to:
http://md.water.usgs.gov/groundwater/web_wells/current/water_table/counties/

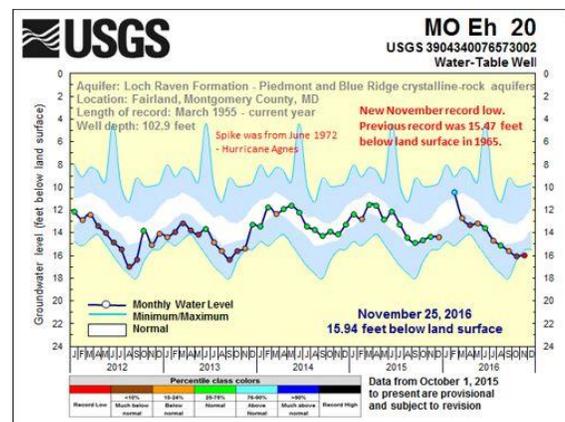
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The groundwater level in USGS observation wells HA Ca 23, MO Eh 20, and WA Ci 82 were at November record low levels, which reflects the lack of rainfall in the region for the past 2 months.

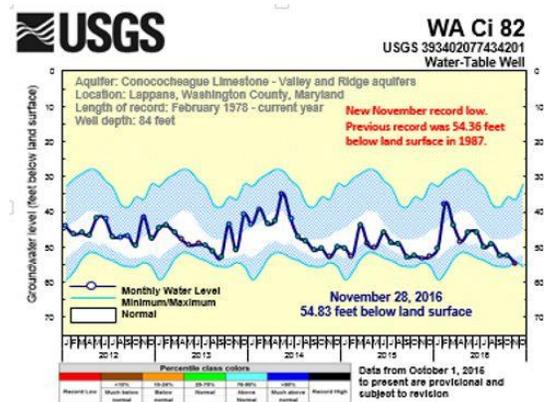
The groundwater level in USGS observation well HA Ca 23 in Harford County, Maryland was 9.62 feet below land surface in November, which was a record November low, and exceeded the previous record of 8.83 feet below land surface set in 2007 by 0.79 feet.



The groundwater level in USGS observation well MO Eh 20 in Montgomery County, Maryland was 15.94 feet below land surface in November, which was a record November low, and exceeded the previous record of 15.47 feet below land surface set in 1965 by 0.47 feet.



The groundwater level in USGS observation well WA Ci 82 in Washington County, Maryland was 54.83 feet below land surface in November, which was a record November low, and exceeded the previous record of 54.36 feet below land surface set in 1987 by 0.47 feet.



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 blue line, the minimum and maximum monthly values, and the normal range (between the 25th and 75th percentiles) as a white band based on the period of record. The maximum water level is at the top of the upper blue section and the minimum water level is at the bottom of the lower blue section in the graph. Each monthly measurement is colored according to the percentile rank in which it falls for the month. These data are provisional and subject to revision.

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Streamflow

Streamflow data are used for many purposes. A few of the most common 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 assess how biological communities are affected by hydrologic conditions. The USGS operates the most extensive network of streamgages in the region.

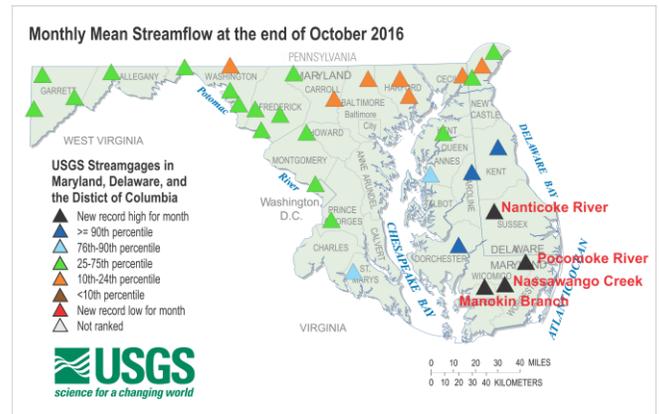
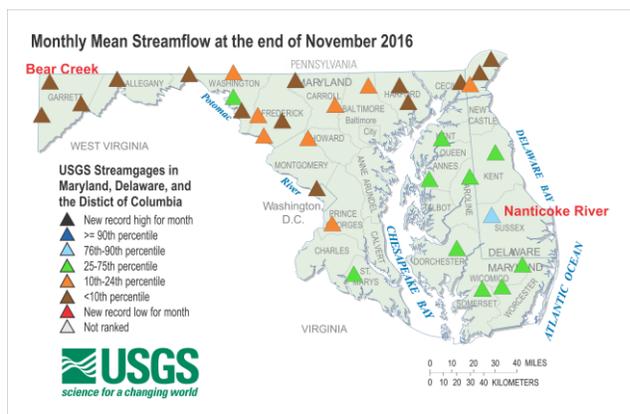
The streamflow locations chosen for the monthly water summary were selected based on the following criteria:

