Extreme Drought: Summary of Hydrologic Conditions in Georgia, 2012

The U.S. Geological Survey (USGS) Georgia Water Science Center (GaWSC) maintains a long-term hydrologic monitoring network of more than 330 real-time streamgages, including 10 real-time lake-level monitoring stations, 63 real-time water-quality monitors, and 48 water-quality sampling stations. Additionally, the GaWSC operates more than 180 groundwater monitoring wells, 42 of which are real-time. One of the many benefits from this monitoring network is that the data analyses provide a well distributed overview of the hydrologic conditions of creeks, rivers, reservoirs, and aquifers in Georgia.

Streamflow and groundwater data are verified throughout the year by USGS hydrographers, and this information is available to water-resource managers, recreationalists, and Federal, State, and local agencies. Hydrologic conditions are determined by comparing the results of statistical analyses of the data collected during the current water year[1] (WY) to historical data collected over the period of record. Changing hydrologic conditions emphasize the need for accurate, timely data to help Federal, State and local officials make informed decisions regarding the management and conservation of Georgia's water resources for agricultural, recreational, ecological, and water-supply needs and for use in protecting life and property.

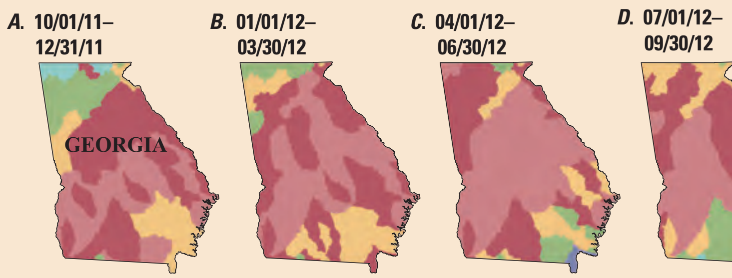
Persistent drought conditions continued in the 2012 WY. By January 2012, over 50 percent of Georgia was experiencing D3 (extreme) drought conditions. The 9-month period of January–September ranked as the 6th warmest on record for Georgia (Dunkley, 2012). Some drought relief was experienced in the far southern part of the State because of tropical storm activity, including Hurricane Isaac in August 2012; however, the majority of the State experienced 50 to 75 percent of normal precipitation for the year. Several streamgages with 20 or more years of record experienced record low flows, including record low annual mean discharges at USGS stations 02210500 Ocmulgee River near Jackson (58 years of record), 02223500 Oconee River at Dublin (60 years of record), and 02226000 Altamaha River at Doctortown (81 years of record).

[1]Water year is the period October 1 through September 30 and is designated by the year in which it ends. For example, the 2012 water year began on October 1, 2011, and ended on September 30, 2012.

Streamflow and Groundwater Data

Daily, monthly, and yearly streamflow statistics from the 2012 USGS annual data report (ADR; U.S. Geological Survey, 2012a) were used to develop this summary. Data for WYs 1999–2012 can be accessed online at *http://ga.water.usgs.gov/publications/pubswdr.html*. A digital map at *http://maps.waterdata.usgs.gov* allows the user to search for current and historical data and graphics collected as part of the USGS monitoring network.

Quarterly Hydrologic Conditions in Georgia for 2012 WY, Based on Drainage Basin Runoff



EXPLANATION

Percentile classes

- Highest
- Much above normal, >90
- Above normal, 76 to 90
- Normal, 25 to 75
- Below normal, 10 to 24
- Much below normal <10
- Lowest

These maps represent hydrologic conditions during the 2012 WY compared to available historical data. Runoff was calculated for each basin and presented as uniform over the entire basin area. Only streamflow stations with a complete daily-flow dataset for the 2012 WY were used (U.S. Geological Survey, 2012b). For the first quarter of the 2012 WY *(A)*, the southern part of the State was observing "much below normal" and "lowest" runoff conditions, while the northern portion of the State was observing "normal" to "above normal" runoff. During the third quarter of the 2012 WY *(C)*, the majority of the State received below normal precipitation and observed record high temperatures and runoff was some of the lowest on record; however, the southeastern corner of the State received above normal precipitation because of Tropical Storm Beryl in May, and Tropical Storm Debby in June (Dunkley, 2012). During the fourth quarter *(D)*, runoff in portions of the State was still "much below normal" or "lowest" on record and the southeastern part received additional rainfall from Tropical Storm Isaac.

New Minimum Streamflows

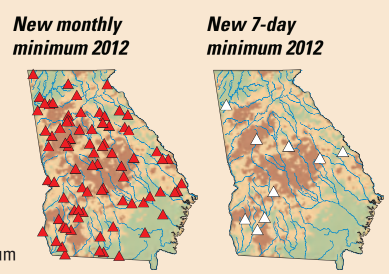
EXPLANATION

Percentage of normal precipitation during 2012 (NOAA, 2012)

