

Summary of Surface-Water Hydrologic Conditions in New Jersey Water Year 2009

The United States Geological Survey (USGS), in cooperation with Federal, State, and local agencies, collects a large amount of data pertaining to the water resources of New Jersey each water year. These data, accumulated over many water years, constitute a valuable database for developing an improved understanding of the water resources of the State.

During water year 2009, the USGS New Jersey Water Science Center maintained and published records for 113 continuous-record discharge-gaging stations, 34 continuous-record annual peak stations, 24 continuous-record tidal gaging stations, 77 crest-stage gages, 32 tidal crest-stage gages, 21 reservoirs, and 42 diversions. Discharge measurements also were made at 240 low-flow and miscellaneous sites during the water year. Published records are included in the report “Water Resources Data for the United States, Water Year 2009” and can be accessed online at <http://wdr.water.usgs.gov/>. The locations of continuous-record gaging stations in New Jersey are shown in figure 1.

discussed for selected sites include water year instantaneous peak flows with associated recurrence intervals and water year lowest daily mean flow with associated percent flow duration. Monthly and annual precipitation data for New Jersey also are discussed.

Streamflow

Three gaging stations, located in north, central, and south New Jersey, on the South Branch Raritan River, the Delaware River, and the Great Egg Harbor River, respectively, are considered index stations for statewide streamflow conditions. A map with the locations of the index stations is shown in the inset in figure 1. Monthly mean discharges at the index station on the

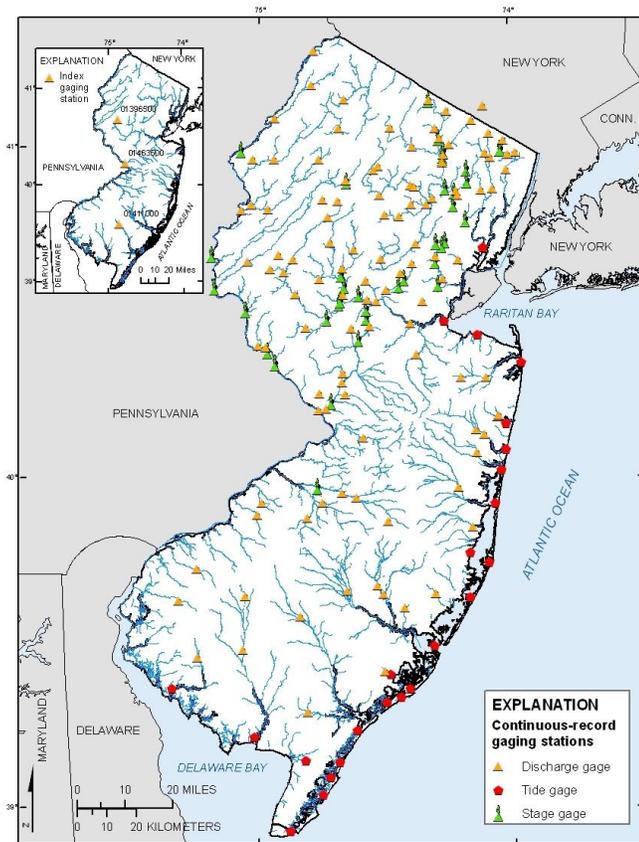


Figure 1. Locations of continuous-record gaging stations.

To demonstrate streamflow conditions in New Jersey during water year 2009, monthly and annual mean discharges at selected continuous gaging stations are compared to period of record monthly and annual means. Other flow characteristics