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

November 2016 Streamflow

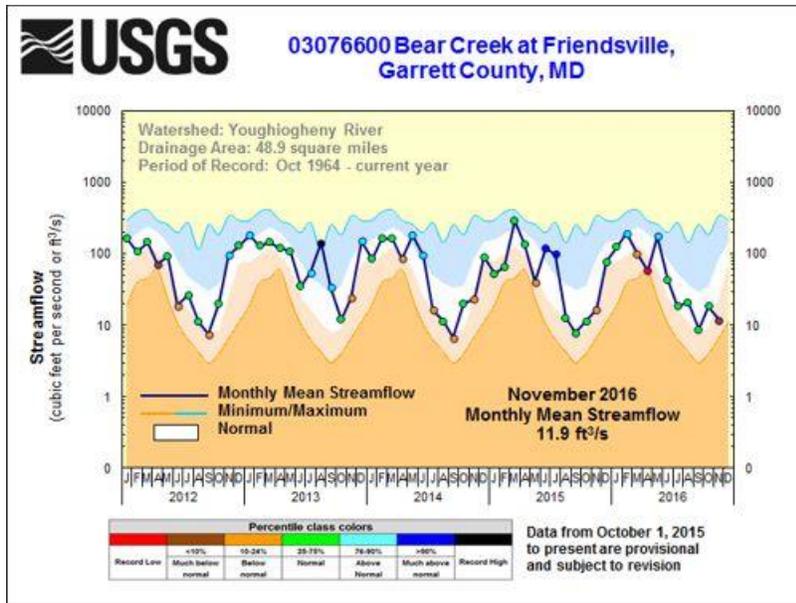
Monthly mean streamflow ranged from below normal, with many levels below the 10th percentile, to above normal at one site in November at USGS streamgages used to monitor climatic conditions in Maryland, Delaware, and the District of Columbia. The maps below show the ranking of monthly mean streamflow at streamgages in October and November 2016 to illustrate the dramatic difference between the 2 months. If the Delmarva Peninsula had not received above normal precipitation at the end of September, the [October-November](#) monthly mean streamflow may have been below normal. Monthly mean streamflow decreased in November at the four streamgages that were setting record highs in October, however, streamflow on the Nanticoke River in Delaware was above normal in November (between the 75th and 89th percentiles).

Streamflow was below normal in 67 percent of the streamgages in Maryland and Delaware, especially in central and western Maryland and northern Delaware in November. Monthly mean streamflow was in the less than 10th percentile at 15 streamgages, and between the 10th and 24th percentiles at 7 streamgages. Thirty percent (10 of 33) of the monthly mean streamflows were in the normal range (25th-75th percentiles) in November.