- 90 percent and greater
- 75 to 89 percent
- 50 to 74 percent

Streamgage

- ▲ New monthly minimum
- △ New 7-day average minimum

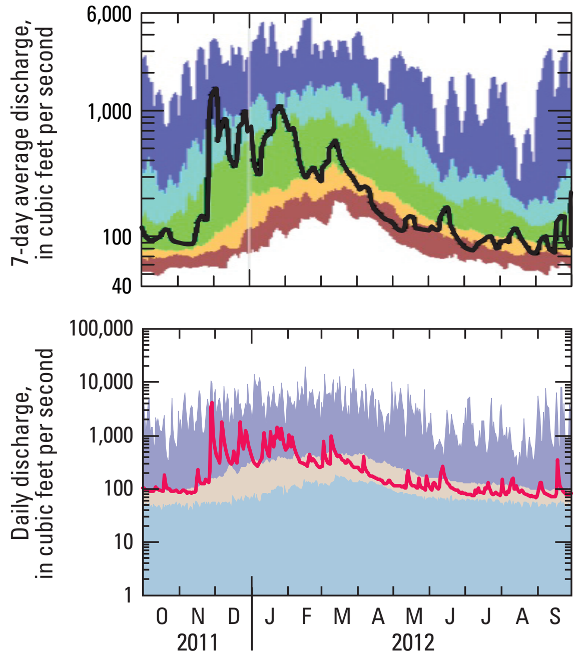


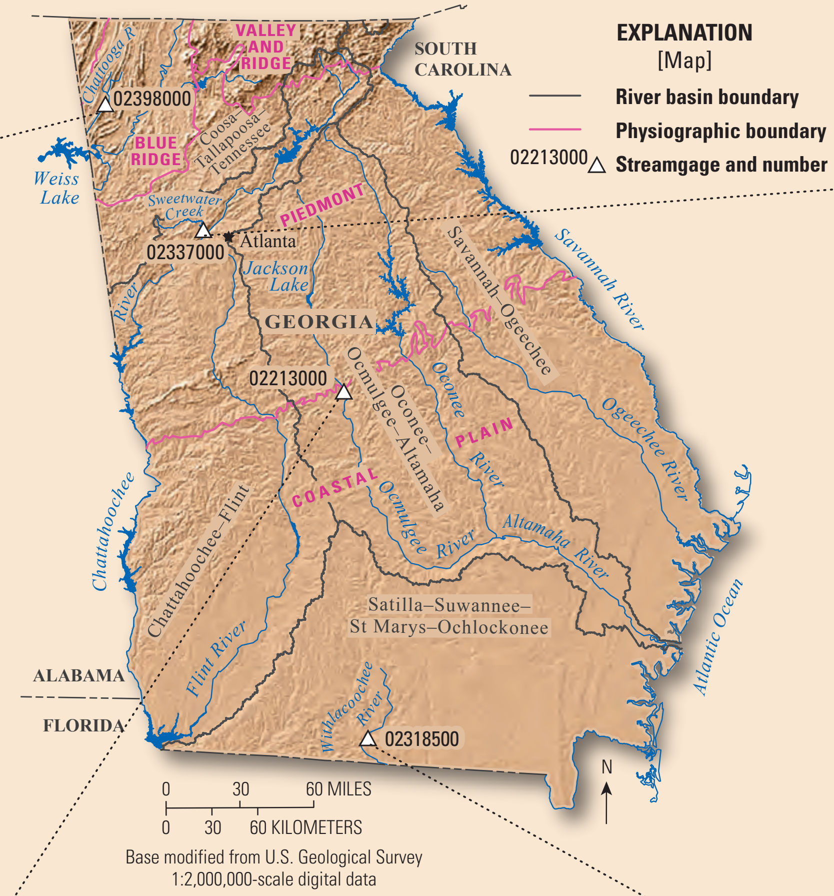
In 2012, new record-low monthly discharge occurred at 79 of 113 streamgages that have 20 or more years of data. The 2012 WY was similar to other recent drought years in which a number of new record-lows were recorded at monthly discharge stations, including 2007 (80), 2008 (75), and 2011 (52). Most of the central and southwestern part of the State received 50 to 75 percent of normal precipitation. Normal is defined as a 30-year average for 1971–2000 (NOAA, 2012).

New record-low 7-day average discharge occurred at 9 of 113 streamgages in 2012 that have 20 or more years of data. The majority of these streamgages are located in areas that received 50 to 74 percent of normal precipitation.

Chattooga River at Summerville, Ga. 02398000

The Chattooga River flows from the northwestern corner of Georgia into Alabama where it flows into Weiss Lake (U.S. Geological Survey, 1975). For the first half of the 2012 WY, 7-day average streamflow conditions were "normal" to "much above normal," followed by "below normal" and "much below normal" streamflow for the latter part of the water year. Daily discharge in most of the first part of the 2012 WY was in the "maximum" range compared to historical data until February, when median daily mean streamflows were observed for most of the rest of the 2012 WY.

