Summary of Surface-Water Hydrologic Conditions in New Jersey Water Year 2007

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 2007, the USGS New Jersey Water Science Center maintained and published records for 107 continuous discharge gaging stations, 109 crest-stage partial-record stations, 25 tidal gaging stations, 33 tidal crest-stage gages, 21 reservoirs, and 42 diversions. Discharge measurements also were made at 317 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 2007" 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.

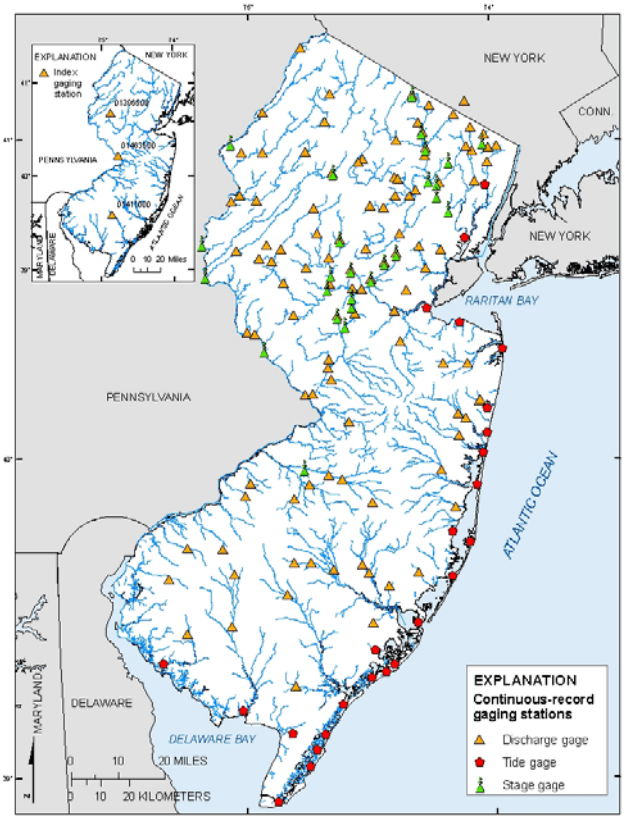

Figure 1. Locations of continuous-record gaging stations.

To demonstrate streamflow conditions in New Jersey during water year 2007, monthly and annual mean discharges at selected continuous gaging stations are compared to period of record monthly and annual means. Other flow characteristics 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, south, and central New Jersey, on the South Branch Raritan River, the Great Egg Harbor River, and the Delaware River, respectively, are considered index stations for statewide streamflow conditions. A map with the locations of the index stations is shown on the inset in figure 1. Monthly mean discharges at all three index stations were above average from October through January, and in March and April, during water year 2007 (fig. 2). Monthly mean discharges also were above average at the index station on the South Branch Raritan River in July and August and at the index station on the Delaware River in August. Monthly mean discharges were below average in February, May, June, and

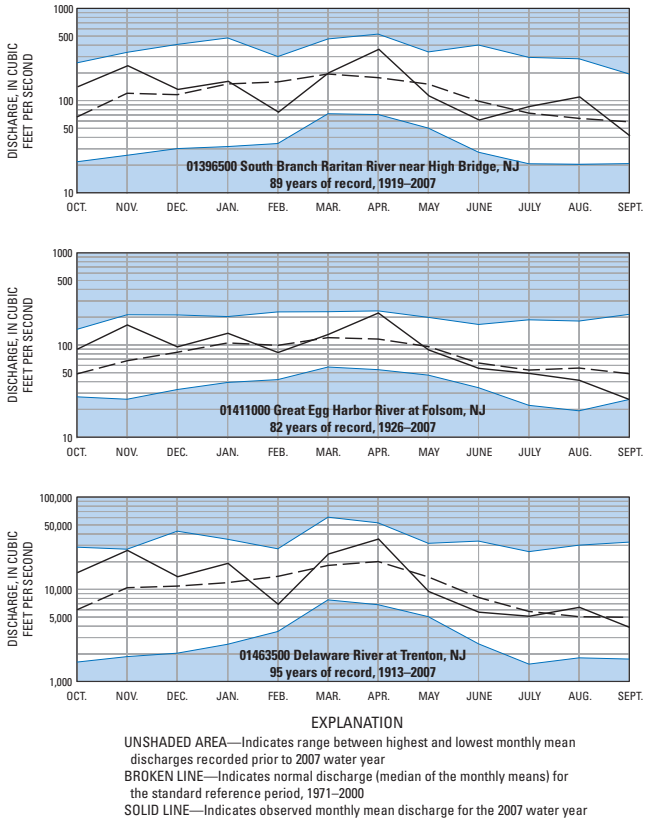

Figure 2. Monthly mean discharge at index gaging stations.

