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Report of the River Master of the Delaware River for the Period December 1, 2011–November 30, 2012

Open-File Report 2021–1095

U.S. Department of the Interior
U.S. Geological Survey

Calendar for Report Year 2012

December 2011

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January 2012

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February 2012

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August 2012

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September 2012

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October 2012

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November 2012

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Report of the River Master of the Delaware River for the Period December 1, 2011–November 30, 2012

By Vincent J. DiFrenna, William J. Andrews, Kendra L. Russell, J. Michael Norris, and Robert R. Mason, Jr.

Open-File Report 2021–1095

U.S. Department of the Interior
U.S. Geological Survey

U.S. Geological Survey, Reston, Virginia: 2022

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Complete records of some data released in this report are not available because they were provided through unpublished written communications. Contact the National Weather Service, New York City Department of Environmental Protection, PPL Corporation, Eagle Creek Renewable Energy, or Kimberly Clark Chester Operations for more information.

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Conversion Factors

U.S. customary units to International System of Units

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
million gallons (Mgal)	3,785	cubic meter (m^3)
billion gallons (Ggal)	3.785	cubic hectometers (hm^3)
cubic foot per second for a day ([ft^3/s]-d)	2,447	cubic meter (m^3)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m^3/s)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F = (1.8 \times °C) + 32.$$

Datums

Vertical coordinate information is referenced to the Bureau of Water Supply datum, which was established by the New York City Department of Environmental Protection, Bureau of Water Supply.

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Elevation, as used in this report, refers to distance above the vertical datum.

Supplemental Information

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 °C).

Concentrations of chemical constituents in water are given in milligrams per liter (mg/L).

Abbreviations

DRBC	Delaware River Basin Commission
FFMP	Flexible Flow Management Program
IERQ	Interim Excess Release Quantity
New York City DEP	New York City Department of Environmental Protection
NWIS	National Water Information System (database)
ODRM	Office of the Delaware River Master
USGS	U.S. Geological Survey

River Master Letter of Transmittal and Special Report

Office of the Delaware River Master
U.S. Geological Survey
415 National Center
Reston, VA 20192

February 10, 2022

The Honorable
John G. Roberts, Jr.
Chief Justice of the United States

The Honorable
John Carney
Governor of Delaware

The Honorable
Phil Murphy
Governor of New Jersey

The Honorable
Kathy Hochul
Governor of New York

The Honorable
Tom Wolf
Governor of Pennsylvania

The Honorable
Eric Adams
Mayor of the City of New York

No. 5, Original.—October Term, 1950
State of New Jersey, Complainant,
v.
State of New York and City of New York, Defendants,
Commonwealth of Pennsylvania and State of Delaware, Intervenors.

To the Chief Justice of the United States:

For the record, and in compliance with the provisions of the amended Decree of the Supreme Court of the United States entered June 7, 1954, I am hereby transmitting the 59th Annual Report of the River Master of the Delaware River for the 12-month period from December 1, 2011, to November 30, 2012. In this report, this period is referred to as the River Master report year.

During the 2012 River Master report year, monthly precipitation in the upper Delaware River Basin ranged from 41 percent of the long-term average in February 2012 to 161 percent of the long-term average in September 2012. Precipitation from December to May, when reservoirs typically refill, was 18.41 inches. Precipitation was below normal in January, February, March, April, June, August, and November, and above normal in the other five months. Hurricane Sandy made landfall at category 1 strength near Brigantine, New Jersey, northeast of Atlantic City, on October 29, 2012. Due in part to that storm, October precipitation over the basin averaged 5.18 inches (139 percent of the monthly mean), water in storage increased by about 1 billion gallons in both

the Pepacton and Cannonsville Reservoirs, and streamflows downstream from the Pepacton, Cannonsville, and Neversink Reservoirs increased substantially. To enhance flood mitigation benefits provided by the Neversink Reservoir prior to the landfall of Hurricane Sandy, an agreement was signed on October 25, 2012, granting the right to make discharge mitigation releases from that reservoir as a temporary modification to the release program for discharge mitigation releases.

On December 1, 2011, when the report year began, combined useable storage in the three New York City reservoirs in the upper Delaware River Basin was 255.341 billion gallons, or 94.3 percent of combined storage capacity. Combined storage in the Pepacton, Cannonsville, and Neversink Reservoirs remained high until late May 2012. Reservoir storage decreased from late May through mid-September and rebounded in mid-October, then declined slightly through the end of November. The combined usable storage was 204.129 billion gallons at the end of the report year on November 30, 2012. During the report year, operations in the basin were conducted as stipulated by the Decree and the Flexible Flow Management Program.

On May 22, 2012, the Delaware River Master Advisory Committee met at Southeast Morris County Municipal Utility Authority in Cedar Knolls, New Jersey, to discuss issues related to new 1-year reservoir releases and provide status updates on NYC activities and information on *Didymosphenia geminata* algae in the Delaware. During the report year, the following individuals served as members of the Advisory Committee:

David Wunsch (Delaware)
Michele Siekerka (New Jersey)
Mark Klotz (New York)
Paul Rush (New York City)
Kelly Heffner (Pennsylvania)

During the report year, Office of the Delaware River Master operations were executed through the U.S. Geological Survey Office of the Delaware River Master located in Milford, Pennsylvania. Marie Stewart, Deputy Delaware River Master, was placed in charge of the office in June 2012, and was assisted by Gary N. Paulachock, U.S. Geological Survey hydrologist.

During the report year, the Office of the Delaware River Master participated in a number of water-supply-related meetings of the Delaware River Basin Commission (DRBC). The Deputy Delaware River Master met periodically with representatives of the Decree Parties (Delaware, New Jersey, New York, New York City, and Pennsylvania) as a member of the Decree Parties Work Group and the DRBC's Regulated Flow Advisory Committee. In addition to management of reservoir releases and streamflow in the upper Delaware River Basin, an issue of particular interest to the River Master was the impending expiration of the current Flexible Flow Management Plan on June 1, 2012. A 1-year extension of the Flexible Flow Management Plan was unanimously approved by the Decree Parties, and was enacted on May 31, 2012.

During the report year, the Office of the Delaware River Master continued the weekly distribution of a summary hydrologic report. These reports contain provisional data on precipitation in the upper Delaware River Basin, releases and spills from New York City reservoirs to the Delaware River, diversions to the New York City water-supply system, reservoir contents, daily segregation of flow of the Delaware River at the U.S. Geological Survey Montague, New Jersey, streamgage, and diversions by New Jersey. The reports were distributed to members of the Advisory Committee and to other parties interested in Delaware River operations. A

monthly summary of hydrologic conditions also was provided to Advisory Committee members. The weekly and monthly hydrologic reports are available through the Office of the Delaware River Master website (https://webapps.usgs.gov/odrm/data_archive.html).

The first section of this report documents Delaware River operations during the report year. During the year, New York City diverted 225.675 Bgal from the Delaware River Basin and released 162.433 billion gallons from Pepacton, Cannonsville, and Neversink Reservoirs to the Delaware River for conservation purposes. In addition, 17.434 billion gallons were spilled from the Pepacton, Cannonsville, and Neversink Reservoirs. The Office of the Delaware River Master directed releases from these reservoirs to the Delaware River that totaled 22.182 billion gallons. The second section of this report describes water quality at various monitoring sites on the Delaware River estuary. It includes basic data on chemical properties and physical characteristics of the water and presents summary statistics on the data.

Throughout the report year, diversions to New York City's water-supply system and releases designed to maintain the flow of the Delaware River at Montague were made as directed by the Office of the Delaware River Master. Diversions by New York City from its reservoirs in the Delaware River Basin did not exceed the limit stipulated by the Decree. Diversions by New Jersey also were within stipulated limits.

The River Master and staff are grateful for the continued cooperation and support of the Decree Parties. Also, the contributions of the PPL Corporation and Eagle Creek Renewable Energy in informing the the Office of the Delaware River Master of plans for power generation and furnishing data on reservoir releases and elevations are greatly appreciated.

Sincerely yours,

Kendra Russell, P.E.
Delaware River Master

Acknowledgments

The Office of the Delaware River Master's daily operation records were prepared from hydrologic data collected mainly on a day-to-day basis. Data for these records were collected and computed by the office or were furnished by the following agencies and utilities: data for streamflow of the Delaware River at Montague, New Jersey, and other locations and tributaries by the U.S. Geological Survey (USGS); for the Pepacton, Cannonsville, and Neversink Reservoirs by the New York City Department of Environmental Protection; for Lake Wallenpaupack by the PPL Corporation; and for Rio Reservoir by Eagle Creek Renewable Energy. Quantitative precipitation forecasts and some precipitation data were provided by the National Weather Service offices in Binghamton, New York, and State College, Pennsylvania. Darwin Ockerman, Marie Owens, and Margaret Philips, all of the USGS, assisted and contributed to this report by collecting, organizing, and reviewing data.

Report of the River Master of the Delaware River for the Period December 1, 2011–November 30, 2012

By Vincent J. DiFrenna, William J. Andrews, Kendra L. Russell, J. Michael Norris, and Robert R. Mason, Jr.

Abstract

A Decree of the Supreme Court of the United States, entered June 7, 1954, established the position of Delaware River Master within the U.S. Geological Survey. In addition, the Decree authorizes diversion of water from the Delaware River Basin and requires compensating releases from certain reservoirs, owned by New York City, to be made under the supervision and direction of the River Master. The Decree stipulates that the River Master will furnish reports to the Court, not less frequently than annually. This report is the 59th annual report of the River Master of the Delaware River. It covers the 2012 River Master report year, the period from December 1, 2011 to November 30, 2012.

During the report year, precipitation in the upper Delaware River Basin was 43.35 inches or 97 percent of the long-term average. Combined storage in the Pepacton, Cannonsville, and Neversink Reservoirs remained high through late May, declined from then until mid-September, decreasing below 80 percent of combined capacity in late August, increased in late October, and decreased slightly in November 2012. Delaware River Master operations during the year were conducted as stipulated by the Decree and the Flexible Flow Management Program.

Diversions from the Delaware River Basin by New York City and New Jersey were in full compliance with the Decree. Reservoir releases were made as directed by the River Master at rates designed to meet the flow objective for the Delaware River at Montague, New Jersey, on 52 days during the report year. Interim Excess Release Quantity and conservation releases, designed to relieve thermal stress and protect the fishery and aquatic habitat in the tailwaters of the reservoirs, were also made during the report year. An agreement was signed on October 25, 2012, to increase discharge mitigation releases from the Neversink Reservoir due to potential impacts from Hurricane Sandy.

The quality of water in the Delaware River estuary between Trenton, New Jersey, and Reedy Island Jetty, Delaware, was monitored at various locations. Data on water temperature, specific conductance, dissolved oxygen, and pH were collected continuously by electronic instruments at four sites.

Definitions of Terms and Procedures

The following definitions apply to various terms and procedures used in the operations documented in this report.

- **Balancing adjustment**—An operating procedure used by the Office of the Delaware River Master to correct for inaccuracies inherent in the design of releases from New York City reservoirs to meet the Montague Flow Objective at Montague, New Jersey. The balancing adjustment calls for more water to be released when previous directed releases (or lack of releases) were insufficient to meet the Montague Flow Objective. It calls for less water to be released when previous directed releases were higher than required to meet the Montague Flow Objective. The balancing adjustment, based on provisional data, is computed as 10 percent of the difference between the cumulative adjusted directed release and the cumulative directed release required for exact forecasting. The balancing adjustment is applied to the following day's release design. The maximum daily balancing adjustment is intentionally limited to preclude unacceptably large variations in the adjusted flow objective.

- **Capacity**—Total useable volume in a reservoir between the point of maximum depletion and the elevation of the lower crest of the spillway.

- **Conservation releases**—Controlled releases from the Pepacton, Cannonsville, and Neversink Reservoirs in New York that are designed to maintain specified minimum flows in stream channels immediately below the reservoirs (tailwaters). The following conservation release rate zones are defined in the June 1, 2012 Flexible Flow Management Plan:

  - **L1**—Spill mitigation when New York City combined reservoir storage is in the spill mitigation (L1) storage zone.