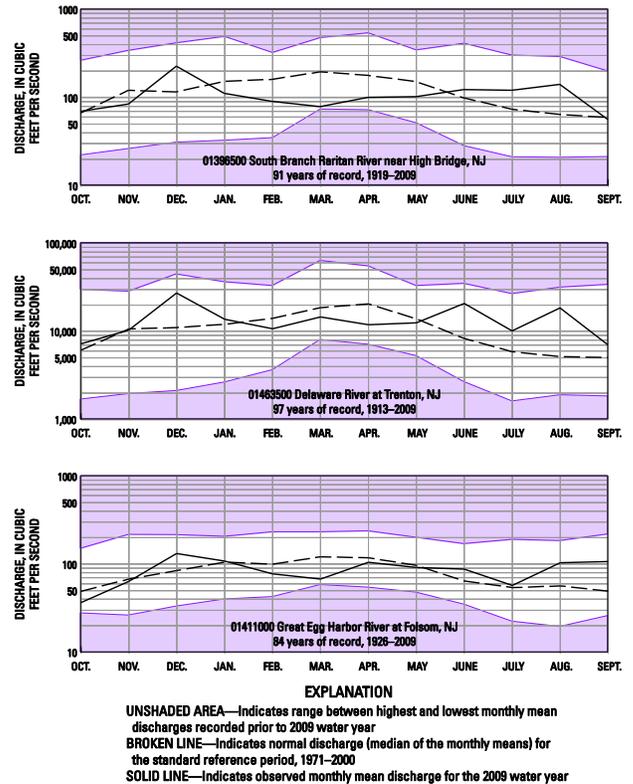


Figure 2. Monthly mean discharge at index gaging stations.

South Branch Raritan River were above average in October, December, June, July, and August; the rest of the water year the monthly mean discharges were near or below average (fig. 2). Monthly mean discharges at the index station on the Delaware River were above average in October, December, January, and June through September; the rest of the water year the monthly mean discharges were near or below average. Monthly mean discharges at the index station on the Great Egg Harbor River were above average in December, January, and June through September; the rest of the water year the monthly mean discharges were near or below average. Annual mean discharge

at the index gaging station located in northern New Jersey was below the annual mean for the period of record. Annual mean discharge at the index gaging station located in central New Jersey was above the annual mean for the period of record, and annual mean discharge at the index gaging station located in southern New Jersey was about equal to the annual mean for the period of record (fig. 3).

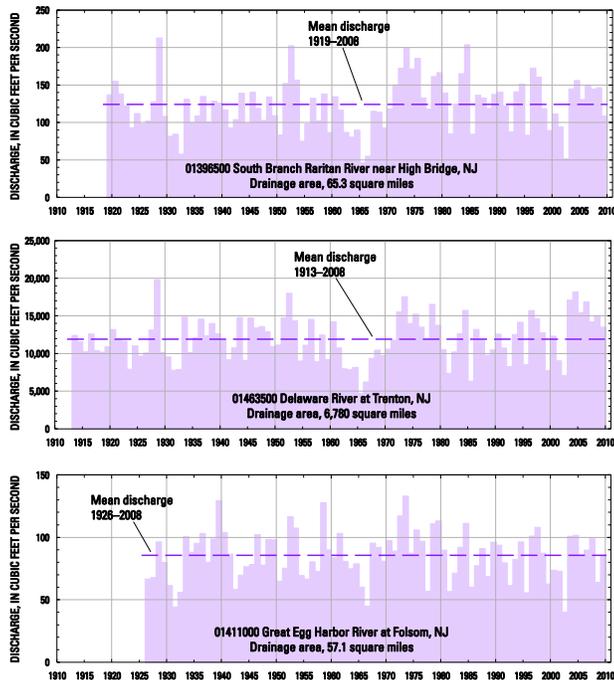


Figure 3. Annual mean discharge at index gaging stations.

Streamflow at the index station in northern New Jersey (South Branch Raritan River near High Bridge) averaged 109 ft³/s for the water year, which is 89 percent of the 1919-2008 average. Peak flow for the water year was 2,660 ft³/s on July 2, 25 percent annual probability of exceedance. The lowest daily mean flow was 29 ft³/s, recorded October 22-24, which is the 95-percent flow duration.