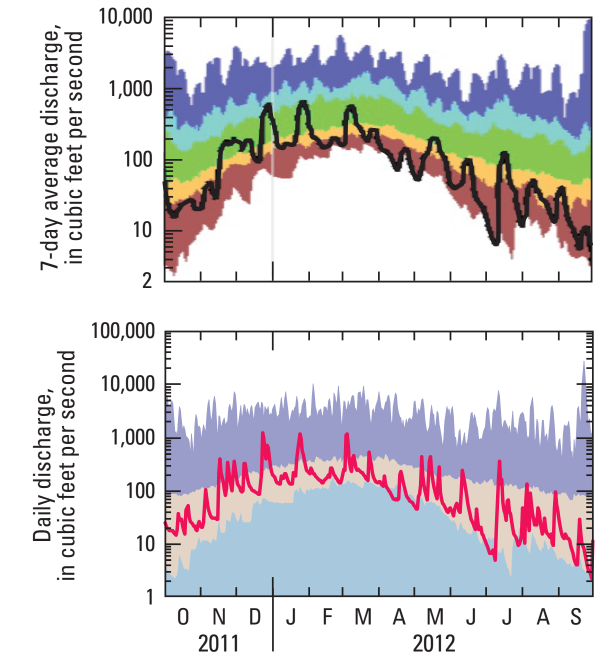




Base modified from U.S. Geological Survey 1:2,000,000-scale digital data

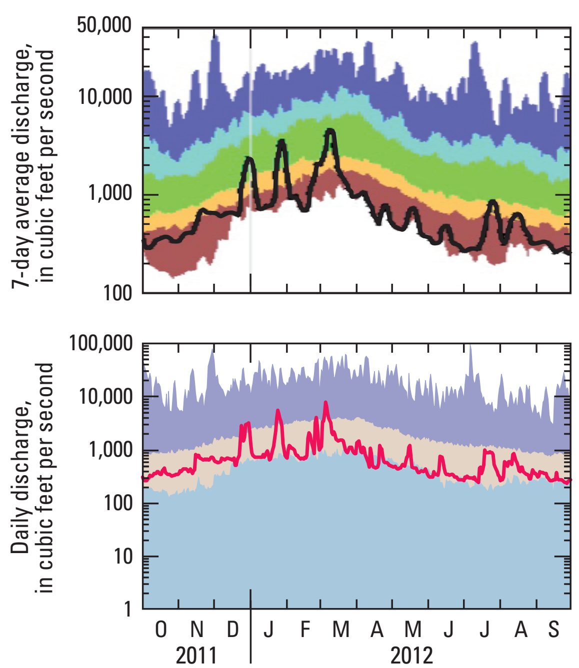
Sweetwater Creek near Austell, Ga. 02337000

Sweetwater Creek is a major tributary of the Chattahoochee River (U.S. Geological Survey, 1975). The 7-day average streamflow fluctuated between "much below normal" and "normal" from October through March, and new 7-day average minimum record flows were recorded during latter part of the water year, in April, May, and July. New minimum daily mean discharges were observed during the months of April and May.



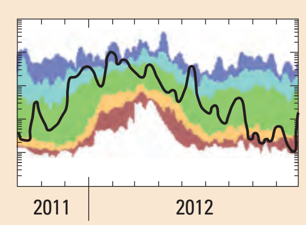
Ocmulgee River at Macon, Ga. 02213000

The Ocmulgee River flows out of Jackson Lake and joins the Oconee River to form the Altamaha River (U.S. Geological Survey, 1975). During the majority of the 2012 WY, the 7-day average discharge was "below normal" to "much below normal." New record-low 7-day average streamflow conditions were observed in 2012 for the months of April, May, June, July, and September. New minimum daily-mean discharges were observed during the months of April, May, and September.



7-Day Average Discharge

Hydrographs show the 7-day average for 2012 as compared to historical 7-day averages. Data are categorized in percentile ranges from "much above normal" (greater than the 90th percentile) to "much below normal" (less than the 10th percentile) (U.S. Geological Survey, 2012d).

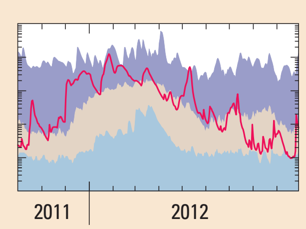


EXPLANATION
[Graphs]

Historical (percentile)
- Much above normal (≥90)
- Above normal (76 to 89)
- Normal (25 to 75)
- Below normal (11 to 24)
- Much below normal (≤10)
- **2012 water year**

Daily Discharge

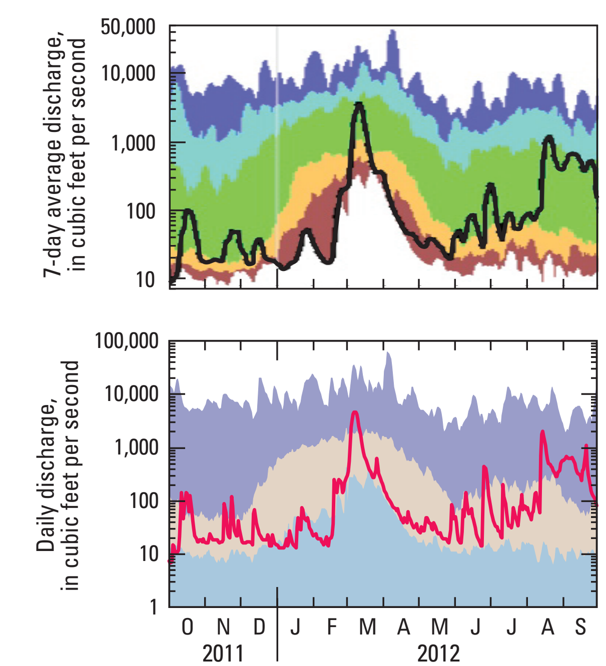
Hydrographs show 2012 daily-mean streamflow, in cubic feet per second, as compared to historical minimum and median streamflow for the entire period of record (U.S. Geological Survey, 2012a).