  - **L2**—Conservation releases when New York City combined reservoir storage is in the normal (L2) storage zone.
  - **L3**—Conservation releases when New York City combined reservoir storage is in the drought watch (L3) storage zone.
  - **L4**—Conservation releases when New York City combined reservoir storage is in the drought warning (L4) storage zone.
  - **L5**—Conservation releases when New York City combined reservoir storage is in the drought (L5) storage zone (also referred to as Drought Emergency).
- **Directed releases**—Controlled releases from New York City reservoirs in the upper Delaware River Basin, designed by the Office of the Delaware River Master to meet the Montague Flow Objective.
- **Discharge mitigation release**—These are releases designed to help mitigate the effects of spilling immediately below the Delaware River Basin reservoirs. The 2012 Flexible Flow Management Program details the releases in section 7 (appendix 1).
- **Diversions**—The out-of-basin transfer of water by New York City from Pepacton, Cannonsville, and Neversink Reservoirs of New York State in the upper Delaware River Basin through the East Delaware, West Delaware, and Neversink Tunnels, respectively, to New York City's water-supply system. Also, the out-of-basin transfer of water by New Jersey from the Delaware River through the Delaware and Raritan Canals.
- **Excess quantity**—As defined by the Decree, the excess quantity of water is "equal to 83 per cent [sic] of the amount by which the estimated consumption during such year is less than the City's estimate of the continuous safe yield during such year of all its sources obtainable without pumping." The excess quantity shall not exceed 70 billion gallons, and the seasonal period for release of the excess quantity begins on June 15 and concludes on the following March 15.
- **Flexible Flow Management Program (FFMP)**—A set of rules for the management of storage, diversions, releases, and flow targets relating to the apportioning of water from the Delaware River Basin under the 1954 U.S. Supreme Court Decree and unanimously agreed to by the Decree Parties (Delaware, New Jersey, New York, New York City, and Pennsylvania).
- **Index gaging stations**—Specific sites on tributaries of the upper Delaware River where systematic observations of gage height and discharge are made. These stations are used mainly during the directed-releases season to help estimate inflows of surface water to the upper Delaware River.
- **Interim Excess Release Quantity**—An Interim Excess Release Quantity (IERQ) was defined in the Flexible Flow Management Program and made available for interim periods from June 1, 2011, to May 31, 2012, and from June 1, 2012, to May 31, 2013. The IERQ is computed as 83 percent of the difference between the highest year's consumption of the New York City water-supply system during the period 2002–2006 (1,257 million gallons per day) and New York City's current estimate of continuous safe yield of the New York City water-supply system of 1,290 million gallons per day, obtainable without pumping. During the 2012 report year, the IERQ available for release was 15,468 cubic feet per second for a day. 6,045 cubic feet per second for a day of the IERQ is incorporated in the releases tables to enhance base releases from the New York City Delaware River Basin reservoirs.
- **Interim Excess Release Quantity Extraordinary Needs Bank**—From the 2012 Flexible Flow Management Program (appendix 1): "In addition to the hydrologic criteria described in Section 2.5.6.A. [sic] of the Water Code and subject to other provisional uses of the IERQ as provided herein, the Decree Parties [Delaware, New Jersey, New York State, New York City, and Pennsylvania], the DRBC and the River Master may at any time review extraordinary water needs to support such research, aquatic-life, or other water-use activity as may be approved by the DRBC. Upon unanimous agreement, the Decree Parties may bank all or a portion of the IERQ remaining at such time, and such portion shall be placed in an IERQ Extraordinary Needs Bank and used to provide for such extraordinary water needs. Such quantity as may be so banked shall be deducted from the IERQ. Any unused Extraordinary Needs Bank water shall be returned to IERQ."
- **Key gaging stations**—Specific sites on the East Branch Delaware River, West Branch Delaware River, Neversink River, Delaware and Raritan Canal, and mainstem Delaware River where continuous, systematic observations of gage height and discharge are made. These stations are used on a year-round basis in Office of the Delaware River Master operations.
- **Maximum reservoir depletion**—The minimum water-surface level or elevation below which a reservoir ceases to continue making delivery of quantities of water for all purposes for which the reservoir was designed. This is also referred to as minimum full-operating level.

- **Montague Flow Objective**—In section 3a of the June 1, 2012 Flexible Flow Management Program (appendix 1), "Except with respect to limitations provided herein in Section 5, releases from the City Delaware Basin Reservoirs shall be in quantities designed to maintain, during Normal storage conditions, a minimum basic rate of flow at the gaging station of the U.S. Geological Survey * * * at Montague, N. J. of 1,750 cubic feet per second (cfs), as directed by the River Master in accordance with Section VII. [sic] of the Decree. During Basinwide Drought Watch, Drought Warning, and Drought Emergency, in accordance with Section 5 of this Agreement and Section 2.5.3.B. [sic] and Tables 1 and 2 of the Delaware River Basin Water Code * * *, the Montague flow objective shall vary based upon the time of year and location of the salt front, and minimum compensating releases shall be made by the City of New York from its reservoirs in the upper Delaware Basin." The Delaware River Basin Water Code can be found in Delaware River Basin Commission (2013).
- **Rate of flow**—Mean discharge for a specified 24-hour period, measured in cubic feet per second for a day ([ft^3/s]-d) or million gallons per day (Mgal/d).
- **Rate of flow at Montague**—Daily mean discharge of the Delaware River at Montague, New Jersey, computed on a calendar-day basis.
- **Reservoir-controlled releases**—Controlled releases from reservoirs passed through outlet valves in the dams or through turbines in powerplants. These releases do not include spillway overflow at the reservoirs.
- **Salt front**—The salt front is defined as the 250 parts-per-million isochlor, or line of equal chloride concentration, in the Delaware River estuary. One part per million is one part of solute (in this case, chloride) per one million parts of solvent (river water). The 7-day average location of the salt front is used as an indicator of salinity intrusion in the Delaware River estuary and a factor affecting the Montague and Trenton Flow Objectives during drought emergencies.
- **Storage or contents**—Usable volume of water in a reservoir. Unless otherwise indicated, volume is computed on the basis of the level of pool above the point of maximum depletion.
- **Time of day**—Time of day is expressed in 24-hour Eastern Standard Time, which during the report year included a 23-hour day on March 11 and a 25-hour day on November 4.
- **Trenton Flow Objective**—In section 3b of the June 1, 2012 Flexible Flow Management Program (appendix 1), "Section 2.5.3 of the Water Code establishes a set of equivalent flow objectives at Trenton, N.J. to control salinity intrusion in the Delaware Estuary. During Basinwide Drought Watch, Drought Warning, and Drought Emergency, in accordance with Section 5 of this Agreement and Section 2.5.3.B. [sic] and Tables 1 and 2 of the Water Code, the Trenton Equivalent Flow Objective shall vary based upon the time of year and location of the salt front, and minimum compensating releases shall be made by the City of New York from its reservoirs in the upper Delaware Basin." The Delaware River Basin Water Code can be found in Delaware River Basin Commission (2013).
- **Uncontrolled runoff at Montague**—Runoff from the 3,480-square-mile drainage area above Montague, New Jersey, excluding the drainage area above the Pepacton, Cannonsville, and Neversink Reservoirs; Lake Wallenpaupack; and Rio Reservoir, but including spillway overflow at these dams.

Introduction

An amended Decree of the Supreme Court of the United States, entered June 7, 1954 (available at https://webapps.usgs.gov/odrm/about/decree), which superseded a 1931 Decree, authorizes diversion of water from the Delaware River Basin and provides for releases of water from three New York City reservoirs—Pepacton, Cannonsville, and Neversink—to the upper Delaware River. The Decree stipulates that these diversions and releases are to be made under the supervision and direction of the Office of the Delaware River Master (ODRM). The Decree also stipulates that reports on Delaware River operations be made to the Court not less frequently than annually. The reports can be accessed at https://webapps.usgs.gov/odrm/publications/publications.

This report documents operations from December 1, 2011, to November 30, 2012, or the 2012 River Master report year. This report also presents information on the quality of water in the Delaware River estuary during the report year.

Since 2007, the Decree Parties (Delaware, New Jersey, New York, New York City, and Pennsylvania) have unanimously approved a series of Flexible Flow Management Program (FFMP) agreements (available at https://webapps.usgs.gov/odrm/ffmp/flexible-flow-management-program) to manage the shared waters of the Delaware River Basin (appendix 1). On December 10, 2008, the Decree Parties signed an FFMP to guide the operations of the ODRM (Russell and others, 2019). A 1-year FFMP approved on June 1, 2011, was set to expire on May 31, 2012. That FFMP was continued with a 1-year extension effective from June 1, 2012, to May 31, 2013 (appendix 1). The June 1, 2012 FFMP agreement differed from the previous FFMP agreement in the following elements:

- section 1b., Current Program, was updated to reflect the June 1, 2012 FFMP 1-year extension;
- the dates were revised to correspond to the effective term of the June 1, 2012 FFMP agreement;
- additional units of measurement for water volume were provided; and
- the State of Delaware had one party signing the current FFMP agreement, as opposed to two.

During this period, two agreements were signed to temporarily modify release amounts specified in the FFMP: (1) an agreement effective on June 20, 2012, to release an additional 350 cubic feet per second (ft^3/s) from Cannonsville Reservoir from June 20 to 21, 2012, to meet thermal conditions specified in the FFMP (appendix 2), and (2) an agreement effective on October 25, 2012, to allow for increasing reservoir releases up to the L1, a rate of 190 ft^3/s, to enhance flood mitigation benefits provided by the Neversink Reservoir prior to the arrival of Hurricane Sandy (appendix 3).

Some hydrologic data presented in this report are records of streamflow and water quality for U.S. Geological Survey (USGS) data-collection stations. These records were collected and computed by the offices of the USGS at Troy, New York, and Exton, New Cumberland, and Milford, Pennsylvania; and Lawrenceville, New Jersey, in cooperation with the States of New York and New Jersey, the Commonwealth of Pennsylvania, and the City of New York. The locations of major streams and reservoirs, and selected USGS streamflow-gaging stations (streamgages), in the Delaware River Basin are shown in figure 1.

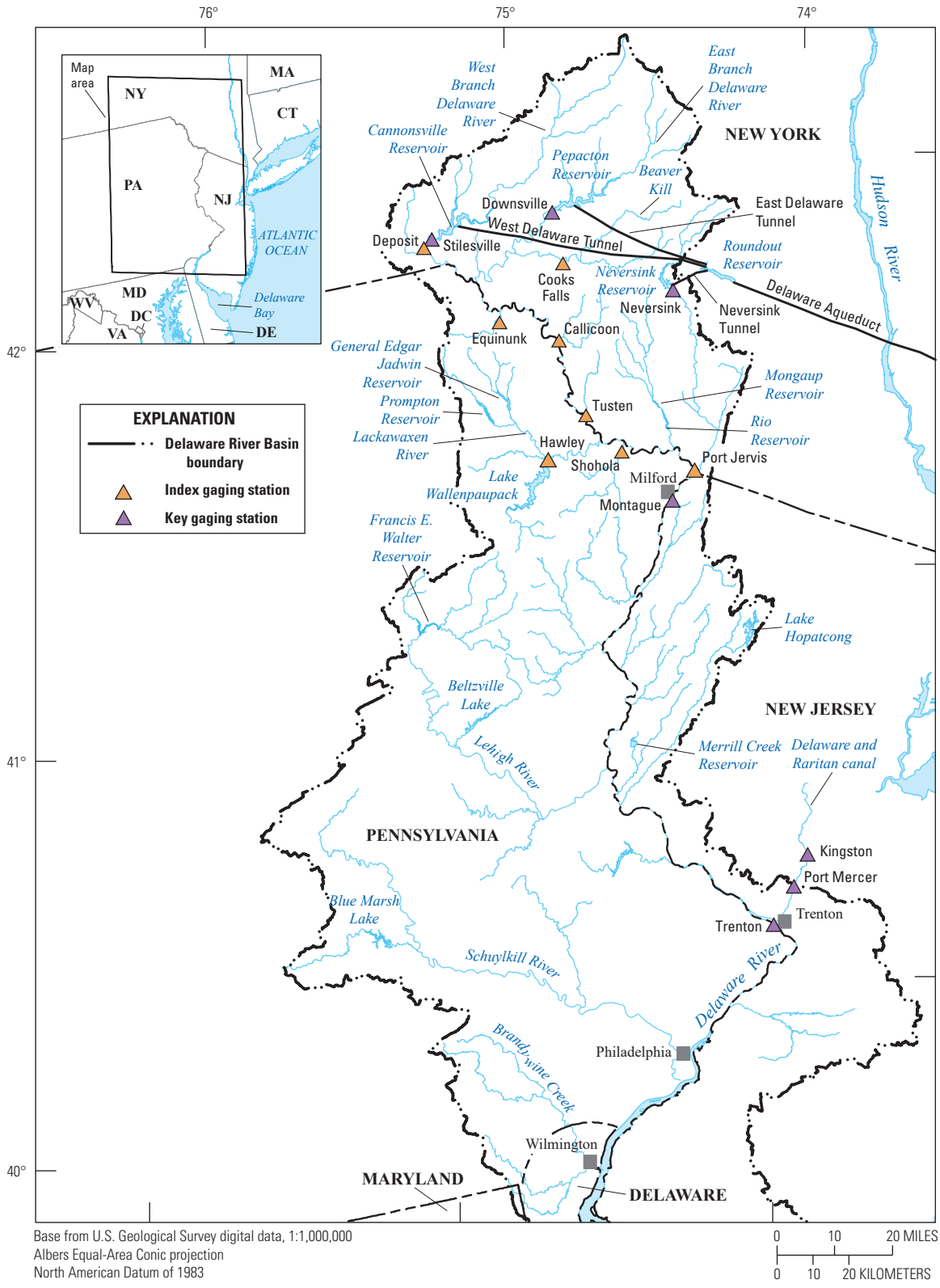

Figure 1. Map showing the Delaware River Basin upstream from Wilmington, Delaware.

Method to Determine Directed Releases from New York City Reservoirs

The data and computations of the various components of streamflow form the basic operational record used by the ODRM to carry out specific responsibilities related to the Montague formula. The operational record has two parts: (1) segregating the streamflow components of the current daily mean discharge at the USGS streamgage at Montague, New Jersey (station number 01438500), to compute the uncontrolled runoff; and (2) forecasting the uncontrolled runoff and using forecasted information from other sources to predict the flow at Montague with adequate advance time to direct releases. The forecasting process is used to determine whether the ODRM directs New York City reservoirs to release water to maintain the minimum flow objective at the USGS streamgage at Montague, New Jersey, which is defined in appendix 1, table 1.