Streamflow at the index station in central New Jersey (Delaware River at Trenton) averaged 13,510 ft³/s for the water year, which is 114 percent of the 1913-2008 average. Peak flow for the water year was 90,400 ft³/s on December 13, greater than 50 percent annual probability of exceedance. The lowest daily mean flow was 3,390 ft³/s, recorded October 20, which is about the 88-percent flow duration. The Delaware River is substantially regulated by reservoirs and diversions.

Streamflow at the index station in southern New Jersey (Great Egg Harbor River at Folsom) averaged 85.9 ft³/s for the water year, which is 101 percent of the 1925-2008 average. Peak flow for the water year was 346 ft³/s on December 14, 33 percent annual probability of exceedance. The lowest daily mean flow was 26 ft³/s, recorded October 19-24, which is about the 98-percent flow duration.

There were several floods and flash floods during the 2009 water year primarily due to heavy rainfall. Some snowmelt during the winter months may have exacerbated the flooding especially in the northern counties. The dates of the events and the affected counties, as documented by the National Oceanic and Atmospheric Administration's National Weather Service (NOAA's NWS) (<http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>), are listed in table 1. Most

Table 1. Floods and flash floods (excluding coastal floods) in New Jersey in water year 2009, by date and county.

(From the National Oceanic and Atmospheric Administration's National Weather Service at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>)

Date	Location by County
Dec 11-12, 2008	Bergen, Camden, Essex, Monmouth, Morris, Ocean, Passaic, Somerset, Union
May 7, 2009	Bergen
Jun 13, 2009	Burlington, Somerset
Jun 15, 2009	Bergen, Passaic
Jun 30, 2009	Bergen, Essex, Passaic
Jul 2, 2009	Hunterdon
Jul 17, 2009	Passaic
Jul 26, 2009	Essex, Hudson
Jul 29, 2009	Bergen, Essex, Hudson, Middlesex, Passaic, Union
Jul 31, 2009	Camden, Monmouth, Ocean, Warren
Aug 2, 2009	Bergen, Essex, Hunterdon, Mercer, Middlesex, Morris, Passaic, Somerset, Union
Aug 12, 2009	Atlantic, Cumberland, Essex, Mercer
Aug 22, 2009	Camden, Mercer, Somerset
Aug 28, 2009	Somerset
Aug 29, 2009	Bergen, Camden, Union
Sep 11, 2009	Cape May, Ocean

of the 16 reports of flooding by date were the result of isolated summertime thunderstorms that affected only one or two counties. The most widespread reports of flooding in the 2009 water year occurred December 11-12 and August 2, 2009. There were no flood events reported by the National Weather Service in Gloucester, Salem, and Sussex Counties in water year 2009. Although there were several documented flood events and some abnormally dry conditions, this water year was a relatively average year for streamflow.

The Office of the New Jersey State Climatologist reported that precipitation for October, January, February, and March were ranked as the 56th, 47th, 1st, and 11th driest, respectively, for the period of record (table 2). The Office of the New Jersey

Table 2. Ranking of monthly precipitation values in New Jersey for water year 2009 in relation to water years 1896-2009 (114 years of record). Monthly precipitation values are spatially weighted averages from many stations throughout the State. (From the Office of the New Jersey State Climatologist at http://climate.rutgers.edu/stateclim_v1/data/njhistprecip.html)

Month of water year	Total precipitation, in inches	Ranking
Oct 2008	2.86	56 th driest
Nov 2008	4.00	39 th wettest
Dec 2008	6.63	6 th wettest
Jan 2009	2.96	47 th driest
Feb 2009	0.67	The driest
Mar 2009	2.07	11 th driest
Apr 2009	4.73	27 th wettest
May 2009	4.43	34 th wettest
Jun 2009	6.79	6 th wettest
Jul 2009	5.04	43 rd wettest
Aug 2009	7.37	11 th wettest
Sep 2009	4.08	45 th wettest

State Climatologist Drought Severity scale ranges from D0 (abnormally dry) to D4 (exceptional drought). Portions of southern New Jersey were classified abnormally dry (D0) from

October through November. The entire State was classified abnormally dry (D0) from the late March through April, and portions of northern New Jersey were classified abnormally dry (D0) from May to early June. No drought warnings were issued by the State of New Jersey during water year 2009.