Historical daily flow
- Maximum
- Median
- Minimum
- **2012 daily mean**

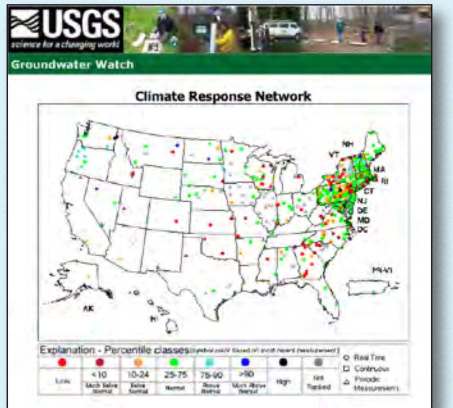
Withlacoochee River at US 84 near Quitman, Ga. 02318500

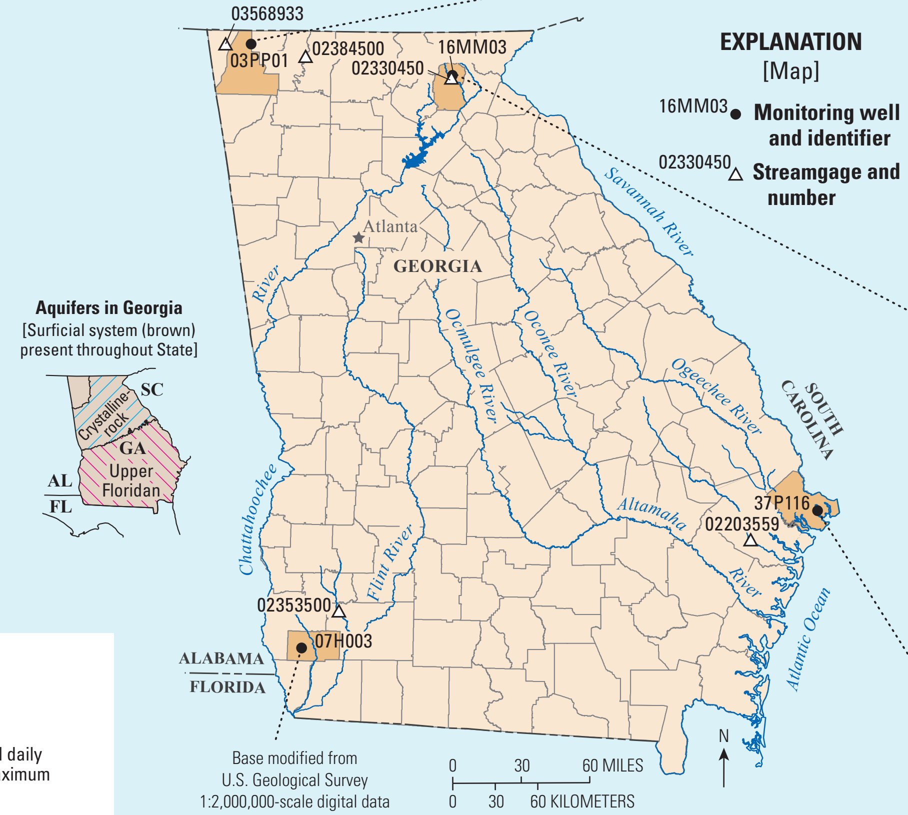
The Withlacoochee River flows in the Suwannee River Basin in the southern coastal plain of Georgia (U.S. Geological Survey, 1975). For much of the 2012 WY, 7-day average streamflow conditions were "below normal" to "much below normal," and record-low 7-day average streamflows were observed during the months of January and February. New minimum daily-mean discharges were recorded during the months of October, January, and February. Normal flows were observed towards the end of the 2012 WY as much needed relief was provided during multiple tropical storm events.