Segregating Streamflow Components, Delaware River at Montague, New Jersey

Segregation of streamflow at Montague involves determining the components of flow, including releases from New York City reservoirs, releases from Lake Wallenpaupack and Rio Reservoir for generation of hydroelectric power, and uncontrolled runoff. For the segregation of components of daily mean flow at Montague, the following data are used:

1. Controlled releases from the Pepacton, Cannonsville, and Neversink Reservoirs of New York City.
2. Controlled releases from Lake Wallenpaupack to Wallenpaupack Creek to produce hydroelectric power.
3. Controlled releases from Rio Reservoir to the Mongaup River to produce hydroelectric power.

To determine the contributions of each of these releases, the amount of time it takes the water to travel from the release point to the USGS streamgage at Montague is required. The various traveltimes are used to determine the appropriate time-delayed flow contributions from the above sources. The time-adjusted controlled flows of the above sources are subtracted from the total streamflow measured at the Montague streamgage to determine the uncontrolled runoff (including reservoir spills and groundwater) from the drainage area upstream from Montague.

Traveltimes were computed from reservoir and powerplant operations data and historical streamflow records. The travel-times are generally adequate for ODRM operations. Occasionally, however, significant exceptions are observed. For example, during a large increase in directed release from Cannonsville Reservoir, the arrival time of the water at Montague can be delayed as long as 1.5 days because a substantial amount of water must first fill the channel before a steady flow arrives at Montague. During winter, the formation of ice, together with lower streamflow, gradually increases the resistance to water flow, resulting in increased traveltimes. Because ice-affected traveltimes increase gradually over several days, and releases were not directed to meet the Montague Flow Objective during periods of ice, no adjustments were made to compensate for increased traveltimes during these periods of the report year. The following list gives the average times for the effective travel of water from the various sources of controlled supply to Montague, New Jersey. These traveltimes, in hours, were used for flow routing during the 2012 report year: Pepacton Reservoir, 60; Cannonsville Reservoir, 48; Neversink Reservoir, 33; Lake Wallenpaupack, 16; and Rio Reservoir, 8.

Forecasting Streamflow, Delaware River at Montague, New Jersey

The releases from New York City's reservoirs necessary to meet the Montague Flow Objective were computed on the basis of the forecasted streamflow at Montague, exclusive of releases from New York City's Delaware River Basin reservoirs. The flow must be forecast 3 days in advance to account for the longest traveltime needed to New York City, from the Pepacton Reservoir.

The electric utilities PPL Corporation and Eagle Creek Renewable Energy furnished daily forecasts of power generation and releases to tributaries of the Delaware River from Lake Wallenpaupack and Rio Reservoir, respectively, to the ODRM. Because the hydroelectric plants were used mainly for meeting rapidly varying peak power demands, the forecasts were subject to various modifying factors, including the vagaries of weather on electricity demand. In addition, because the power companies are members of regional transmission organizations, demand for power outside of the local service area may unexpectedly affect generation schedules. Consequently, at times, the actual use of water for power generation differs considerably from the forecasts used in the design of reservoir releases.

For computational purposes during periods of low flow, estimates of uncontrolled runoff at Montague were treated as two components: (1) current runoff and (2) forecasted runoff from precipitation.

An estimate of uncontrolled runoff was computed by using a routing and recession procedure based on discharges at 0800 hours at several USGS streamgages (table 1).

Forecasted runoff was determined from data provided by the National Weather Service office in Binghamton, New York, which furnished quantitative forecasts of average precipitation and air temperatures for the 3,480-square-mile (mi^2) drainage basin upstream from Montague, New Jersey. During winter, runoff was estimated based on the status of snow and ice, along with forecasted precipitation and temperature. During other periods, forecasted precipitation was used to estimate runoff.

The forecasted flow at Montague, exclusive of releases from New York City's Delaware River Basin reservoirs, is computed as the sum of forecasted releases from hydroelectric power reservoirs, estimated uncontrolled runoff including conservation releases from Rio Reservoir, and estimated runoff from predicted rainfall. Each of these inputs are adjusted for traveltime. If the computed total flow is less than the flow objective at Montague, then the deficiency is made up by releases from New York City's reservoirs, as directed by the ODRM.

A balancing adjustment is applied to the following day's release design based on the previous day's provisional data. The balancing adjustment is computed as 10 percent of the difference between the cumulative directed release and the cumulative directed release required for exact forecasting and limited to a maximum of 50 ft^3/s magnitude. The balancing adjustment calls for more water to be released when previous directed releases (or lack of releases) were insufficient to meet the Montague Flow Objective. It calls for less water to be released when previous directed releases were higher than required to meet the Montague Flow Objective.

When updated forecasts of precipitation or powerplant releases showed appreciable changes after a release was directed, the release required from New York City's reservoirs was recomputed on the basis of the updated forecasts. Commonly, this procedure resulted in a reduced release requirement for New York City reservoirs that day. Only final values for releases from New York City reservoirs are presented in this report.

Table 1. Streamgages in the Delaware River Basin used to estimate uncontrolled runoff at Montague, New Jersey.

[mi^2, square mile]

Station name (identification number)	Drainage area (mi^2)
Beaver Kill at Cooks Falls, New York (01420500)	241
Oquaga Creek at Deposit, New York (01426000)	67.6
Equinunk Creek at Equinunk, Pennsylvania (01427203)	56.3
Callicoon Creek at Callicoon, New York (01427500)	110
Tenmile River at Tusten, New York (01428000)	45.6
Lackawaxen River at Hawley, Pennsylvania (01431500)	290
Shohola Creek near Shohola, Pennsylvania (01432500)	83.6
Neversink River at Port Jervis, New York (01438000)	336

Hydrologic Conditions

Precipitation

Average precipitation in the Delaware River Basin above Montague, New Jersey, totaled 43.35 inches (in.) during the 2012 report year and was 97 percent of the long-term (71-year) average (table 4). Monthly precipitation ranged from 28 percent of the long-term average in November 2012 to 161 percent of the long-term average in September 2012 (table 4). Precipitation data for the 2012 report year were computed from records from 10 geographically distributed stations operated by the National Weather Service; the New York City Department of Environmental Protection (New York City DEP), Bureau of Water Supply; and the ODRM.

The seasonal period from December to May typically is when surface-water and groundwater reservoirs refill. During this period in 2011–2012, total precipitation was 18.41 in., which is about 90 percent of the 71-year long-term average. During the June to November period, total precipitation was 25.14 in., which is 104 percent of the 71-year long-term average.

Reservoir Storage

Table 2 summarizes the "point of maximum depletion" and other pertinent levels and contents of Pepacton, Cannonsville, and Neversink Reservoirs. This information was provided by the New York City DEP.

Daily storage in the Pepacton, Cannonsville, and Neversink Reservoirs above the point of maximum depletion, or minimum full-operating level, is given in tables 5, 6, and 7, respectively, and combined storage during the report year is shown in figure 2. On December 1, 2012, combined useable storage in the three reservoirs was 255.341 billion gallons or 94.3 percent of combined capacity. From December to May, inflow to the New York City reservoirs typically exceeds outflow, and consequently, storage increases. Combined storage increased during the report year, and the reservoirs were at about 100 percent of usable capacity on May 31, 2012. Combined storage remained high (above 80 percent combined capacity) until August 2012. The lowest combined storage was 176.644 billion gallons or 65.3 percent on September 18, 2012.

The three reservoirs spilled a total of 17.434 billion gallons during the year when reservoirs reached maximum capacity. Pepacton spilled during the following periods: December 8–16, 2011, and May 19–30, 2012. Cannonsville spilled May 18–26, 2012. Neversink spilled during the following periods: December 8, 2011, to February 9, 2012; May 23 to June 1, 2012; and October 28 to November 19, 2012. Combined storage reached a maximum for the report year on May 24, 2012, at 272.260 billion gallons. The reservoirs' storage decreased from this point, and the combined storage was 204.129 billion gallons or 75.4 percent of combined capacity on November 30, 2012. In October 2012, an agreement to modify the release program for discharge mitigation releases was made to provide additional storage capacity at the Neversink Reservoir and to reduce potential downstream flooding prior to the landfall of Hurricane Sandy (appendix 3).

Table 2. Elevation and capacities of structures of the Pepacton, Cannonsville, and Neversink Reservoirs.

[ft, foot; Mgal, million gallons; NA, not available; —, not applicable]

Level	Pepacton Reservoir		Cannonsville Reservoir		Neversink Reservoir	
	Elevation (ft)	Volume (Mgal)	Elevation (ft)	Volume (Mgal)	Elevation (ft)	Volume (Mgal)
Full pool or spillway crest	1,280	—	1,150	—	1,440	—
Point of maximum depletion	1,152	[1]140,190	1,040	[1]95,706	1,319	[1]34,941
Sill of diversion tunnel	1,143	[2]3,511	[3]1,035	[2]1,020	1,314	[2]525
Sill of river outlet tunnel	1,126.50	[4]4,200	1,020.50	[4]1,564	1,314	NA
Dead storage	—	1,800	—	328	—	1,680

[1]Quantity stored between full pool or spillway crest and point of maximum depletion.

[2]Quantity stored between point of maximum depletion and sill of diversion tunnel.

[3]Elevation of mouth of inlet channel of diversion works.

[4]Quantity stored between sill of diversion tunnel and sill of river outlet tunnel.

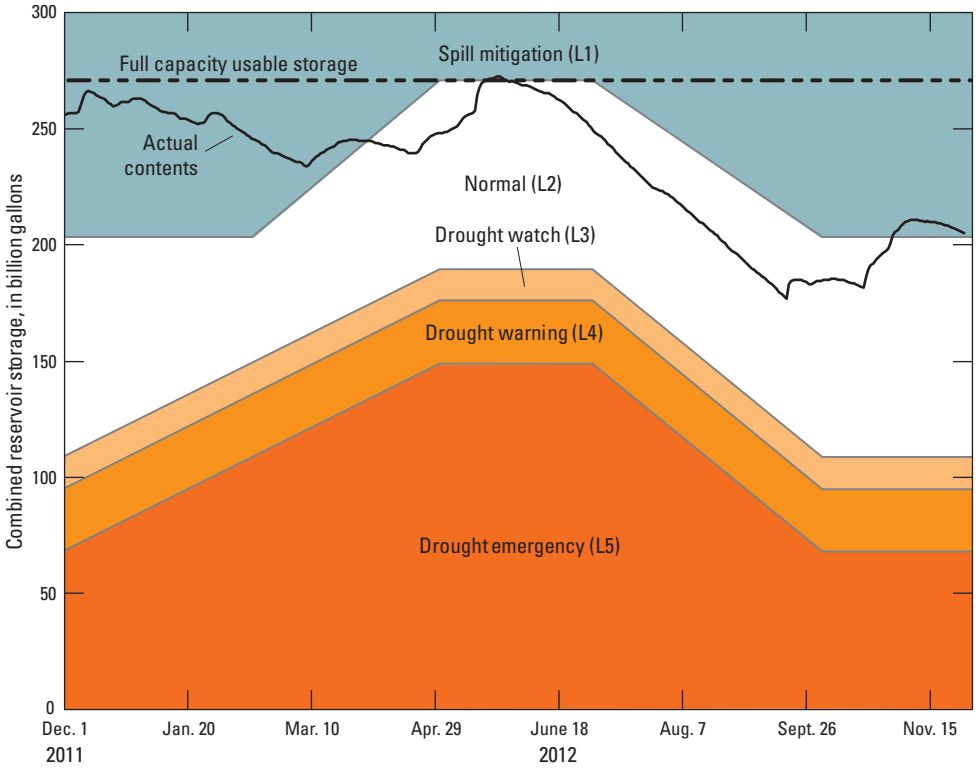

Figure 2. Graph showing rule curves and actual contents for New York City reservoirs in the Delaware River Basin, from December 1, 2011, to November 30, 2012.

Operations

Operations during December 1, 2011, through November 30, 2012, were conducted as described by the FFMP (revised, effective June 1, 2011, and continued for a second year effective June 1, 2012). The allowable diversion to New York City was 800 million gallons per day (Mgal/d) throughout the year. The Montague Flow Objective was 1,750 ft^3/s. The allowable diversion to New Jersey was 100 Mgal/d. Conservation releases from New York City reservoirs were made at the rates shown in 2012 FFMP tables 4a through 4g in appendix 1; using tables 4f through 4g in December 2011, table 4a in April 2012, table 4d in March and late July 2012, table 4e in early July and August 2012, and tables 4f and 4g in January, May, June, September, and October 2012 (see "Archived OST Summary Data" at https://webapps.usgs.gov/odrm/data/data.html).

Diversions to New York City Water Supply

The 1954 amended Decree authorizes New York City to divert water from the Delaware River Basin at a rate not to exceed the equivalent of 800 Mgal/d. The Decree specifies that the diversion rate shall be computed as the aggregate total diversion beginning June 1 of each year divided by the total number of days elapsed since the preceding May 31.

Records of daily diversions through the East Delaware, West Delaware, and Neversink Tunnels (fig. 1) were furnished to the ODRM by the New York City DEP. These records were obtained from the City's calibrated instruments connected to venturi meters installed in the tunnel conduits. The measured flows were transmitted electronically on a 15-second interval to New York City computers, and 5-minute interval release and diversion quantities for the preceding 5-minute period were computed by using the instantaneous rate-of-flow data from each instrument. These 5-minute quantities were then summed to compute daily total flows, which were reported each day to the ODRM. Each week, the computed diversion values were checked against the flow meter totalizer readings by New York City DEP and corrected when necessary.