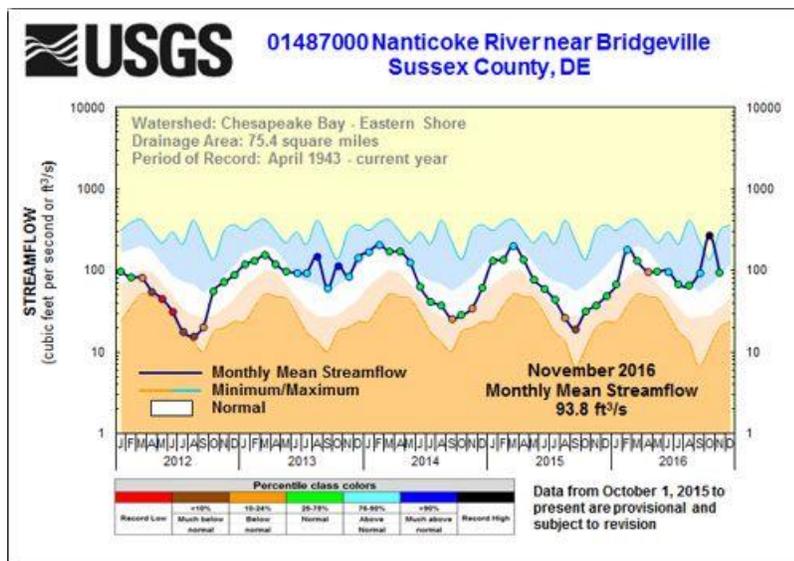
To access the clickable streamflow map, go to:
<http://md.water.usgs.gov/surfacewater/streamflow/>

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Monthly mean streamflow on Bear Creek near Friendsville in Garrett County, Maryland was below normal at 11.9 ft³/s. The value had been normal in October. Similar decreases in streamflow were seen throughout Maryland, Delaware, and the District of Columbia.

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



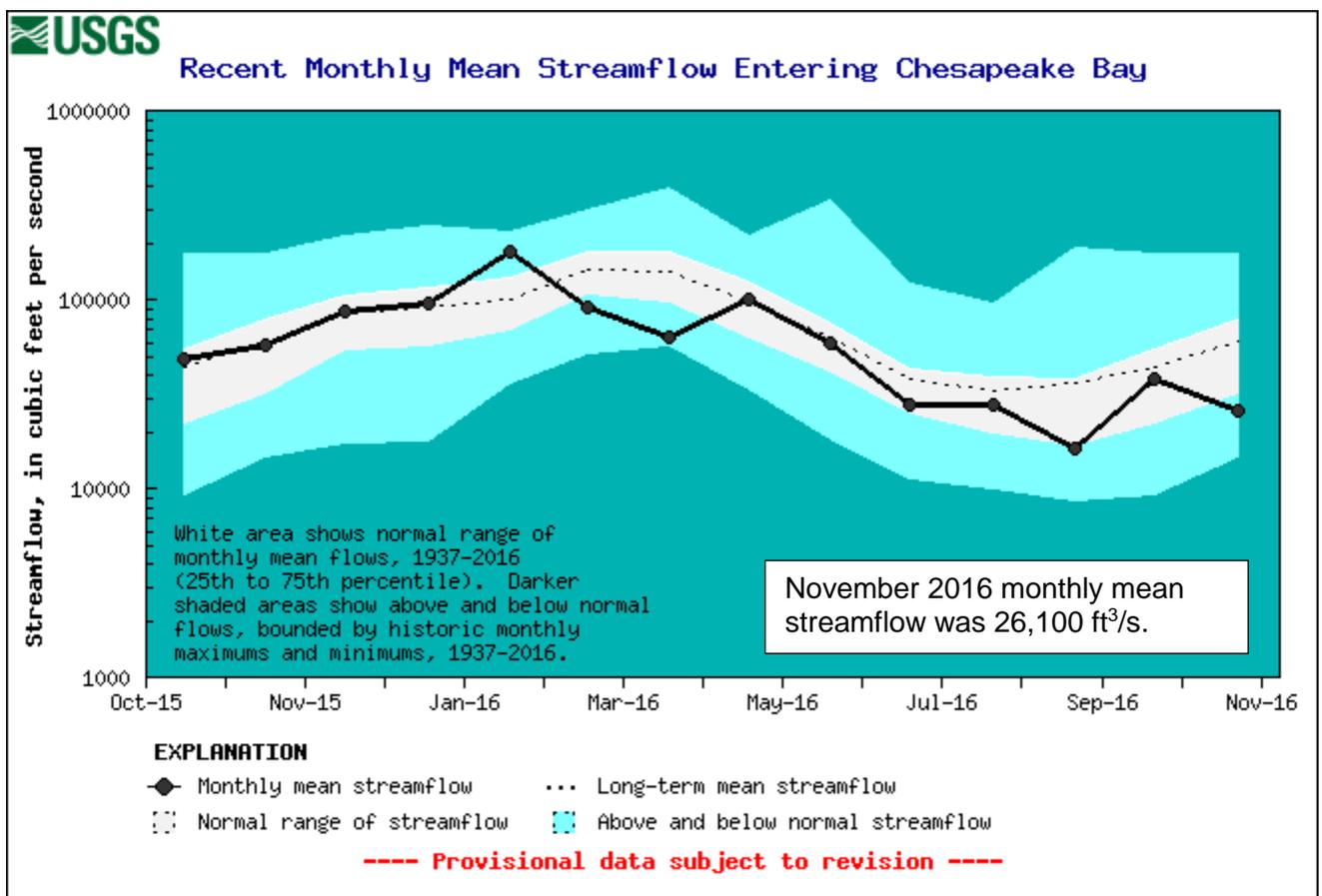
Monthly mean streamflow on the Nanticoke River near Bridgeville in Sussex County, Delaware was above normal at 93.8 ft³/s. The value had been at a record high in October.