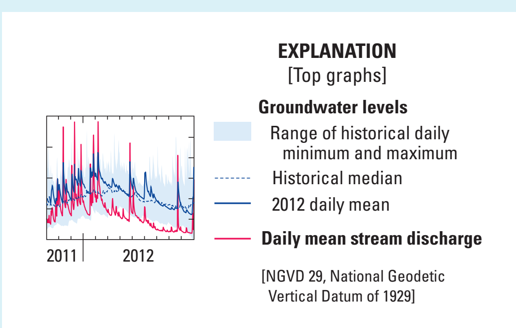


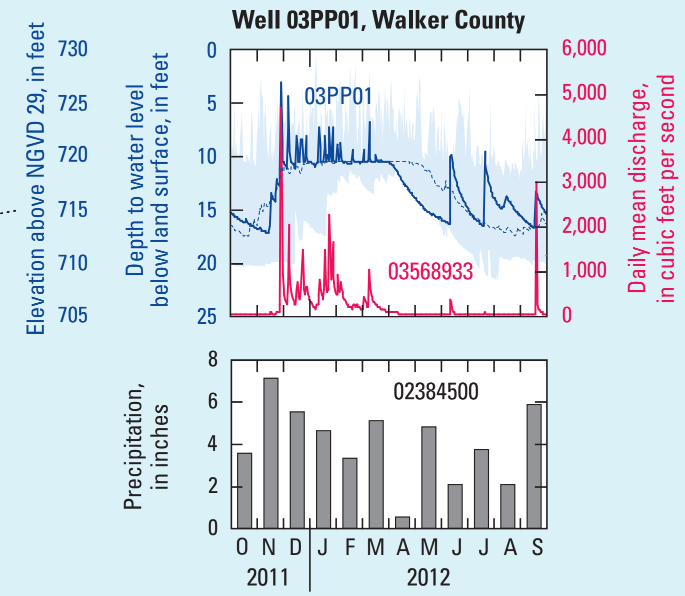
Climate Response Network

The USGS maintains a network of groundwater wells to monitor the effects of droughts and other climate variability on groundwater levels. These wells are part of the Climate Response Network, which is designed to measure the effects of climate on groundwater levels in unconfined aquifers or near-surface confined aquifers where pumping or other human influences on groundwater levels are minimal (U.S. Geological Survey, 2007, 2012c). The national network consists of about 130 wells, of which 15 are located in Georgia. These wells are monitored as part of the USGS Groundwater Resources and Cooperative Water Programs. Current conditions of groundwater wells in the Climate Response Network can be accessed online at *http://groundwaterwatch.usgs.gov/*. The hydrographs presented here are for selected wells in Georgia having at least 5 years of continuous data.

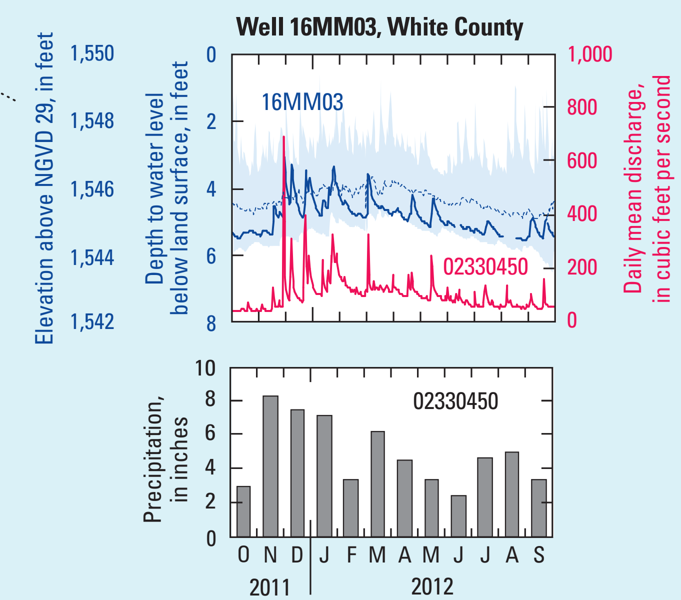






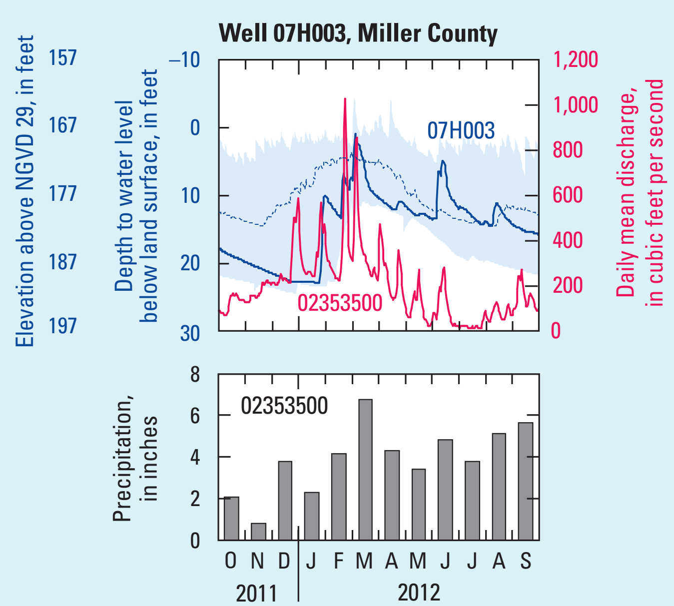


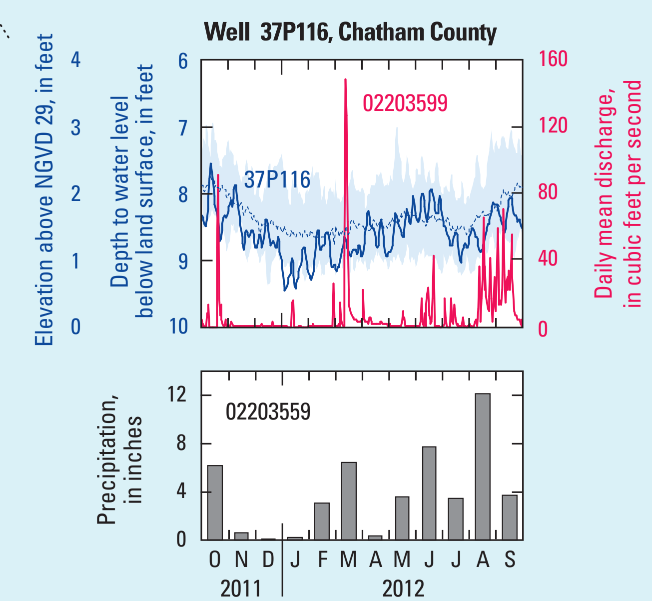
Well 03PP01 is in Walker County in northwestern Georgia and is completed in the Paleozoic-Rock aquifer in the Chickamauga limestone. Water storage is in the regolith, primary openings, and secondary fractures and solution openings in rock (Peck and others, 2013). Water levels are influenced mainly by precipitation and local pumping (Cressler, 1964). The water level in well 03PP01 responds to seasonal change similarly to streamflow at the nearby streamgage on Lookout Creek near New England, Ga. (03568933), which indicates atmospheric, surface-water, and groundwater interactions. The water level in well 03PP01 was near the historical daily median for much of the first half of the 2012 WY and above the historical daily median from June through September.