Daily diversions during the report year from Pepacton, Cannonsville, and Neversink Reservoirs to the New York City water-supply system (Rondout Reservoir) are given in table 8. A running account of the average rates of combined

diversions from the three reservoirs from June 1, 2011, computed as stipulated by the Decree, also is shown in table 8. A total of 225.675 billion gallons of water were diverted to the New York City water-supply system during the report year with an average of 617 Mgal/d, which is below the maximum diversion rate. The maximum daily diversion from a single reservoir was 599 million gallons (Mgal) on November 3, 2012, from Pepacton Reservoir. The maximum daily combined diversion from all three reservoirs was 1,038 Mgal on November 1, 2012. Diversions by New York City did not exceed the limits stipulated by the Decree and the FFMP. Data on water consumption by New York City for each calendar year since 1950, from all sources of supply, are presented in table 9.

The East Delaware Tunnel is used to divert water from Pepacton Reservoir to Rondout Reservoir. The hydroelectric powerplant at the downstream end of the East Delaware Tunnel operated most days of the report year. When the powerplant was not in operation, some water leaked through the wicket gates and was not recorded on the totalizer. A current-meter measurement made in 1989 showed that the (assumed constant) rate of leakage is about 12.4 ft^3/s (8.0 Mgal/d). Because the powerplant was not in operation for the equivalent of 71 days during the 2012 report year, the estimated quantity of unmeasured leakage (diverted but not recorded) was about 0.6 billion gallons.

The West Delaware Tunnel is used to divert water from Cannonsville Reservoir to Rondout Reservoir. Inspections of the channel below the outlet, when the valves were closed, revealed only negligible leakage. A hydroelectric powerplant uses water diverted through the West Delaware Tunnel, but the plant operates only when diversions are less than 300 Mgal/d. When the powerplant is not operating, the valves on the pipelines to the plant are closed, and there is no leakage through the system.

The Neversink Tunnel is used to divert water from Neversink Reservoir to Rondout Reservoir. A hydroelectric powerplant uses water diverted through the Neversink Tunnel. When the powerplant is not operating and the main valve on the diversion tunnel is open, leakage develops that is not recorded by the venturi instruments. One current-meter measurement made in 1999 showed a leakage rate of 16.2 ft^3/s (10.5 Mgal/d). When the powerplant is operating, the leakage is included in the recorded flow. No leakage occurs when the main valve on the tunnel is closed. During the 2012 report year, the powerplant operated part of the day on most days and was not operated the equivalent of 242 days. About 2.5 billion gallons of water was diverted but not recorded, according to the leakage rate noted above and records of powerplant operation.

Diversions by New Jersey

The Decree authorizes New Jersey to divert water from the Delaware River and its tributaries in New Jersey to areas outside of the Delaware River Basin, without compensating releases. Under the FFMP, New Jersey diversions shall not exceed 100 Mgal/d as a monthly average, and the daily mean diversion shall not exceed 120 Mgal/d. When the lower part of the Delaware River Basin is in a drought warning period, diversions shall not exceed 85 Mgal/d as a running average. No drought warning was issued in the 2012 report year for the basin.

The USGS streamgage on the Delaware and Raritan Canal at Port Mercer, New Jersey (station number 01460440; fig. 1), is used as the official control point for measuring these diversions by New Jersey. Based on data collected by the USGS at this site, the maximum monthly average diversion was 91.7 Mgal/d during May 2012 (table 10). The maximum daily mean diversion was 100 Mgal/d on May 8 and 9, 2012 (table 10). Diversions by New Jersey did not exceed the limits stipulated by the FFMP.

Montague Flow Objective

The components of forecasted flow at Montague during low flow (forecasted releases from power reservoirs, estimated uncontrolled runoff including conservation releases from Rio Reservoir, and forecasted increase in runoff from precipitation) and the sums of flows exclusive of releases from New York City's reservoirs are given in table 11. If the computed sum of the components is less than the flow objective at Montague, then the deficiency is made up by releases from New York City's reservoirs, as directed by the ODRM. Table 12 presents the ODRM daily operations record of reservoir releases and segregation of the various components contributing to the flow of the Delaware River at Montague, New Jersey.

The forecasted flow of the Delaware River at Montague, based on provisional data and exclusive of water released from the New York City reservoirs, was greater than the flow objective on all days in the period from December 1, 2011, to April 20, 2012, and no releases were directed. The observed daily mean discharge at Montague was greater than the applicable flow objective (1,750 ft^3/s) on all days except for 2 days in April, 9 days in August, and 7 days in September 2012 (table 13).

The forecasted flow at Montague, exclusive of water released from the New York City reservoirs, was less than the flow objective on 52 days between April 20, 2012, and September 18, 2012, and directed releases totaling 31.757 billion gallons were required (table 11). On 18 days during the period from April 20, 2012, to September 18, 2012, the observed flow at Montague was less than the flow objective (table 13). However, 15 of those 18 observed flows were within 10 percent of the flow objective (table 13). On September 16, 2012, the observed flow was 1,440 ft^3/s, 82 percent of the flow objective (table 13).

The forecasted flow at Montague, exclusive of water released from the New York City reservoirs, was greater than the flow objective from September 18, 2012, to November 30, 2012, and no directed releases were required during that period. The observed daily mean discharge at Montague exceeded the flow objective throughout this period (table 13).

The components of total flow observed at Montague in April and from July through November 2012 are shown in figure 3. The flow is segregated into the portion derived from the New York City reservoirs, the portion contributed by the power reservoirs, and the uncontrolled runoff from the drainage area below the reservoirs. As described above, the uncontrolled runoff was computed as the residual of observed flow minus releases and was subject to errors in observations, transit times, and routings of the various components of flow. The conservation release from Rio Reservoir is included in the uncontrolled runoff component. The effect of these uncertainties is incorporated in the computation of uncontrolled runoff.

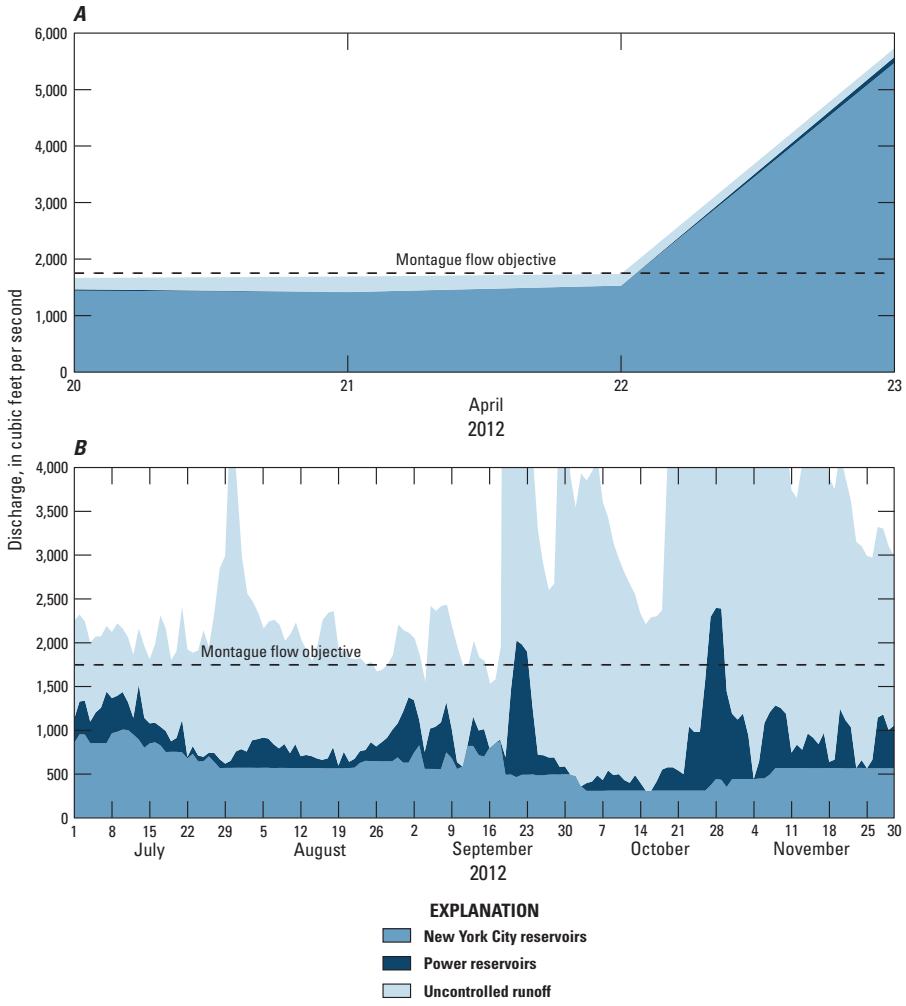

Figure 3. Graph showing components of flow, Delaware River at Montague, New Jersey from *A*, April 20 to 23, 2012; and , July 1 to November 30, 2012.

Excess Release Quantity and Interim Excess Release Quantity

Per section 4c of the 2012 FFMP (appendix 1 of this report), the Excess Release Quantity is used in support of the Interim Excess Release Quantity (IERQ). The IERQ is 10.0 billion gallons (15,468 cubic feet per second for a day ([ft^3/s]-d). The 2012 FFMP specifies that 3.91 billion gallons (6,045 [ft^3/s]-d) of the IERQ is incorporated in the releases tables to enhance base releases from the New York City's Delaware Basin Reservoirs. The remaining IERQ balance of 6.09 billion gallons (9,423 [ft^3/s]-d) is reserved and may be used for additional releases to meet the Trenton Equivalent Flow Objective or to establish an Extraordinary Needs Bank as provided for in section 4d of the 2012 FFMP. Per section 4c of the 2021 FFMP, upon request by the "Lower Basin States" or the Delaware River Basin Commission (DRBC), New York City is required to release water in sufficient quantities from the remaining IERQ balance to maintain a flow in the Delaware River at Trenton, New Jersey, of 3,000 ft^3/s during basinwide normal conditions from June 15 through March 15 (known as the seasonal period). The maximum amount of water required to be released from the remaining IERQ in any seasonal period is 70 billion gallons. New York City is required to make releases from the IERQ until May 31, 2013, or until the aggregate quantity of the IERQ is exhausted, whichever occurs first.

As described in section 4d of the 2012 FFMP, the DRBC and the ODRM may at any time review extraordinary water needs to support such research, aquatic life, or other water-use activity as may be approved by the DRBC. Upon unanimous agreement, the Decree Parties may bank all or a portion of the IERQ remaining in an IERQ Extraordinary Needs Bank which can be used to provide for such extraordinary water needs. Banked quantities are deducted from the IERQ and any unused Extraordinary Needs Bank water is returned to IERQ.

From June 20 to 21, 2012, 293 (ft^3/s)-d was discharged at the request of the New York State Department of Environmental Conservation for water temperature control (see appendix 2). In addition, 300 (ft^3/s)-d of the IERQ water was released to maintain a target flow of 3,000 ft^3/s at Trenton from August 30, 2012, to September 17, 2012.

Tailwaters Habitat Protection and Discharge Mitigation Program

The FFMP established a Tailwaters Habitat Protection and Discharge Mitigation Program, which consists of (1) conservation releases, designed for protection of the ecology in the tailwaters below the New York City reservoirs; and (2) discharge mitigation releases, designed to help mitigate the effects of water spilling from the full Delaware River Basin reservoirs. Controlled releases were made from the New York City Delaware River Basin reservoirs in accordance with the FFMP.

Comparison of River Master Operations Data with Other Records

ODRM operations are conducted on a day-to-day basis and, by necessity, use preliminary streamflow data. In this section, records used in ODRM operations are compared to final data published for selected USGS streamgages. Data on releases were reported in million gallons per day and converted to cubic feet per second for use in the comparisons.

Analysis of Forecasts

Forecasts of streamflow at Montague, based on anticipated contributions from the components described previously but excluding releases from New York City reservoirs, differed from observed flow on most days. Occasionally, variations in the components were partially compensating, and observed flows compared favorably with forecasted flows.

The forecasted flow of the Delaware River at Montague, exclusive of releases from the New York City reservoirs, was less than the flow objective for the following periods: April 17–20, 2012; June 28–July 24, 2012; August 19–21, 2012; August 28–September 2, 2012; and September 5–15, 2012. Table 3 computes forecasted and actual hydroelectric power releases for the period from July 1–November 1, 2012.

Table 3. Cumulative forecasted and actual release volume from Lake Wallenpaupack, Rio Reservoir, and uncontrolled runoff from July 1 to November 1, 2012.

[(ft^3/s)-d, cubic foot per second for a day]

Releases and runoff	Forecasted volume ([ft^3/s]-d)	Actual volume ([ft^3/s]-d)
Lake Wallenpaupack	23,453	32,274
Rio Reservoir	6,905	9,424
Runoff from uncontrolled area	213,009	314,305

For the July 1 to November 1, 2012 period shown in table 3, actual releases from Lake Wallenpaupack and Rio Reservoir averaged 37.6 and 36.5 percent more than the forecasted releases, respectively. Observed runoff from the uncontrolled area was about 48 percent more than forecasted runoff.

On any given day, forecasted releases and actual releases from Lake Wallenpaupack and Rio Reservoir can differ considerably. The differences between actual daily releases and forecasted daily releases from July 1 to November 1, 2012, are as follows: daily releases at Lake Wallenpaupack varied between 945 ft^3/s-d less than forecasted releases and 1,400 ft^3/s-d greater than forecasted releases, and daily releases at Rio Reservoir differed by 319 ft^3/s-d less than forecasted releases to 301 ft^3/s-d greater than forecasted releases. Based on gaged streamflow at Montague, total directed releases from New York City reservoirs during the report year were about 6 percent more than required for exact forecasting.