Annual mean discharges for water year 2009 and mean annual discharges for the period of record at 48 selected gaging stations that had 40 years or more of continuous record are shown in table 3. The differences in annual mean discharges are listed as percent difference and range from -27.5 to 24.9 percent. Annual mean discharges at 31 of the 48 selected gaging stations were below the historical mean for water year 2009, marking the first year since water year 2002 that most of the selected sites had annual mean discharges lower than the historical mean (fig. 4). Several gaging stations that monitor heavily regulated rivers were not included in this comparison because of large artificial deficits related to regulation. The criterion of assessing gaging stations with 40 years or more of record was used in order to encompass at least one of the approximately 30-year drought cycles that New Jersey has experienced.

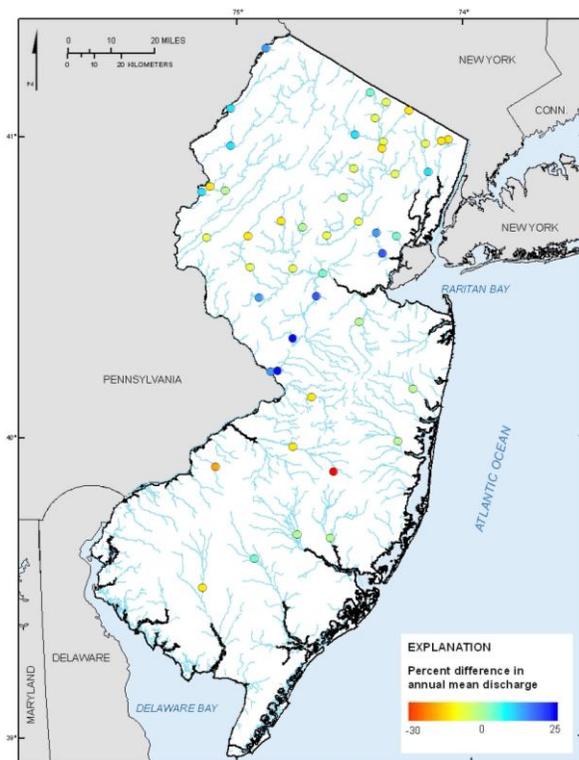


Figure 4. Percent differences between annual mean discharges for water year 2009 and mean annual discharges for the period of record at selected streamflow-gaging stations with 40 years or more of continuous record.

Precipitation

Monthly spatially weighted average-precipitation values determined using data from several dozen stations throughout New Jersey, along with the statewide long-term monthly means (water years 1896-2009), can be accessed at http://climate.rutgers.edu/stateclim_v1/data/njhistprecip.html. For water year 2009, the spatially weighted values for 8 of 12 months were above the long-term mean (November, December, and April through September, as shown in figure 5). Water year 2009 was the 19th wettest for the period of record. The statewide spatially weighted average-precipitation total for water year 2009 was

51.63 inches, which is 6.55 inches more than the long-term mean-annual precipitation for water years 1896 to 2008. The average annual precipitation for New Jersey is approximately 45 inches. During the 2009 water year, August had the highest monthly total with 7.37 inches of precipitation, and February had the lowest monthly total with 0.67 inches. Rankings of monthly precipitation in New Jersey for water year 2009 in relation to the period of record, water years 1896-2009, are listed in table 2.