Well 16MM03 is in White County in northeastern Georgia and is completed in the crystalline-rock aquifer. Water is stored in the regolith and fractures, and the water level is affected by precipitation and evapotranspiration (Cressler and others, 1983). Precipitation can cause a rapid water-level rise in wells tapping aquifers overlain by thin regolith (Peck and others, 2013). The water level in well 16MM03 responds to seasonal change similarly to streamflow at the nearby streamgage on Chattahoochee River at Helen, Ga. (02330450), which indicates atmospheric, surface-water, and groundwater interactions. The water level in well 16MM03 remained below the historical daily median during much of the 2012 WY.

Well 07H003 is in Miller County in southwestern Georgia and is completed in the surficial aquifer, which is an unconfined aquifer in this area (Peck and others, 2013). The water level in this well generally rises rapidly during wet periods and declines slowly during dry periods. The water level in well 07H003 responds to seasonal change similarly to streamflow at the nearby streamgage on Ichawaynochaway Creek at Milford, Ga. (02353500), which indicates atmospheric, surface-water, and groundwater interactions. In the 2012 WY, water levels in well 07H003 were below the historical daily median from October through February. In March the area received more than 6 inches of precipitation and the water level in well 07H003 was greater than the historical median. Water levels were also above the historical median during the months of June, July, and August.

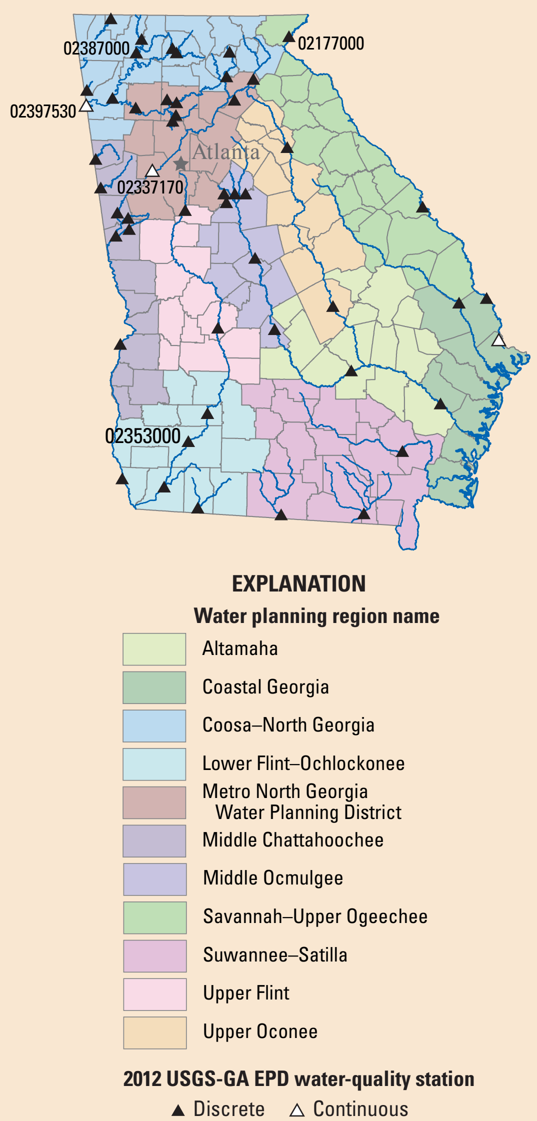




Well 37P116 is in Chatham County in southeastern Georgia and is completed in the surficial aquifer. Water levels in this well generally rise rapidly during wet periods and decline slowly during dry periods. The water level in well 37P116 responds to seasonal change similarly to streamflow at the nearby streamgage on Peacock Creek at McIntosh, Ga. (02203559), which indicates atmospheric, surface-water, and groundwater interactions. The water level in well 37P116 fluctuated above and below the historical daily median during most of the 2012 WY.

Water-Quality Conditions in Georgia

Water-quantity and quality information are both important for ensuring adequate water availability for human consumption, industrial uses, and aquatic ecosystems. Precipitation and streamflow conditions are primary agents of delivery and transport of both point- and nonpoint-source-contaminants (Hirsch and others, 2006). The USGS provides the GaEPD and the public with a relevant, nationally consistent database of long-term water-quality data, which assists the GaEPD in meeting its responsibilities under the Clean Water Act, including (1) identifying the beneficial uses of surface waters within the State, (2) establishing water-quality standards to maintain the full beneficial uses of surface waters, and (3) identifying water bodies where stream standards are not met and beneficial uses are impaired (Grams, 2011). The USGS-GaEPD discrete water-quality sampling program is designed to collect data systematically, regardless of hydrologic conditions. Water-quality data for Georgia streams are available to the public at *http://waterdata.usgs.gov/ga/nwis/qw/*.