September at the index station on the South Branch Raritan River; February and May through September at the index station on the Great Egg Harbor River; and February, May through July, and September at the index station on the Delaware River.

Annual mean discharge at each index gaging station was above the annual mean for the period of record for the fifth consecutive year (fig. 3).

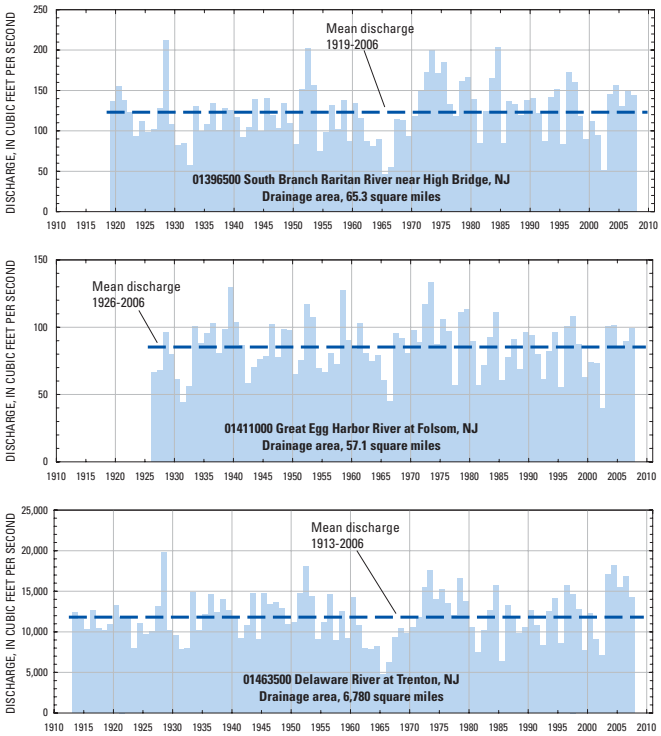

Figure 3. Annual mean discharge at index gaging stations.

Streamflow at the index station in northern New Jersey (South Branch Raritan River near High Bridge) averaged 145 ft^3/s for the water year, which is 118 percent of the 1919-2006 average. Peak flow for the water year was 4,370 ft^3/s on April 16; the recurrence interval is about 20 years. The lowest daily mean flow was 30 ft^3/s, recorded on September 30, which is about the 95-percent flow duration.

Streamflow at the index station in southern New Jersey (Great Egg Harbor River at Folsom) averaged 99.0 ft^3/s for the water year, which is 116 percent of the 1925-2006 average. Peak flow for the water year was 1,230 ft^3/s on April 17; the recurrence interval is greater than 100 years. The lowest daily mean flow was 22 ft^3/s, recorded September 24-30, which is less than the 99-percent flow duration.

Streamflow at the index station in central New Jersey (Delaware River at Trenton) averaged 14,230 ft^3/s for the water year, which is 120 percent of the 1913-2006 average. Peak flow for the water year was 116,000 ft^3/s on April 17; the recurrence interval is about 3 years. The lowest daily mean flow was 3,200 ft^3/s, recorded on September 30, which is about the 90-percent flow duration. The Delaware River is substantially regulated by reservoirs and diversions.