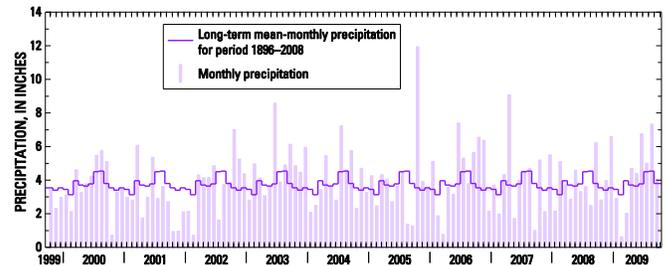


Figure 5. Monthly precipitation for water years 1999-2009 in New Jersey and long-term mean-monthly precipitation for period 1896-2008. (Long-term mean-monthly and monthly precipitation are spatially weighted averages for several dozen stations throughout the State).

Three National Oceanic and Atmospheric Administration's National Weather Service (NWS) precipitation stations located in Newark, Hightstown, and Atlantic City have been selected as index sites for precipitation. Water year 2009 precipitation totals were above normal at the Atlantic City and Hightstown index sites and below normal at the index site in Newark. The Newark station recorded 45.91 inches, which is 0.34 inches below normal or 99.3 percent of the 30-year reference-period (1971-2000) mean. The Hightstown station recorded 50.7 inches, which is 3.02 inches above normal or 106 percent of the 30-year mean. The Atlantic City station recorded 55.24 inches, which is 14.65 inches above normal or 136 percent of the 30-year mean. Monthly precipitation at the three NWS stations, along with the 30-year mean, is shown in figure 6.

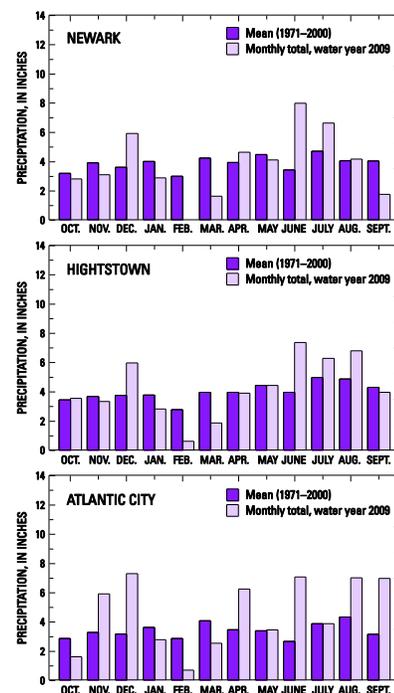


Figure 6. Monthly precipitation at three National Weather Service stations.

Table 3. Annual mean discharges for water year 2009 and mean annual discharges for the period of record at selected gaging stations with 40 years or more of continuous record.
[ft³/s, cubic feet per second; mi², square miles]