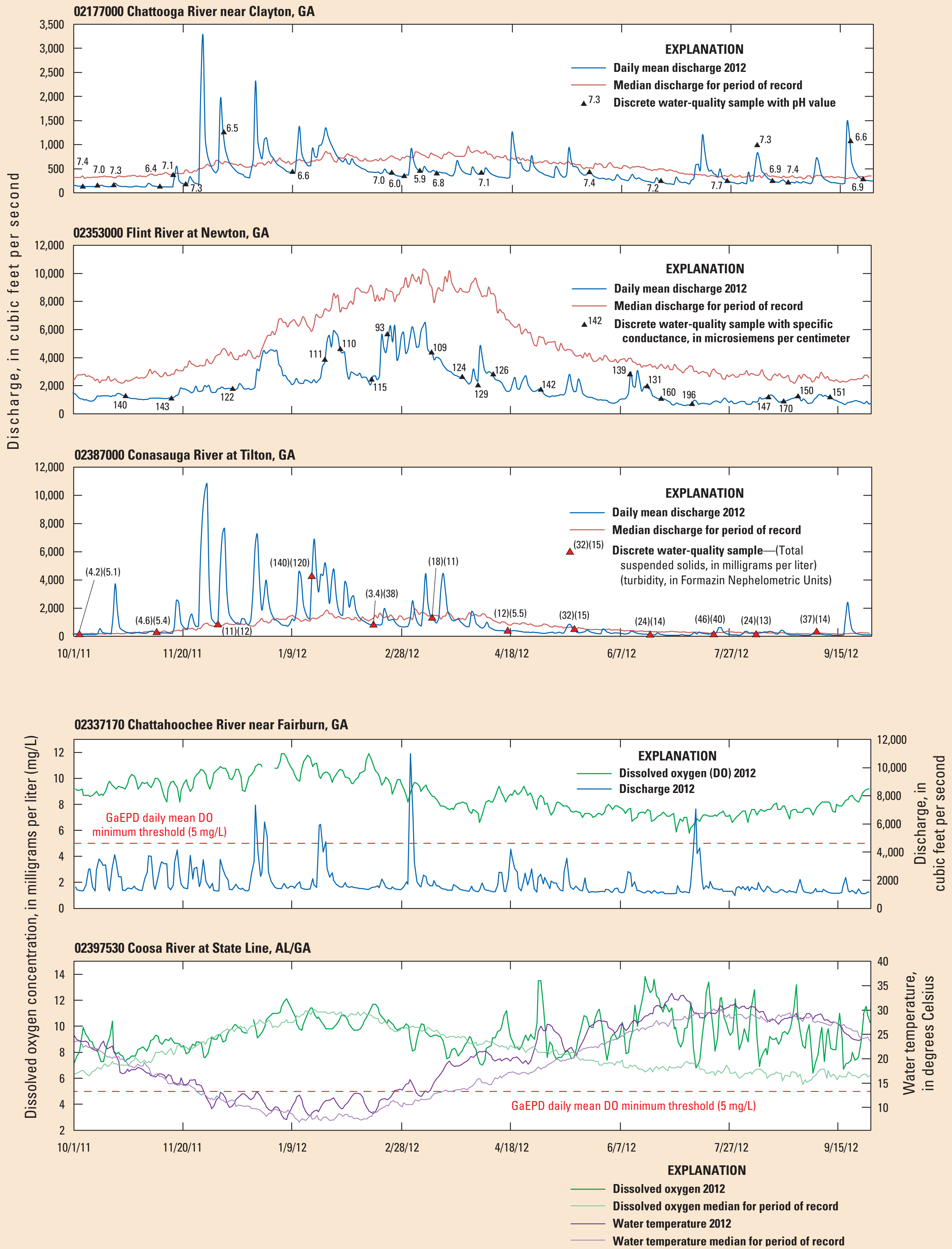
Chattooga River station 02177000, located in northeastern Georgia in the Savannah-Upper Ogeechee water planning region, which has a drainage area of 207 square miles (mi²). A number of pH measurements were collected at this station during the 2012 WY; pH is a measure of how acidic or basic the water is and can influence the biological integrity of streams. For example, the reproduction of some fish can be affected in water having a pH below 5 (U.S. Geological Survey, 2012c).

Flint River at Newton station 02353000, located in southwestern Georgia in the Lower Flint-Ochlockonee water planning region, has a drainage area of 5,740 mi². A number of specific conductance (SC) measurements were collected at this station during the 2012 WY. SC is a measure of dissolved ionic constituents, such as salts in water. Throughout the 2012 WY, SC was typically lower during higher flows because dissolved constituents in streams can be diluted during rainfall runoff, as compared to lower flows.

Conasauga River station 02387000, located in northwestern Georgia in the Coosa-North Georgia water planning region, has a drainage area of 687 mi². During the 2012 WY, a number of total suspended solids (TSS) samples were collected and turbidity measurements made. Turbidity is a measure of water clarity and light reflected off particles in streamflow caused by clay, silt, and fine suspended inorganic and organic matter; therefore, TSS and turbidity react similarly during changing streamflow conditions. Chronic levels of suspended materials in streams are often the cause of designated use impairment. TSS concentrations and turbidity levels were typically greater during higher flows compared to lower flows because these constituents are washed from the land into streams during periods of rainfall runoff and suspended in the water column, demonstrating a relation between water quality and water quantity.

Chattahoochee River station 02337170, located just south of Atlanta in the Metro North Georgia Water Planning District planning region, has a drainage area of 2,060 mi². Water use for this stream reach is classified as "fishing" under Georgia Code 391-3-6-.03, which requires the daily mean dissolved oxygen (DO) concentrations in the stream be equal to or greater than 5.0 milligrams per liter (mg/L; Georgia Department of Natural Resource, 2012). No daily mean DO levels fell below the "minimum DO" criteria at station 02337170 during the 2012 WY.