There were several floods and flash floods during the 2007 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 (NWS) (http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms), are listed in table 1. The most widespread flooding in the 2007 water year occurred during April 15-18 as a result of a very intense low pressure system aptly termed a nor'easter because of the strong northeast winds associated with it. The low pressure system rapidly intensified over New Jersey as it combined with another low pressure system that had formed along a warm front over the Chesapeake Bay. The consolidated storm, moving in a northeast direction, produced heavy rain and wind across New Jersey on April 15-16. Rainfall totals ranged from 2 inches in southern New Jersey up to nearly 10 inches in northeastern New Jersey. The National Weather Service reported that the lowest central pressure of the storm (966 millibars or 28.53 inches) was near that of a category 2 or 3 hurricane, using the Saffir-Simpson Hurricane Scale, and peak wind gusts averaged from 40 to 60 miles an hour. Statewide damage due to the storm was estimated at $180 million and a state of emergency was declared by the governor on April 16. Many surface-water gages throughout the state recorded peak-of-year discharges during this period, and nine gages recorded period of record peak discharges, most of which were located in northeast New Jersey where some of the heaviest rains fell. A detailed summary of the April 15-18 flooding in New Jersey can be accessed at http://nj.usgs.gov/ special/flood0407/. The Office of the New Jersey State Climatologist reported April 2007 as being the wettest April on record for the State of New Jersey since State records began in 1895 and the April 15-16 rain event as the 7th largest statewide rain event on record. This record rain event was the only one of the top 20 events to occur outside of the August to November period (when offshore waters are warmest and tropical systems often produce heavy rains).

Table 1. Floods and flash floods in New Jersey in water year 2007, 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
Oct 28, 2006	Bergen, Morris, Passaic, Somerset, Union
Nov 8-9, 2006	Bergen, Burlington, Camden, Essex, Hudson, Mercer, Monmouth, Morris, Passaic, Somerset, Union
Jan 1, 2007	Somerset
Jan 8, 2007	Burlington, Camden, Somerset
Mar 2, 2007	Bergen, Essex, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Passaic, Somerset, Union
Apr 12, 2007	Somerset
Apr 15, 2007	Atlantic, Bergen, Burlington, Camden, Cumberland, Essex, Gloucester, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Passaic, Salem, Somerset, Sussex, Union, Warren
Apr 27, 2007	Bergen, Essex, Hudson, Hunterdon, Mercer, Middlesex, Passaic, Somerset, Union
May 31, 2007	Warren
Jun 4, 2007	Atlantic, Bergen, Hudson
Jun 12, 2007	Bergen, Hudson
Jun 27, 2007	Essex
Jun 28, 2007	Sussex
July 11, 2007	Bergen, Essex, Hudson, Union
Aug 8, 2007	Bergen, Essex, Hudson, Middlesex, Morris, Passaic, Union, Warren
Aug 10, 2007	Essex, Union

The Office of the New Jersey State Climatologist reported that precipitation for December, February, May, and September were ranked as the 23d, 19th, 16th, and 4th driest, respectively, for the period of record (table 2). The Office of the New Jersey State Climatologist Drought Severity scale ranges from D0

(abnormally dry) to D4 (exceptional drought). Extreme southern New Jersey was classified abnormally dry (D0) during July and August, and the southern half of New Jersey was classified abnormally dry (D0) to moderate drought (D1) during September; however, no drought warnings were issued by the State of New Jersey during water year 2007.

Table 2. Ranking of monthly precipitation values in New Jersey for water year 2007 in relation to the period of record, water years 1896-2007. Monthly precipitation 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 2006	6.58	10th wettest
Nov 2006	6.40	7th wettest
Dec 2006	2.18	23rd driest
Jan 2007	3.74	40th wettest
Feb 2007	2.02	19th driest
Mar 2007	4.37	41st wettest
Apr 2007	9.11	The wettest
May 2007	1.74	16th driest
Jun 2007	4.04	44th wettest
Jul 2007	4.58	50th wettest
Aug 2007	4.73	44th wettest
Sep 2007	1.04	4th driest

Annual mean discharges for water year 2007 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 for water year 2007 are listed as percent difference and range from 2.6 to 86.5 percent. For all 48 of the sites, annual mean discharges were above the period of record mean. Annual mean discharges at most of the selected gaging stations were above the historical mean for water years 2003-06. In contrast, during the 2001 and 2002 water years, annual mean discharges at most of the selected gaging stations were below the historical mean. 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.

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 1896-2006), can be accessed at http://climate.rutgers.edu/stateclim_v1/data/njhistprecip.html. For water year 2007, the spatially weighted values for 8 of 12 months were above the long-term mean (October, November, January, March, April, and June through August, as shown in figure 4). Water year 2007 was the 23d wettest for the period of record. The statewide spatially weighted average-precipitation total was 50.53 inches, which is 5.47 inches more than the long-term mean-annual precipitation from 1896 to 2006. The average annual precipitation for New Jersey is approximately 45 inches. Rankings of monthly precipitation in New Jersey for water year 2007 in relation to the period of record, water years 1896-2007, are listed in table 2.