Comparison of hydrographs of forecasted runoff and computed runoff from the uncontrolled area (fig. 4) indicated that the forecasts generally were suitable for use in designing releases from New York City Delaware River Basin reservoirs. Numerical adjustments to the designs were made when needed to compensate for errors in the forecasts, but because of traveltimes, the effects of the adjustments on flows at Montague were not evident until several days after the design date.

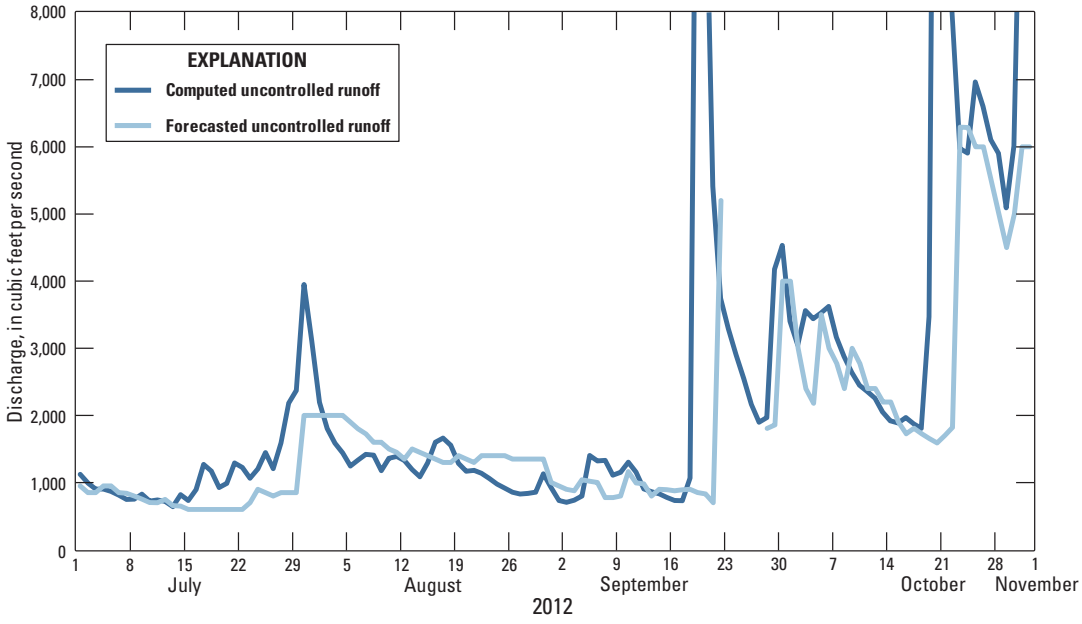

Figure 4. Hydrographs of computed and forecasted uncontrolled runoff components, Delaware River at Montague, New Jersey, from July 1 to November 1, 2012.

Releases from New York City Reservoirs

ODRM operations data on controlled releases from Pepacton, Cannonsville, and Neversink Reservoirs to the Delaware River were furnished by the New York City DEP to the ODRM. These data were collected from calibrated instruments connected to venturi meters installed in the outlet conduits of the reservoirs.

The USGS streamgage on East Branch Delaware River at Downsville, New York (station number 01417000), is 0.5 miles (mi) downstream from Downsville Dam (fig. 1). Discharge measured at this station includes releases from Pepacton Reservoir and a small amount of seepage and any runoff that enters the channel between the dam and the streamgage. The drainage area is 371 mi^2 at the dam and 372 mi^2 at the streamgage. The streamgage's records are rated "good," which means that about 95 percent of the measured daily mean discharges are within 10 percent of the true discharge.

Figure 5*A* shows measured flow from Pepacton Reservoir, including spillway, conservation, and directed releases, reported by New York City, compared to the records for the USGS streamgage on East Branch Delaware River at Downsville, New York (table 14, U.S. Geological Survey, 2019a) from December 1, 2011, to November 30, 2012. The mean difference is 5.4 percent, and 95 percent of the daily differences between the streamgage readings and New York City records are less than 15.1 percent. Larger differences rarely occur and may be due to rainfall. Instruments connected to the venturi meters were recalibrated periodically by New York City to improve the accuracy of the recorded flow data.

The USGS streamgage on West Branch Delaware River at Stilesville, New York (station number 01425000; fig. 1), is 1.4 mi downstream from Cannonsville Dam. Discharge measured at this station includes releases from Cannonsville Reservoir and runoff from 2 mi^2 of drainage area between the dam and the streamgage. The drainage area is 454 mi^2 at the dam and 456 mi^2 at the streamgage. The streamgage records are rated "fair," which means that about 95 percent of the daily mean discharges are within 15 percent of the true discharge. The records include runoff from the area between the dam and the streamgage and seepage near the base of the dam.

Figure 5*B* shows releases from Cannonsville Reservoir (including spillway, conservation, and directed releases), reported by New York City versus records for the USGS streamgage on West Branch Delaware River at Stilesville, New York (table 15, U.S. Geological Survey, 2019b), from December 1, 2011, to November 30, 2012. The mean difference is 5.9 percent and 95 percent of the daily differences between the streamgage readings and New York City records are less than 19.5 percent. The largest differences between the measured flows are primarily at lower flow rates.

The USGS streamgage on Neversink River at Neversink, New York (station number 01436000), is 1,650 ft downstream from Neversink Dam (fig. 1). Discharge measured at this streamgage includes releases from Neversink Reservoir and, during storms, a small amount of runoff that originates between the dam and the streamgage. The drainage area is 92.5 mi^2 at the dam and 92.6 mi^2 at the streamgage. The streamgage records are rated "good," which means that about 95 percent of the measured daily mean discharges are within 10 percent of the true discharge.

Figure 5*C* shows releases from Neversink Reservoir, including spillway, conservation, and directed releases, reported by New York City, compared to the records for the USGS streamgage on Neversink River at Neversink, New York (table 16, U.S. Geological Survey, 2019c), from December 1, 2011, to November 30, 2012. The mean difference between the released flow and measured flow is 6.8 percent, and 95 percent of the daily differences between the streamgage readings and New York City records are less than 24.0 percent.

Delaware River at Montague, New Jersey

The ODRM's operations record for the Delaware River at Montague, New Jersey (table 12), showed 0.2 percent less discharge for the report year than the published USGS record for the streamgage (table 13). Daily values for the two records agreed closely, except during ice-affected periods and the summer vegetation growth season.

Conformance of Operations Under the Amended Decree of the U.S. Supreme Court Entered June 7, 1954

From December 1, 2011, to November 30, 2012, operations of the ODRM were conducted as stipulated by the Decree and the FFMP.

Diversions from the Delaware River Basin to the New York City water-supply system did not exceed those authorized by the Decree and the FFMP. New York City released water from its reservoirs at rates directed by the ODRM to meet the applicable flow objectives at Montague, New Jersey. During the report year, New York City complied fully with all directives and requests of the ODRM.

Diversions from the Delaware River Basin by New Jersey were within limits stipulated by the Decree. New Jersey complied fully with all directives and requests of the ODRM.

The IERQ was used in accordance with the FFMP and agreements completed throughout the report year.

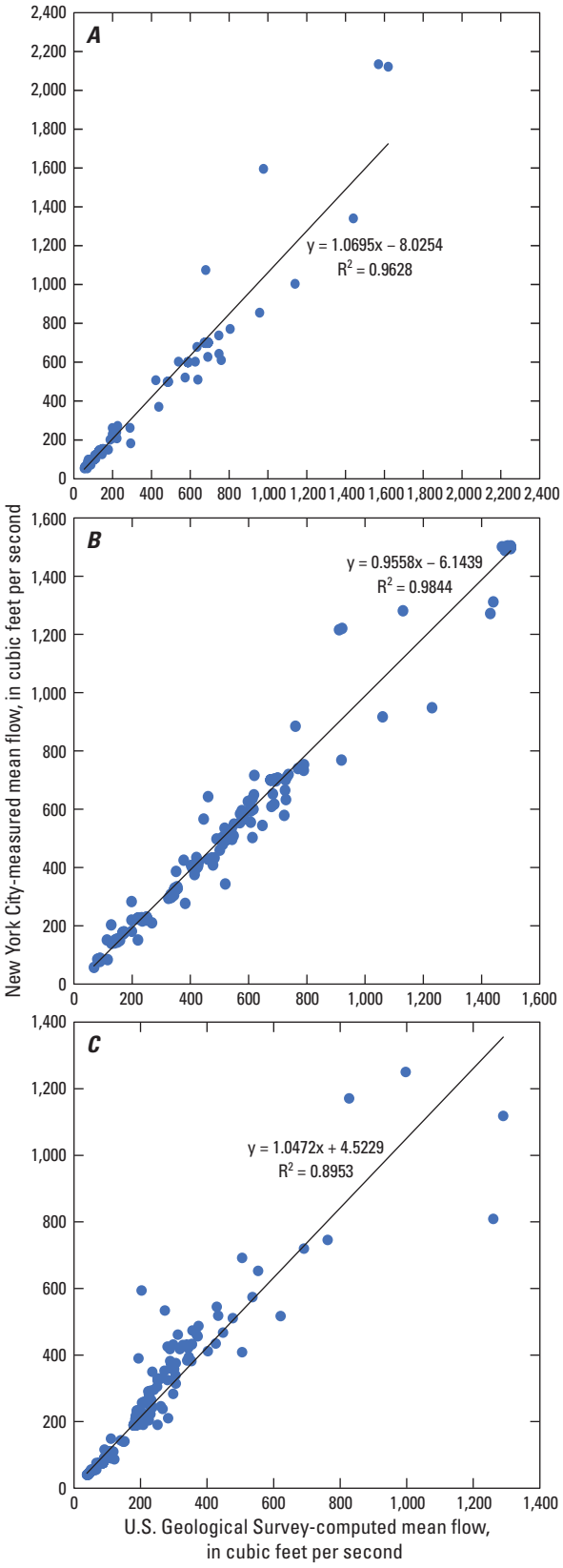

Figure 5. Graphs showing New York City-measured mean flow compared to computed mean flow records of U.S. Geological Survey gaging stations downstream from their respective reservoirs: *A*, 01417000, East Branch Delaware River at Downsville NY, downstream from Pepacton Reservoir; *B*, 01425000, West Branch Delaware River at Stilesville NY, downstream from Cannonsville Reservoir; and *C*, 01436000, Neversink River at Neversink, New York, downstream from Neversink Reservoir.

Table 4. Precipitation in the Delaware River Basin upstream from Montague, New Jersey.

[Data from the National Weather Service, New York City Department of Environmental Protection, and Office of the Delaware River Master. in., inches; —, not applicable]

Month	December 1940 to November 2011 monthly average precipitation (in.)	December 2011 to November 2012			
		Precipitation (in.)	Percent of average	Excess or deficit precipitation compared with long-term average (in.)	
				Month	Cumulative
December	3.47	4.23	122	0.76	0.76
January	3.03	2.88	95	−0.15	0.61
February	2.66	1.09	41	−1.57	−0.96
March	3.44	2.04	59	−1.40	−2.36
April	3.80	2.59	68	−1.21	−3.57
May	4.17	5.58	134	1.41	−2.16
June	4.16	3.18	76	−0.98	−3.14
July	4.15	5.55	134	1.40	−1.74
August	4.06	3.37	83	−0.69	−2.43
September	4.11	6.62	161	2.51	0.08
October	3.72	5.18	139	1.46	1.54
November	3.76	1.04	28	−2.72	−1.18
Total	44.53	43.35	97	—	—

Table 5. Storage in Pepacton Reservoir, New York, for year ending November 30, 2012.