The dark line in the 5-year hydrograph represents the monthly mean streamflow for this period and the white band shows the normal range (25th-75th percentiles) 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. Each monthly mean measurement is colored according to the percentile rank in which it falls for the month.

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Estimated Streamflow to the Chesapeake Bay

The USGS estimates monthly mean freshwater streamflow to the Chesapeake Bay using streamflow measurements from the Susquehanna, Potomac, and James Rivers. In November 2016, the monthly mean freshwater flow to the Chesapeake Bay was 26,100 cubic feet per second (ft³/s; provisional, and subject to revision), which is in the below normal range. The long-term November average (mean) is 60,900 ft³/s, and the normal range is between 31,800 ft³/s and 78,000 ft³/s, the 25th and 75th percentiles of all November values. These provisional statistics are based on a 80-year period of record.



Runoff in the Chesapeake Bay watershed carries pollutants, such as nutrients and sediment, to rivers and streams that drain to the Bay. The amount of water flowing into the Chesapeake Bay from its tributaries has a direct impact on how much pollution is in the estuary and it also affects the salinity levels that are important for fish, crabs, and oysters. Generally, as river flow increases, it brings more nutrient and sediment pollution to the Bay.

More information on freshwater flow to the Bay can be found here:
<http://md.water.usgs.gov/waterdata/chesinflow/>

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Baltimore and Patuxent Reservoir Levels

Available reservoir storage at the end of November 2016 in the Baltimore reservoirs (Loch Raven, Liberty, and Prettyboy) was 88.72 percent of available storage capacity, or a total of 67.07 billion gallons of water. The Baltimore City Environmental Services Division manages the Baltimore reservoirs.

Total normal storage in the Triadelphia and Duckett Reservoirs, which serve parts of Howard, Montgomery, and Prince George's Counties in suburban Maryland around the District of Columbia, was 55.06 percent of normal storage capacity at the end of November 2016, with 5.88 billion gallons of water.

Not all of the water in the Patuxent Reservoirs is usable; for operational purposes, percent of normal storage capacity is used, but this value can exceed 100 percent of the usable storage. In the graph below, 100 percent is the maximum. The Washington Suburban Sanitary Commission (WSSC) manages the Patuxent reservoirs.

November 2016	Percent available/normal storage	Volume (billion gallons)
Baltimore Reservoirs		
Baltimore City – Environmental Services Division		
Liberty	86.17%	31.71
Loch Raven	96.51%	20.46
Prettyboy	83.47%	14.90
Total	88.72%	67.07
Patuxent Reservoirs		
Washington Suburban Sanitary Commission (WSSC)		
Triadelphia	61.42%	3.44
Duckett	48.69%	2.44
Total	55.06%	5.88