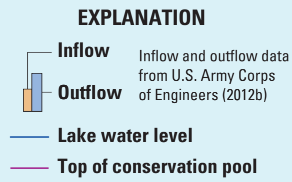
Coosa River station 02397530, located on the border of Georgia and Alabama and is in the Coosa-North Georgia planning region, has a drainage area of 4,362 mi². Water use for this stream reach is classified as "fishing" under the Georgia Code 391-3-6-.03, which requires that the daily mean dissolved oxygen (DO) concentrations in the stream be equal to or greater than 5.0 milligrams per liter. This figure shows daily mean DO and water temperature WT for the 2012 WY and median values for the period of record (1975–2011) for this site. Typically, DO and WT are inversely related, as indicated by data for the period of record at this site. From March through August of the 2012 WY, however, DO increases as WT increases. The DO increase may have been caused by phytoplankton growth, which can lead to algal blooms. Water-quality at this station is influenced by fluctuations in water level and water velocity because of regulation at Weiss Lake and resulting backwater conditions; inflows of municipal and industrial wastewater from upstream facilities; and hot-water releases from power generation plants. During the 2012 WY, no daily mean DO levels fell below the "minimum DO" criteria at station 02397530.



Lakes and Reservoirs

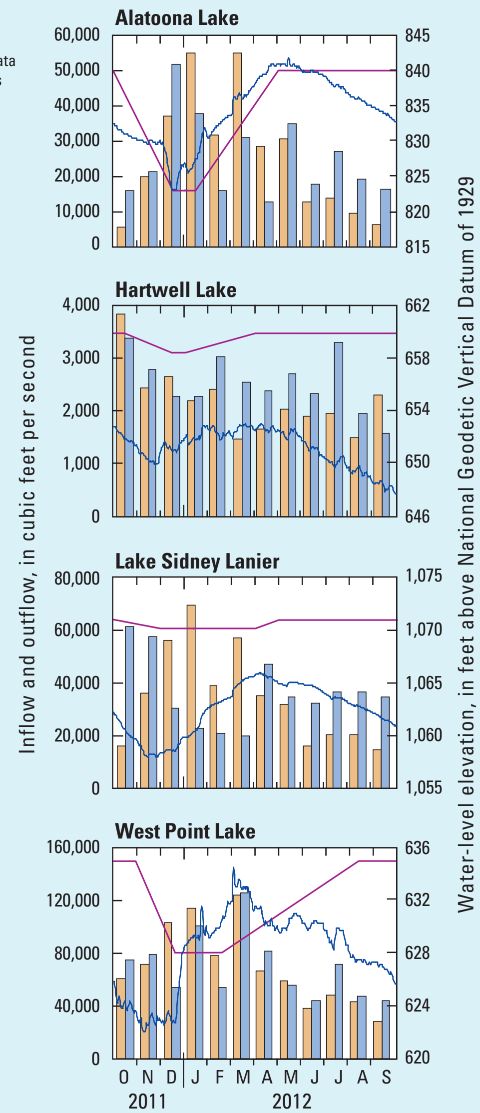
Major lakes and reservoirs throughout Georgia are managed primarily by the U.S. Army Corps of Engineers and Georgia Power Company to provide water for public and industrial use, flood protection, power generation, wildlife management, and recreation. To manage lakes and reservoirs, tools such as computer models that rely on USGS data help to predict changes in climate and water demands.

Lake Sidney Lanier on the Chattahoochee River is the primary drinking-water source for Atlanta. Lake Sidney Lanier is the farthest upstream reservoir in a series of reservoirs that include West Point Lake, Walter F. George Lake, and Lake Seminole. Lake Lanier outflow and inflow were nearly equal during the 2012 WY, and the lake elevation peak for the year was nearly 4 feet (ft) below the top of conservation elevation. The water-level elevation of West Point Lake was managed to near the top of conservation pool until March when the lake level was lowered nearly 6 ft during the remainder of the WY. West Point Dam provides flood protection and hydroelectric power to Troup County, and its construction was authorized by the Flood Control Act of 1962 (Troup County Georgia, 2012).



Hartwell Lake is on the border between Georgia and South Carolina on the Savannah and Tugaloo Rivers. Hartwell Lake is the most upstream major reservoir on the Savannah River. Water is released to the downstream reservoirs, Richard B. Russell and J. Strom Thurmond. These three lakes on the Savannah River are managed by the U.S. Army Corps of Engineers for water supply, power generation, and water-quality needs of the Savannah River from below Thurmond Dam to Savannah, Georgia, and the Atlantic Ocean (U.S. Army Corps of Engineers, 2012a). Hartwell Lake water elevation for the 2012 WY peaked at 653.02 ft. and was nearly 7 ft lower than the top of conservation elevation of 660 ft. Hartwell Lake elevation was lowered nearly 5 ft as outflow was 25 percent greater than inflow from April through September.

Allatoona Lake is on the Etowah River and is managed by the U.S. Army Corps of Engineers. During the 2012 WY, Allatoona Lake remained above or just below the top of conservation pool from October through June. By the end of the 2012 WY, the lake level was nearly 7 ft below the top of conservation pool, as outflow was 2.1 times greater than inflow from July through September.



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ISSN 2327-6932 (online)
http://dx.doi.org/10.3133/fs20143028