[River Master daily operations record; gage reading at 0800 hours; data provided by New York City Department of Environmental Protection. Storage is given in millions of gallons above the elevation of 1,152.00 feet. Add 7,711 million gallons for total contents above the sill of the outlet tunnel at the elevation of 1,126.50 feet. Storage at spillway level is 140,190 million gallons. —, not applicable; Mgal/d, million gallons per day; ft^3/s, cubic foot per second]

Day	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
1	135,475	139,381	123,469	121,677	124,846	127,952	139,961	131,612	125,436	108,920	100,590	103,672
2	135,910	139,418	1,323,081	121,643	124,863	128,233	139,822	131,274	124,863	108,379	100,311	104,383
3	136,308	139,271	132,058	121,436	124,846	128,602	139,730	131,220	124,343	107,814	100,032	104,827
4	136,472	139,068	131,666	121,300	124,673	129,060	139,656	131,185	123,790	107,268	99,675	105,098
5	136,636	138,627	131,309	121,129	124,551	129,430	139,748	131,149	123,222	106,740	99,660	105,177
6	136,781	138,369	130,848	120,872	124,464	129,713	139,693	131,149	122,636	106,340	99,428	105,177
7	137,127	138,058	130,351	120,531	124,343	130,032	139,528	131,078	122,087	105,892	99,197	105,129
8	139,252	137,748	129,855	120,395	124,239	130,334	139,345	131,043	121,540	105,415	98,983	105,018
9	140,671	137,401	129,341	120,395	124,031	131,113	139,160	131,007	120,941	105,082	98,644	104,875
10	141,301	136,908	128,743	121,112	124,014	131,737	138,995	130,954	120,514	104,606	98,352	104,669
11	141,412	136,454	128,093	121,419	123,979	132,165	138,811	130,635	120,055	104,066	98,014	104,526
12	141,079	136,073	127,407	121,728	123,893	132,361	138,572	130,564	119,512	103,594	97,664	104,240
13	140,765	135,982	126,726	121,985	123,722	132,773	138,535	130,457	119,002	103,090	97,389	104,082
14	140,579	135,765	126,079	122,258	123,480	133,168	138,369	130,263	118,428	102,601	96,992	104,066
15	140,412	135,221	125,488	122,550	123,204	133,797	138,040	130,156	117,939	102,148	96,673	103,767
16	140,394	134,516	125,140	122,688	122,981	136,763	137,657	130,226	117,451	101,648	96,325	103,563
17	140,190	133,977	124,984	122,791	122,722	138,388	137,255	130,173	116,913	101,195	95,993	103,452
18	139,895	133,635	124,620	122,860	122,395	139,455	136,927	130,067	116,428	100,745	95,584	103,262
19	139,564	133,132	124,135	122,860	122,190	140,043	136,526	130,014	115,876	102,476	95,327	103,121
20	139,252	132,647	123,635	123,394	122,121	140,246	136,109	129,996	115,310	103,105	96,279	102,916
21	138,811	132,255	123,084	123,790	122,173	140,264	135,711	129,979	114,795	103,168	97,161	102,727
22	138,700	131,719	122,773	124,222	122,412	140,690	135,276	129,837	114,246	102,900	97,786	102,523
23	138,645	131,220	122,344	124,585	123,067	140,950	134,859	129,448	113,683	102,648	97,953	102,289
24	138,793	130,866	122,275	124,828	124,014	140,876	134,390	129,077	113,140	102,320	98,198	102,117
25	138,664	130,617	122,224	125,071	124,879	140,820	133,977	128,567	112,563	101,961	98,229	101,898
26	138,498	130,263	122,121	125,245	125,661	140,671	133,527	128,075	112,004	101,586	98,260	101,617
27	138,314	130,404	122,036	125,175	126,289	140,320	133,096	127,688	111,447	101,211	98,690	101,382
28	138,848	131,523	121,933	125,157	126,795	140,116	132,594	127,093	111,089	100,946	99,106	101,133
29	138,958	132,058	121,831	125,036	127,355	139,914	132,361	126,936	110,582	100,978	99,428	100,823
30	139,179	132,308	—	125,019	127,670	140,264	132,093	126,482	110,046	100,838	100,962	100,513
31	139,326	132,434	—	124,932	—	140,190	—	125,974	109,478	—	102,775	—
Change[1]	3,851	−6,947	−10,638	3,255	2,824	12,238	−7,858	−5,638	−15,958	−8,082	2,185	−3,159
Equivalent change (Mgal/d)[2]	124.2	−224.1	−366.8	105	94.1	394.8	−261.9	−181.8	−514.8	−269.4	70.5	−101.9
Equivalent change (ft^3/s)[3]	192.5	−347.4	−568.5	162.8	145.8	611.9	−405.9	−281.8	−797.9	−417.6	109.3	−157.9

[1]Change is calculated as the storage on the last day of each month minus the storage on the first day of each month. Net change for the year is −34,962.0 million gallons; minimum and maximum storage for December through May is 120,395 and 141,412 million gallons, respectively; minimum and maximum storage for June through November is 95,327 and 139,951 million gallons, respectively.

[2]Net equivalent for the year is −95.5 million gallons per day.

[3]Net equivalent for the year is −147.8 cubic feet per second.

Table 6. Storage in Cannonsville Reservoir, New York, for year ending November 30, 2012.

[River Master daily operations record; gage reading at 0800 hours; data provided by New York City Department of Environmental Protection. Storage is given in millions of gallons above the elevation of 1,040.00 feet. Add 2,584 million gallons for total contents above the sill of the outlet tunnel at the elevation of 1,020.50 feet. Storage at spillway level is 95,706 million gallons. —, not applicable; Mgal/d, million gallons per day; ft^3/s, cubic foot per second]

Day	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
1	86,655	88,146	88,937	82,883	87,840	88,784	94,368	87,016	71,212	60,341	53,552	66,363
2	86,814	87,768	88,617	82,781	87,782	88,830	94,170	86,323	71,066	59,865	53,774	66,885
3	86,828	87,349	88,237	82,550	87,739	88,921	93,987	85,716	70,920	59,499	53,961	67,715
4	86,698	86,713	87,695	82,579	87,609	89,073	93,805	85,094	70,709	59,132	54,159	68,523
5	86,496	86,135	87,016	82,666	87,479	89,241	93,729	84,458	70,523	58,803	54,346	69,225
6	86,308	85,947	86,250	82,593	87,363	89,317	93,546	83,793	70,391	58,424	54,544	69,768
7	86,193	85,759	86,005	82,536	87,161	89,347	93,394	83,070	69,953	57,960	54,684	70,218
8	87,305	85,513	85,716	82,478	86,958	89,393	93,227	82,333	69,437	57,533	54,789	70,629
9	88,404	85,326	85,629	82,969	86,727	89,910	92,968	81,582	68,960	57,264	54,895	70,788
10	88,997	85,239	85,586	83,894	86,626	90,594	92,710	80,961	68,550	56,886	55,005	70,801
11	89,332	85,456	85,571	84,473	86,511	90,990	92,466	80,156	68,126	56,385	55,079	70,761
12	89,454	85,513	85,571	85,008	86,453	91,112	92,131	79,562	67,781	55,872	54,969	70,682
13	89,195	85,716	85,513	85,456	86,265	91,051	92,116	78,982	67,397	55,396	54,848	70,695
14	88,632	85,875	85,484	85,745	86,048	90,959	92,055	78,374	67,037	54,871	54,696	70,881
15	88,130	85,831	85,457	86,106	85,803	91,066	91,903	77,793	66,732	54,288	54,568	70,960
16	87,753	85,600	85,383	86,438	85,586	92,892	91,736	77,462	66,388	53,716	54,428	70,973
17	87,334	85,412	85,354	86,771	85,340	94,291	91,553	76,882	66,032	53,085	54,311	70,973
18	86,799	85,600	85,239	87,031	85,123	95,189	91,340	76,274	65,701	52,724	54,159	70,960
19	86,236	85,889	85,094	87,219	85,080	95,851	91,142	75,680	65,357	52,770	54,101	70,907
20	85,947	85,933	84,849	87,508	85,123	96,317	90,914	75,141	64,975	53,062	56,471	70,841
21	85,803	86,005	84,617	87,609	85,051	96,559	90,594	74,478	64,644	53,132	58,046	70,735
22	86,091	86,005	84,386	87,724	85,152	96,366	90,290	73,728	64,198	53,121	59,059	70,629
23	86,525	85,990	84,183	87,883	85,687	96,269	90,062	73,040	63,816	53,132	59,804	70,497
24	87,175	86,178	84,010	87,912	86,583	96,334	89,819	72,669	63,370	53,132	60,732	70,351
25	87,580	86,568	83,851	88,013	87,161	96,205	89,606	72,284	62,925	53,074	61,562	70,218
26	87,811	86,742	83,692	88,100	87,609	95,883	89,347	71,940	62,492	52,840	62,237	70,046
27	87,970	87,060	83,461	88,161	87,999	95,554	89,104	71,795	62,021	52,572	62,823	69,874
28	88,419	88,359	83,215	88,115	88,328	95,204	88,830	71,636	61,766	52,467	63,344	69,689
29	88,845	88,937	83,042	88,042	88,541	94,839	88,328	71,569	61,562	52,992	63,802	69,477
30	88,693	89,332	—	87,970	88,678	94,717	87,695	71,503	61,231	53,354	64,478	69,251
31	88,435	89,210	—	87,912	—	94,565	—	71,358	60,817	—	65,726	—
Change[1]	1,780	1,064	−5,895	5,029	838	5,781	−6,673	−15,658	−10,395	−6987	12,174	2,888
Equivalent change (Mgal/d)[2]	57.4	34.3	−203.3	162.2	27.9	186.5	−222.4	−505.1	−335.3	−232.9	392.7	96.3
Equivalent change (ft^3/s)[3]	89	53	−314	251	43	288	−344	−781	−519	−360	608	149

[1]Change is calculated as the storage on the last day of each month minus the storage on the first day of each month. Net change for the year is −17,404.0 million gallons; minimum and maximum storage for December through May is 82,478 and 96,559 million gallons, respectively; minimum and maximum storage for June through November is 52,467 and 94,368, respectively.

[2]Net equivalent for the year is −47.6 million gallons per day.

[3]Net equivalent for the year is −73.6 cubic feet per second.

Table 7. Storage in Neversink Reservoir, New York, for year ending November 30, 2012.

[River Master daily operations record; gage reading at 0800 hours; data provided by New York City Department of Environmental Protection. Storage is given in millions of gallons above the elevation of 1,319.00 feet. Add 525 million gallons for total contents above the sill of the outlet tunnel at the elevation of 1,314.00 feet. Storage at spillway level is 34,941 million gallons. —, not applicable; Mgal/d, million gallons per day; ft^3/s, cubic foot per second]

Day	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
1	33,211	35,075	35,075	32,155	31,686	31,127	34,961	31,480	24,793	23,413	30,287	35,219
2	33,345	35,070	35,080	31,878	31,798	30,854	34,907	31,285	24,739	23,366	30,433	35,150
3	33,446	35,050	35,065	31,774	31,789	30,644	34,931	31,062	24,703	23,310	30,584	35,095
4	33,523	35,006	35,050	31,771	31,771	30,483	34,892	30,841	24,519	23,282	30,712	35,065
5	33,601	34,996	35,041	31,733	31,728	30,566	34,882	30,634	24,478	23,294	30,882	35,050
6	33,664	35,011	35,026	31,447	31,663	30,675	34,808	30,415	24,470	23,389	31,026	35,041
7	33,794	35,011	34,991	31,146	31,620	30,753	34,769	30,191	24,430	23,389	31,146	35,031
8	34,705	35,001	34,986	30,859	31,667	30,836	34,665	29,968	24,381	23,374	31,257	35,016
9	35,130	34,981	34,976	30,703	31,710	31,461	34,587	29,737	24,323	23,429	31,354	34,976
10	35,165	34,981	34,803	30,786	31,771	31,808	34,518	29,468	24,287	23,445	31,438	34,971
11	35,125	34,941	34,725	30,896	31,789	32,052	34,438	28,959	24,246	23,437	31,518	34,961
12	35,095	34,946	34,720	30,998	31,832	32,227	34,335	28,530	24,413	23,382	31,625	34,956
13	35,080	35,011	34,689	30,989	31,868	32,358	34,483	28,110	24,417	23,354	31,713	34,961
14	35,070	35,001	34,675	31,108	31,905	32,491	34,497	27,705	24,393	23,306	31,789	35,031
15	35,070	34,966	34,660	31,220	31,939	32,810	34,404	27,322	24,368	23,282	31,864	35,026
16	35,055	34,912	34,443	31,401	31,962	34,473	34,262	27,090	24,389	23,234	31,957	35,011
17	35,050	34,907	34,204	31,578	32,009	34,912	34,111	26,689	24,376	23,199	32,009	34,996
18	35,045	34,907	34,101	31,752	32,000	34,788	33,964	26,240	24,364	23,175	32,009	34,981
19	35,031	34,887	34,077	31,920	32,027	34,645	33,915	25,796	24,311	27,749	32,108	34,956
20	35,016	34,858	34,042	32,173	32,052	34,523	33,939	25,408	24,279	28,320	33,201	34,936
21	35,016	34,837	33,998	32,236	32,014	34,379	33,722	25,184	24,246	28,587	33,644	34,912
22	35,070	34,828	33,713	32,207	32,075	34,443	33,499	24,969	24,205	28,641	33,910	34,868
23	35,110	34,808	33,441	32,137	32,335	34,587	33,187	24,887	24,173	28,929	34,101	34,823
24	35,110	34,878	33,192	32,023	32,557	35,050	32,995	24,813	24,108	29,070	34,365	34,784
25	35,085	34,981	33,091	31,892	32,515	35,070	32,824	24,662	23,858	29,163	34,611	34,725
26	35,070	34,976	33,048	31,756	32,363	35,095	32,624	24,629	23,805	29,204	34,769	34,680
27	35,055	35,060	33,000	31,704	32,140	35,085	32,425	24,674	23,761	29,288	34,848	34,645
28	35,204	35,294	32,719	31,691	31,981	35,080	32,216	24,670	23,717	29,342	34,936	34,587
29	35,130	35,170	32,410	31,663	31,704	35,075	32,009	24,756	23,701	29,584	35,026	34,538
30	35,095	35,105	—	31,620	31,411	35,189	31,691	24,817	23,665	30,137	35,150	34,365
31	35,085	35,080	—	31,606	—	35,075	—	24,817	23,605	—	35,329	—
Change[1]	1,874	5	−2,665	−549	−275	3,948	−3,270	−6,663	−1,188	6,724	5,042	−854
Equivalent change (Mgal/d)[2]	60.5	0.2	−91.9	−17.7	−9.2	127.4	−109	−214.9	−38.3	224.1	162.6	−28.5
Equivalent change (ft3/s)[3]	94	0.3	−142	−27	−14	197	−169	−333	−59	347	252	−44

[1]Change is calculated as the storage on the last day of each month minus the storage on the first day of each month. Net change for year is more than 1,154.0 million gallons; minimum and maximum storage for December through May is 30,483 and 35,294 million gallons, respectively; minimum and maximum storage for June through November is 23,175 and 35,329 million gallons, respectively.