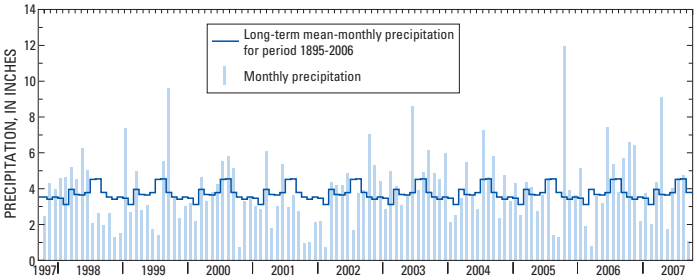

Figure 4. Monthly precipitation for water years 1997-2007 in New Jersey and long-term mean-monthly precipitation for period 1895-2006. (Long-term mean-monthly and monthly precipitation are spatially weighted averages for several dozen stations throughout the State).

Three National Oceanic and Atmospheric Administration's National Weather Service (NWS) precipitation stations located in Newark, Trenton, and Atlantic City have been selected as index sites for precipitation. Water year 2007 precipitation totals were above normal at all three index sites. The Newark station recorded 59.55 inches, which is 13.3 inches above normal or 129 percent of the 30-year reference-period (1971-2000) mean. The Trenton station recorded 46.63 inches, which is 5.24 inches above normal or 113 percent of the 30-year mean. The Atlantic City station recorded 42.95 inches, which is 2.36 inches above normal or 106 percent of the 30-year mean. Monthly precipitation at the three NWS stations, along with the 30-year mean, is shown in figure 5.

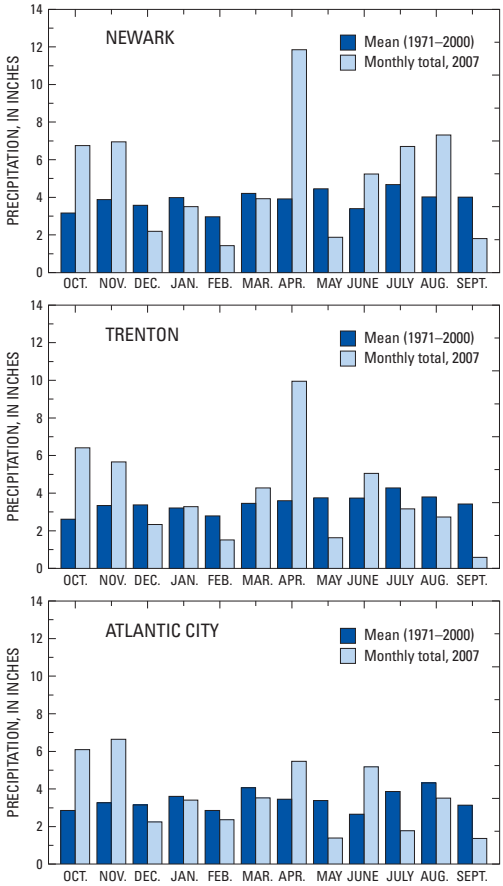

Figure 5. Monthly precipitation at three National Weather Service stations.

Table 3. Annual mean discharges for water year 2007 and mean annual discharges for the period of record at selected gaging stations with 40 years or more of continuous record. [ft^3/s, cubic feet per second; mi^2, square miles]