Station number	Station name	Drainage area (mi ²)	Number of years of record	Annual mean discharge		Percent difference
				for 2009 (ft ³ /s)	Mean annual discharge for period of record (ft ³ /s)	
01377000	Hackensack River at Rivervale, NJ	58.0	68	75.4	87	-13.3
01377500	Pascack Brook at Westwood, NJ	29.6	75	47.7	54.3	-12.2
01379000	Passaic River near Millington, NJ	55.4	88	85.4	91.5	-6.7
01379500	Passaic River near Chatham, NJ	100	81	163	173	-5.8
01380500	Rockaway River above reservoir, at Boonton, NJ	116	72	210	231	-9.1
01381500	Whippany River at Morristown, NJ	29.4	88	53.7	55	-2.4
01382500	Pequanock River at Macopin Intake Dam, NJ	63.7	86	53.2	49.1	8.4
01383500	Wanaque River at Awosting, NJ	27.1	90	55.1	54.8	0.5
01384500	Ringwood Creek near Wanaque, NJ	19.1	68	31.8	33.6	-5.4
01386000	West Brook Near Wanaque	11.8	49	23.1	24.8	-6.9
01387500	Ramapo River near Mahwah, NJ	120	90	200	230	-13.0
01388000	Ramapo River at Pompton Lakes, NJ	160	88	268	289	-7.3
01388500	Pompton River at Pompton Plains, NJ	355	70	440	500	-12.0
01389500	Passaic River at Little Falls, NJ	762	111	1057	1142	-7.4
01390500	Saddle River at Ridgewood, NJ	21.6	52	31.2	34	-8.2
01391500	Saddle River at Lodi, NJ	54.6	87	110	102	7.8
01393450	Elizabeth River at Ursino Lake, at Elizabeth, NJ	16.9	88	26.1	26	0.4
01394500	Rahway River near Springfield, NJ	25.5	72	35.4	31.4	12.7
01395000	Rahway River at Rahway, NJ	40.9	87	60.1	50.4	19.2
01396500	South Branch Raritan River near High Bridge, NJ	65.3	91	109	123	-11.4
01397000	South Branch Raritan River at Stanton, NJ	147	93	234	250	-6.4
01398000	Neshanic River at Reaville, NJ	25.7	79	44	38.5	14.3
01398500	North Branch Raritan River near Far Hills, NJ	26.2	86	48.1	48.4	-0.6
01399500	Lamington (Black) River near Pottersville, NJ	32.8	88	50.1	56	-10.5
01400000	North Branch Raritan River near Raritan, NJ	190	86	294	314	-6.4
01401000	Stony Brook at Princeton, NJ	44.5	56	84.9	68	24.9
01402000	Millstone River at Blackwells Mills, NJ	258	88	449	387	16.0
01403060	Raritan River below Calco Dam, at Bound Brook, NJ	785	71	1206	1204	0.2
01405400	Manalapan Brook at Spotswood, NJ	40.7	52	61.9	62.3	-0.6
01408000	Manasquan River at Squankum, NJ	44.0	78	73.2	73.5	-0.4
01408500	Toms River near Toms River, NJ	123	81	209	211	-0.9
01409400	Mullica River near Batsto, NJ	46.7	52	100	105	-4.8
01410000	Oswego River at Harrisville, NJ	72.5	79	81.6	85.1	-4.1
01411000	Great Egg Harbor River at Folsom, NJ	57.1	84	85.9	85.2	0.8
01411500	Maurice River at Norma, NJ	112	77	139	163	-14.7
01438500	Delaware River at Montague, NJ	3,480	70	6696	5840	14.7
01440000	Flat Brook near Flatbrookville, NJ	64.0	86	121	112	8.0
01443500	Paulins Kill at Blairstown, NJ	126	87	214	202	5.9
01445500	Pequest River at Pequest, NJ	106	88	154	160	-3.8
01446000	Beaver Brook near Belvidere, NJ	36.7	45	48.2	54.4	-11.4
01446500	Delaware River at Belvidere, NJ	4,535	87	8782	7995	9.8
01457000	Musconetcong River near Bloomsbury, NJ	141	92	225	241	-6.6
01463500	Delaware River at Trenton, NJ	6,780	97	13510	11900	13.5
01464000	Assunpink Creek at Trenton, NJ	90.6	86	166	135	23.0
01464500	Crosswicks Creek at Extonville, NJ	81.5	68	115	133	-13.5
01466500	McDonalds Branch in Byrne State Forest, NJ	2.35	55	1.53	2.11	-27.5
01467000	North Branch Rancocas Creek at Pemberton, NJ	118	88	146	169	-13.6
01467150	Cooper River at Haddonfield, NJ	17.0	45	26.9	32.7	-17.7

Access to USGS water data

The USGS New Jersey Water Science Center maintains a World Wide Web site, which has water-resource related information for New Jersey; the site can be accessed at <http://nj.usgs.gov/>. Links to other USGS and Federal web sites are also available. Information on the Water Resources Data for the United States, Water Year 2009, can be accessed online at <http://wdr.water.usgs.gov/>.

by Jason Shvanda



Northern New Jersey Index Gaging Station--01396500 South Branch Raritan River near High Bridge

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