[2]Net equivalent for the year is more than 3.2 million gallons per day.

[3]Net equivalent for year is more than 4.9 cubic feet per second.

Table 8. Diversions to New York City water-supply system.

[River Master daily operations record. Diversions in million gallons per day for each 24-hour period beginning 0800 local time. —, not applicable]

Date	East Delaware Tunnel	West Delaware Tunnel	Neversink Tunnel	Average from June 1, 2011, to date
12/1/2011	0	479	0	509
12/2/2011	0	479	0	509
12/3/2011	0	479	0	509
12/4/2011	0	479	0	508
12/5/2011	0	479	0	508
12/6/2011	0	479	0	508
12/7/2011	0	479	0	508
12/8/2011	0	69	0	506
12/9/2011	0	0	0	503
12/10/2011	0	0	0	500
12/11/2011	0	0	0	498
12/12/2011	171	205	0	497
12/13/2011	199	293	0	497
12/14/2011	254	221	0	497
12/15/2011	300	303	0	498
12/16/2011	384	303	0	499
12/17/2011	400	303	0	500
12/18/2011	400	303	0	501
12/19/2011	448	303	0	502
12/20/2011	450	302	0	503
12/21/2011	450	303	0	504
12/22/2011	450	303	0	506
12/23/2011	450	303	0	507
12/24/2011	450	303	0	508
12/25/2011	450	303	0	509
12/26/2011	450	303	0	510
12/27/2011	319	304	0	511
12/28/2011	300	304	0	511
12/29/2011	301	304	0	512
12/30/2011	298	301	0	512
12/31/2011	301	304	0	513
Total	7,225	9,293	0	—

Date	East Delaware Tunnel	West Delaware Tunnel	Neversink Tunnel	Average from June 1, 2011, to date
1/1/2012	298	300	0	513
1/2/2012	301	304	0	513
1/3/2012	300	303	0	514
1/4/2012	301	303	0	514
1/5/2012	301	303	0	515
1/6/2012	301	303	0	515
1/7/2012	301	303	0	515
1/8/2012	301	303	0	516
1/9/2012	380	303	0	517
1/10/2012	400	33	0	516
1/11/2012	366	258	0	517
1/12/2012	0	399	0	516
1/13/2012	358	465	0	518
1/14/2012	487	479	0	519
1/15/2012	499	479	0	521
1/16/2012	500	479	0	523
1/17/2012	500	343	0	525
1/18/2012	384	293	0	526
1/19/2012	430	296	0	526
1/20/2012	434	293	0	527
1/21/2012	449	293	0	528
1/22/2012	449	293	0	529
1/23/2012	449	294	0	530
1/24/2012	450	206	0	530
1/25/2012	450	184	0	531
1/26/2012	125	0	0	529
1/27/2012	204	0	0	528
1/28/2012	300	273	0	528
1/29/2012	300	295	0	528
1/30/2012	300	295	0	529
1/31/2012	299	202	0	529
Total	10,917	8,877	0	—

Table 8. Diversions to New York City water-supply system.—Continued

[River Master daily operations record. Million gallons per day for 24-hour period beginning 0800 local time. —, not applicable]

Date	East Delaware Tunnel	West Delaware Tunnel	Neversink Tunnel	Average from June 1, 2011, to date
2/1/2012	300	295	0	529
2/2/2012	427	200	0	529
2/3/2012	450	237	0	530
2/4/2012	450	289	0	531
2/5/2012	450	305	0	532
2/6/2012	450	305	0	532
2/7/2012	450	305	0	533
2/8/2012	450	309	0	534
2/9/2012	483	305	156	536
2/10/2012	500	223	81	537
2/11/2012	500	202	0	538
2/12/2012	500	202	0	538
2/13/2012	500	202	0	539
2/14/2012	500	202	0	539
2/15/2012	301	202	190	540
2/16/2012	200	202	261	540
2/17/2012	351	285	76	541
2/18/2012	400	307	0	542
2/19/2012	400	307	0	542
2/20/2012	400	307	0	543
2/21/2012	400	303	246	545
2/22/2012	400	303	260	546
2/23/2012	233	303	260	547
2/24/2012	200	302	81	547
2/25/2012	200	303	0	547
2/26/2012	200	302	0	547
2/27/2012	200	302	244	548
2/28/2012	200	302	260	548
2/29/2012	200	302	259	549
Total	10,695	7,913	2,374	—

Date	East Delaware Tunnel	West Delaware Tunnel	Neversink Tunnel	Average from June 1, 2011, to date
3/1/2012	200	302	259	550
3/2/2012	345	302	80	551
3/3/2012	401	302	0	551
3/4/2012	401	302	0	552
3/5/2012	401	302	242	553
3/6/2012	401	302	260	555
3/7/2012	336	302	260	556
3/8/2012	217	302	259	557
3/9/2012	200	302	77	557
3/10/2012	191	290	0	556
3/11/2012	198	303	0	556
3/12/2012	196	303	143	556
3/13/2012	200	303	143	557
3/14/2012	200	303	121	557
3/15/2012	412	300	0	558
3/16/2012	449	301	18	558
3/17/2012	450	301	0	559
3/18/2012	450	301	0	560
3/19/2012	403	301	0	560
3/20/2012	339	301	126	561
3/21/2012	300	301	223	562
3/22/2012	300	301	228	563
3/23/2012	301	301	254	564
3/24/2012	301	301	254	565
3/25/2012	301	301	254	566
3/26/2012	409	216	109	566
3/27/2012	363	285	100	567
3/28/2012	349	298	98	567
3/29/2012	351	300	103	568
3/30/2012	351	300	104	568
3/31/2012	351	299	0	569
Total	10,067	9,217	3,715	—

Table 8. Diversions to New York City water-supply system.—Continued

[River Master daily operations record. Million gallons per day for 24-hour period beginning 0800 local time. —, not applicable]

Date	East Delaware Tunnel	West Delaware Tunnel	Neversink Tunnel	Average from June 1, 2011, to date
4/1/2012	351	299	0	569
4/2/2012	351	299	105	570
4/3/2012	351	299	104	570
4/4/2012	350	299	103	571
4/5/2012	351	299	105	571
4/6/2012	351	299	104	572
4/7/2012	351	299	0	572
4/8/2012	351	299	0	572
4/9/2012	226	216	0	572
4/10/2012	200	199	0	572
4/11/2012	200	183	0	571
4/12/2012	360	289	0	571
4/13/2012	400	298	0	572
4/14/2012	400	298	0	572
4/15/2012	400	298	0	572
4/16/2012	400	298	0	573
4/17/2012	399	298	0	573
4/18/2012	250	87	0	572
4/19/2012	200	0	2	571
4/20/2012	1	0	68	570
4/21/2012	0	0	0	568
4/22/2012	0	0	0	566
4/23/2012	0	224	150	566
4/24/2012	0	299	278	566
4/25/2012	0	300	299	566
4/26/2012	0	300	385	566
4/27/2012	0	300	290	566
4/28/2012	0	300	398	567
4/29/2012	0	300	398	567
4/30/2012	0	300	398	567
Total	6,243	7,179	3,187	—

Date	East Delaware Tunnel	West Delaware Tunnel	Neversink Tunnel	Average from June 1, 2011, to date
5/1/2012	0	300	398	568
5/2/2012	0	300	299	568
5/3/2012	0	300	294	568
5/4/2012	0	301	35	567
5/5/2012	0	301	0	566
5/6/2012	0	301	0	566
5/7/2012	0	301	0	565
5/8/2012	0	298	0	564
5/9/2012	0	51	0	563
5/10/2012	0	211	0	562
5/11/2012	0	399	0	561
5/12/2012	0	482	0	561
5/13/2012	0	482	0	561
5/14/2012	0	482	0	560
5/15/2012	0	0	0	559
5/16/2012	0	0	159	558
5/17/2012	0	0	465	557
5/18/2012	255	10	401	558
5/19/2012	495	0	304	558
5/20/2012	497	0	304	559
5/21/2012	1	376	158	559
5/22/2012	0	315	278	559
5/23/2012	0	99	34	558
5/24/2012	0	219	172	558
5/25/2012	250	300	61	558
5/26/2012	350	300	0	558
5/27/2012	350	300	0	558
5/28/2012	349	300	0	558
5/29/2012	162	102	108	558
5/30/2012	279	171	100	558
5/31/2012	351	99	198	558
Total	3,339	7,100	3,768	—

Table 8. Diversions to New York City water-supply system.—Continued

[River Master daily operations record. Million gallons per day for 24-hour period beginning 0800 local time. —, not applicable]

Date	East Delaware Tunnel	West Delaware Tunnel	Neversink Tunnel	Average from June 1, 2012, to date
6/1/2012	350	101	204	655
6/2/2012	350	102	204	656
6/3/2012	351	104	204	657
6/4/2012	351	101	204	657
6/5/2012	304	109	204	649
6/6/2012	400	99	140	647
6/7/2012	399	101	204	655
6/8/2012	349	148	155	655
6/9/2012	349	148	155	654
6/10/2012	349	148	155	654
6/11/2012	348	150	155	654
6/12/2012	228	0	155	632
6/13/2012	375	0	204	627
6/14/2012	445	0	204	629
6/15/2012	449	0	204	631
6/16/2012	449	0	204	632
6/17/2012	449	0	204	633
6/18/2012	417	0	76	625
6/19/2012	450	0	3	616
6/20/2012	449	0	229	619
6/21/2012	449	0	251	623
6/22/2012	450	0	349	631
6/23/2012	450	0	200	632
6/24/2012	451	0	200	633
6/25/2012	451	0	200	634
6/26/2012	451	0	199	634
6/27/2012	451	0	218	636
6/28/2012	190	267	206	637
6/29/2012	303	298	327	647
6/30/2012	449	298	200	657
Total	11,706	2,174	5,817	—

Date	East Delaware Tunnel	West Delaware Tunnel	Neversink Tunnel	Average from June 1, 2012, to date
7/1/2012	295	298	200	661
7/2/2012	0	298	200	656
7/3/2012	0	298	199	651
7/4/2012	0	297	200	647
7/5/2012	0	297	204	642
7/6/2012	0	297	205	638
7/7/2012	0	300	205	635
7/8/2012	0	300	205	631
7/9/2012	0	300	335	632
7/10/2012	0	300	399	633
7/11/2012	0	299	399	635
7/12/2012	0	299	399	636
7/13/2012	0	299	402	638
7/14/2012	0	248	344	637
7/15/2012	0	299	399	638
7/16/2012	0	299	406	640
7/17/2012	0	299	437	642
7/18/2012	0	299	428	643
7/19/2012	0	298	375	644
7/20/2012	0	417	238	644
7/21/2012	0	469	205	645
7/22/2012	325	468	34	648
7/23/2012	512	174	71	650
7/24/2012	512	199	139	654
7/25/2012	511	199	0	655
7/26/2012	481	42	0	653
7/27/2012	511	0	0	650
7/28/2012	511	0	0	648
7/29/2012	511	0	0	646
7/30/2012	510	0	0	643
7/31/2012	510	0	0	641
Total	5,189	7,592	6,628	—

Table 8. Diversions to New York City water-supply system.—Continued

[River Master daily operations record. Million gallons per day for 24-hour period beginning 0800 local time. —, not applicable]

Date	East Delaware Tunnel	West Delaware Tunnel	Neversink Tunnel	Average from June 1, 2012, to date
8/1/2012	510	0	0	639
8/2/2012	510	0	0	637
8/3/2012	509	0	140	637
8/4/2012	509	0	0	635
8/5/2012	509	0	0	633
8/6/2012	509	256	0	635
8/7/2012	509	299	0	638
8/8/2012	508	299	0	640
8/9/2012	405	247	0	640
8/10/2012	485	299	0	642
8/11/2012	505	202	0	643
8/12/2012	505	200	0	644
8/13/2012	505	200	0	645
8/14/2012	505	199	0	646
8/15/2012	505	199	0	647
8/16/2012	505	199	0	647
8/17/2012	505	199	0	648
8/18/2012	505	199	0	649
8/19/2012	505	199	0	649
8/20/2012	505	199	0	650
8/21/2012	505	198	0	651
8/22/2012	505	198	0	651
8/23/2012	505	198	5	652
8/24/2012	504	198	224	655
8/25/2012	503	198	0	656
8/26/2012	503	198	0	656
8/27/2012	503	197	0	657
8/28/2012	503	198	0	657
8/29/2012	502	198	0	658
8/30/2012	502	199	0	658
8/31/2012	501	199	151	660
Total	15,549	5,574	520	—

Date	East Delaware Tunnel	West Delaware Tunnel	Neversink Tunnel	Average from June 1, 2012, to date
9/1/2012	501	199	0	661
9/2/2012	501	199	0	661
9/3/2012	500	199	0	662
9/4/2012	500	198	0	662
9/5/2012	433	200	0	662
9/6/2012	452	201	0	662
9/7/2012	446	201	0	661
9/8/2012	446	200	0	661
9/9/2012	446	200	0	661
9/10/2012	447	198	0	661
9/11/2012	446	197	0	661
9/12/2012	446	199	0	661
9/13/2012	446	251	0	661
9/14/2012	446	271	0	661
9/15/2012	446	271	0	662
9/16/2012	446	271	0	663
9/17/2012	446	221	0	663
9/18/2012	184	87	0	659
9/19/2012	0	0	127	654
9/20/2012	414	0	0	652
9/21/2012	493	0	0	651
9/22/2012	493	0	0	649
9/23/2012	493	0	0	648
9/24/2012	493	0	0	647
9/25/2012	456	171	0	646
9/26/2012	493	205	0	647
9/27/2012	438	205	0	647
9/28/2012	493	60	0	646
9/29/2012	493	0	0	645
9/30/2012	493	0	0	644
Total	13,230	4,404	127	—