Station number	Station name	Drainage area (mi^2)	Number of years of record	Annual mean discharge for 2007 water year (ft^3/s)	Mean annual discharge for period of record (ft^3/s)	Percent difference
01377000	Hackensack River at Rivervale, NJ	58.0	66	109	87.4	24.7
01377500	Pascack Brook at Westwood, NJ	29.6	73	67.8	54.3	24.9
01379000	Passaic River near Millington, NJ	55.4	86	123	91.5	34.4
01379500	Passaic River near Chatham, NJ	100	79	231	173	33.5
01380500	Rockaway River above reservoir, at Boonton, NJ	116	70	257	231	11.3
01381500	Whippany River at Morristown, NJ	29.4	86	73.2	54.9	33.3
01382500	Pequannock River at Macopin Intake Dam, NJ	63.7	84	81.7	48.7	67.8
01383500	Wanaque River at Awosting, NJ	27.1	88	56.2	54.7	2.7
01384500	Ringwood Creek near Wanaque, NJ	19.1	66	35.5	33.6	5.7
01386000	West Brook Near Wanaque	11.8	47	25.7	24.8	3.6
01387500	Ramapo River near Mahwah, NJ	120	88	236	230	2.6
01388000	Ramapo River at Pompton Lakes, NJ	160	86	332	289	14.9
01388500	Pompton River at Pompton Plains, NJ	355	68	649	501	29.5
01389500	Passaic River at Little Falls, NJ	762	109	1451	1143	26.9
01390500	Saddle River at Ridgewood, NJ	21.6	50	39.8	34.1	16.7
01391500	Saddle River at Lodi, NJ	54.6	85	138	101	36.6
01393450	Elizabeth River at Ursino Lake, at Elizabeth, NJ	16.9	86	35.6	26.0	36.9
01394500	Rahway River near Springfield, NJ	25.5	70	54.4	31.3	73.8
01395000	Rahway River at Rahway, NJ	40.9	85	93.6	50.2	86.5
01396500	South Branch Raritan River near High Bridge, NJ	65.3	89	145	123	17.9
01397000	South Branch Raritan River at Stanton, NJ	147	91	316	250	26.4
01398000	Neshanic River at Reaville, NJ	25.7	77	53.8	38.4	40.1
01398500	North Branch Raritan River near Far Hills, NJ	26.2	84	62.8	48.3	30.0
01399500	Lamington (Black) River near Pottersville, NJ	32.8	86	68.9	55.9	23.3
01400000	North Branch Raritan River near Raritan, NJ	190	84	408	313	30.4
01401000	Stony Brook at Princeton, NJ	44.5	54	94.4	67.9	39.0
01402000	Millstone River at Blackwells Mills, NJ	258	86	553	387	42.9
01403060	Raritan River below Calco Dam, at Bound Brook, NJ	785	69	1544	1204	28.2
01405400	Manalapan Brook at Spotswood, NJ	40.7	50	81.5	62.5	30.4
01408000	Manasquan River at Squankum, NJ	44.0	76	85.3	73.8	15.6
01408500	Toms River near Toms River, NJ	123	79	249	211	18.0
01409400	Mullica River near Batsto, NJ	46.7	50	130	106	22.6
01410000	Oswego River at Harrisville, NJ	72.5	77	96.1	85.4	12.5
01411000	Great Egg Harbor River at Folsom, NJ	57.1	82	99.0	85.5	15.8
01411500	Maurice River at Norma, NJ	112	75	194	163	19.0
01438500	Delaware River at Montague, NJ	3,480	68	6889	5802	18.7
01440000	Flat Brook near Flatbrookville, NJ	64.0	84	128	112	14.3
01443500	Paulins Kill at Blairstown, NJ	126	85	244	201	21.4
01445500	Pequest River at Pequest, NJ	106	86	186	159	17.0
01446000	Beaver Brook near Belvidere, NJ	36.7	43	59.1	54.2	9.0
01446500	Delaware River at Belvidere, NJ	4,535	85	9432	7958	18.5
01457000	Musconetcong River near Bloomsbury, NJ	141	90	286	241	18.7
01463500	Delaware River at Trenton, NJ	6,780	95	14230	11850	20.1
01464000	Assunpink Creek at Trenton, NJ	90.6	84	180	135	33.3
01464500	Crosswicks Creek at Extonville, NJ	81.5	66	144	134	7.5
01466500	McDonalds Branch in Byrne State Forest, NJ	2.35	53	2.40	2.13	12.7
01467000	North Branch Rancocas Creek at Pemberton, NJ	118	86	202	170	18.8
01467150	Cooper River at Haddonfield, NJ	17.0	43	37.0	33.0	12.1

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 2007 can be accessed online at http://wdr.water.usgs.gov/.

by Jason Shvanda

Photograph of the gaging station on the Hackensack River at Rivervale, New Jersey (USGS downstream order number 01377000), a few hours after the flood peak on April 16, 2007, at a stage approximately 0.3 ft less than the peak.

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