Table 8. Diversions to New York City water-supply system.—Continued

[River Master daily operations record. Million gallons per day for 24-hour period beginning 0800 local time. —, not applicable]

Date	East Delaware Tunnel	West Delaware Tunnel	Neversink Tunnel	Average from June 1, 2012, to date
10/1/2012	493	0	0	642
10/2/2012	493	0	0	641
10/3/2012	493	0	0	640
10/4/2012	493	0	0	639
10/5/2012	493	0	0	638
10/6/2012	493	0	0	636
10/7/2012	493	0	0	635
10/8/2012	493	0	0	634
10/9/2012	492	0	0	633
10/10/2012	492	0	0	632
10/11/2012	492	180	0	632
10/12/2012	462	206	0	633
10/13/2012	491	206	0	633
10/14/2012	491	206	0	634
10/15/2012	491	204	0	634
10/16/2012	496	206	0	635
10/17/2012	496	206	0	635
10/18/2012	498	292	0	636
10/19/2012	284	107	0	634
10/20/2012	0	0	0	630
10/21/2012	0	0	0	626
10/22/2012	414	0	0	624
10/23/2012	492	0	0	623
10/24/2012	491	0	0	622
10/25/2012	495	0	0	621
10/26/2012	0	0	0	617
10/27/2012	0	0	0	613
10/28/2012	0	0	0	609
10/29/2012	0	0	0	605
10/30/2012	495	311	0	606
10/31/2012	572	460	0	609
Total	12,088	2,584	0	—

Date	East Delaware Tunnel	West Delaware Tunnel	Neversink Tunnel	Average from June 1, 2012, to date
11/1/2012	578	460	0	612
11/2/2012	573	72	0	612
11/3/2012	599	0	0	612
11/4/2012	580	0	0	612
11/5/2012	574	0	0	612
11/6/2012	483	0	0	611
11/7/2012	495	0	0	610
11/8/2012	500	180	0	610
11/9/2012	495	293	0	612
11/10/2012	495	304	0	613
11/11/2012	494	304	0	614
11/12/2012	494	304	0	615
11/13/2012	494	301	0	616
11/14/2012	494	304	0	617
11/15/2012	495	304	0	618
11/16/2012	397	304	0	619
11/17/2012	396	304	0	619
11/18/2012	396	301	0	620
11/19/2012	396	304	0	620
11/20/2012	396	304	0	621
11/21/2012	396	304	0	621
11/22/2012	396	304	0	621
11/23/2012	396	304	0	622
11/24/2012	396	304	0	622
11/25/2012	397	301	0	623
11/26/2012	397	304	0	623
11/27/2012	397	304	0	624
11/28/2012	400	305	0	624
11/29/2012	397	304	107	625
11/30/2012	397	304	103	626
Total	13,793	7,381	210	—

Table 9. Consumption of water by New York City, from 1950 to 2012.

[Data furnished by New York City Department of Environmental Protection. Mgal/d, million gallons per day; Ggal, billion gallons]

Year	Average daily consumption			Annual consumption (Ggal)
	City proper (Mgal/d)	Outside communities (Mgal/d)	Total (Mgal/d)	
1950	953.30	29.1	982.40	358.6
1951	1,041.90	28.1	1,070.00	390.6
1952	1,087.00	32.7	1,119.70	409.8
1953	1,093.90	44.6	1,138.50	415.6
1954	1,063.40	46.3	1,109.70	405.0
1955	1,109.90	45.3	1,155.20	421.6
1956	1,111.30	48.9	1,160.20	424.6
1957	1,169.00	57.2	1,226.20	447.6
1958	1,152.90	49.6	1,202.50	438.9
1959	1,204.30	60.3	1,264.60	461.6
1960	1,199.40	58.9	1,258.30	460.5
1961	1,221.00	64.0	1,285.00	469.0
1962	1,207.60	68.8	1,276.40	465.9
1963	1,218.00	76.7	1,294.70	472.6
1964	1,189.20	79.4	1,268.60	464.3
1965	1,052.10	71.2	1,123.30	410.0
1966	1,044.90	73.2	1,118.10	408.1
1967	1,135.30	71.0	1,206.30	440.3
1968	1,242.00	78.2	1,320.20	483.2
1969	1,328.70	80.1	1,408.80	514.2
1970	1,400.30	90.4	1,490.70	544.1
1971	1,423.60	87.9	1,511.50	551.7
1972	1,412.40	83.0	1,495.40	547.3
1973	1,448.90	95.4	1,544.30	563.7
1974	1,441.80	96.3	1,538.10	561.4
1975	1,415.00	92.1	1,507.10	550.1
1976	1,435.00	95.8	1,530.80	560.3
1977	1,483.00	104.7	1,587.70	579.5
1978	1,479.40	103.0	1,582.40	577.6
1979	1,513.00	104.6	1,617.60	590.4
1980	1,506.30	110.1	1,616.30	591.6
1981	1,309.50	100.0	1,409.50	514.5
1982	1,383.00	104.8	1,487.80	543.1
1983	1,424.20	112.6	1,536.80	561.0
1984	1,465.20	113.9	1,579.10	578.0
1985	1,325.40	106.5	1,431.90	522.7
1986	1,351.10	115.2	1,466.30	535.2
1987	1,447.10	119.8	1,566.90	571.9
1988	1,484.30	125.6	1,609.90	589.1
1989	1,402.00	113.4	1,515.40	553.2
1990	1,424.40	122.4	1,546.80	564.6
1991	1,469.90	123.6	1,593.50	581.6

Table 9. Consumption of water by New York City, from 1950 to 2012.—Continued

[Data furnished by New York City Department of Environmental Protection. Mgal/d, million gallons per day; Ggal, billion gallons]

Year	Average daily consumption			Annual consumption (Ggal)
	City proper (Mgal/d)	Outside communities (Mgal/d)	Total (Mgal/d)	
1992	1,368.70	113.9	1,482.60	542.6
1993	1,368.90	118.8	1,487.70	543.0
1994	1,357.80	119.2	1,477.00	539.1
1995	1,326.10	123.1	1,449.20	529.0
1996	1,283.50	120.2	1,403.70	512.4
1997	1,201.30	123.5	1,324.80	483.6
1998	1,220.00	124.7	1,344.70	490.8
1999	1,237.20	128.6	1,365.80	498.5
2000	1,240.40	124.9	1,365.30	499.7
2001	1,184.00	128.4	1,312.40	479.0
2002	1,135.60	121.1	1,256.70	458.7
2003	1,093.70	115.9	1,209.60	441.5
2004	1,099.60	117.5	1,217.10	445.5
2005	1,107.60	123.8	1,231.40	449.5
2006	1,069.20	116.8	1,186.00	432.9
2007	1,114.00	122.9	1,236.90	451.5
2008	1,082.90	114.8	1,197.70	438.4
2009	1,007.20	109.4	1,116.60	407.6
2010	1,039.00	119.0	1,158.00	422.7
2011	1,021.00	116.0	1,137.00	415.0
2012	1,009.00	116.0	1,125.00	411.8

Table 10. Diversions by New Jersey; daily mean discharge, Delaware and Raritan Canal at Port Mercer, New Jersey (station number 01460440), for report year ending November 30, 2012.

[Data from U.S. Geological Survey, 2019e. All values except total are in million gallons per day (Mgal/d); total in million gallons (Mgal). —, not applicable]

Day	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
1	62	79	76	73	78	81	90	87	61	74	68	78
2	55	78	77	73	76	80	88	87	73	74	69	79
3	57	78	78	74	80	78	86	86	80	74	66	76
4	55	80	78	72	85	83	83	87	80	80	69	74
5	59	78	84	76	85	85	77	89	80	74	72	76
6	68	76	76	76	84	86	72	83	82	74	73	71
7	46	76	76	76	83	90	80	85	80	72	75	79
8	−42	79	77	77	83	100	91	83	78	72	76	81
9	41	79	73	74	80	100	92	82	82	71	76	76
10	51	76	76	79	78	92	93	84	78	72	79	80
11	76	81	83	83	83	95	80	83	74	73	75	78
12	79	41	81	85	81	94	72	82	78	69	80	78
13	77	60	77	85	81	94	72	82	76	67	72	84
14	80	72	86	84	81	96	78	81	77	70	76	85
15	81	78	88	84	83	98	89	84	76	69	80	83
16	79	76	83	76	80	97	90	86	76	68	78	87
17	83	73	84	78	81	90	90	84	75	64	78	81
18	83	57	72	80	81	94	89	80	78	68	76	80
19	77	70	81	82	81	95	90	83	77	67	73	78
20	79	77	80	74	82	95	91	82	76	65	66	81
21	80	87	80	74	82	91	91	81	73	64	70	78
22	80	87	80	78	76	93	92	80	73	66	72	78
23	43	78	77	81	36	81	91	78	74	65	81	77
24	70	71	83	83	67	99	84	76	73	65	79	79
25	78	75	76	85	74	98	90	75	74	66	80	80
26	78	78	78	83	80	96	88	80	73	69	80	84
27	81	66	76	80	78	96	88	80	82	70	83	87
28	59	65	78	81	80	95	87	78	75	70	81	85
29	72	76	80	78	78	92	89	79	74	71	81	85
30	78	69	—	78	80	91	88	80	74	71	66	83
31	78	73	—	75	—	89	—	77	74	—	72	—
Total[1]	2,043	2,289	2,294	2,437	2,357	2,844	2,581	2,544	2,356	2,094	2,322	2,401
Mean[2]	65.9	73.8	79.1	78.6	75.9	91.7	82.1	82.1	76	67.4	74.9	77.3

[1]The year's total is 28,562 million gallons.

[2]The combined mean is 77.2 million gallons per day.

Table 11. New York City reservoir release design data, from December 1, 2011, to November 30, 2012.

[River Master daily operations record. The Montague design rate was 1,750 ft³/s. Column (col.) 1 was furnished by electric utility PPL Corporation; col. 2 furnished by electric utility Eagle Creek Renewable Energy; col. 3 computed from index stations; col. 4 computed increase in runoff based on quantitative precipitation forecasts; col. 5 = col. 1 + col. 2 + col. 3 + col. 4; col. 6 = design rate − col. 5, when positive, otherwise col. 6 = 0; col. 7 = col. 14 (4 days earlier); col. 8, directed release amount from the Office of Delaware River Master = col. 6 + col. 7, when positive, otherwise col. 8 =0; col. 9 = col. 7 from table 12; col. 10 = summation of col. 9; col. 11 = flow objective − (col. 9 + col. 10 from table 12) when positive, otherwise col. 11 = 0; col. 12 = summation of col. 11; col. 13 = col. 10 − col. 12; col. 14 = col. 13 divided by −10, limited to ±50 ft³/s; cols. 10, 12, 13, and 14 are accumulated from the previous water year starting June 1, 2011, with these values being reset on June 1, 2012; X, a miscalculation of col. 12 − col 10 was recorded during the directed release design process; Y, the balancing adjustment was not reset on June 15, 2012. ft³/s, cubic foot per second; (ft³/s)-d, cubic foot per second for a day]

Advance estimate of discharge of Delaware River at Montague, New Jersey, exclusive of New York City reservoir releases							Indicated deficiency (ft³/s)	Balancing adjustment (ft³/s)	Directed release (ft³/s)	Computation of balancing adjustment					
Date of advance estimate	Powerplant release forecasts		Uncontrolled runoff		Montague date	Discharge (ft³/s)				Adjusted directed release		Actual deficiency		Cumulative difference (ft³/s)-d	Balancing adjustment (ft³/s)
	Lake Wallenpaupack (ft³/s)	Rio Reservoir (ft³/s)	Current condition (ft³/s)	Weather adjustment (ft³/s)						Daily (ft³/s)	Cumulative ([ft³/s]-d)	Daily (ft³/s)	Cumulative ([ft³/s]-d)		
	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14
The estimated Montague discharge was greater than the Montague design rate from 12/01/2011 to 04/19/2012															
4/17/2012	0	0	1,673	0	4/20/2012	1,673	77	1	78	78	78	0	283	−723	50
4/18/2012	0	0	1,628	0	4/21/2012	1,628	122	6	128	128	206	0	333	−928	50
4/19/2012	0	0	1,326	0	4/22/2012	1,326	424	26	450	448	654	0	218	−698	50
4/20/2012	0	0	1,450	0	4/23/2012	1,450	300	50	350	350	1,004	0	0	−338−X	−35
The estimated Montague discharge was greater than the Montague design rate from 4/24/2012 to 06/30/2012															
6/29/2012	0	0	850	0	7/2/2012	850	900	50	950	952	2,807	382	3,702	−895	50
6/30/2012	0	0	850	0	7/3/2012	850	900	50	950	949	3,756	459	4,161	−405	40
7/1/2012	0	0	950	0	7/24/2012	950	800	50	850	850	4,606	600	4,761	−155	16
7/2/2012	0	0	950	0	7/5/2012	950	800	50	850	851	5,457	531	5,292	165	−16
7/3/2012	0	0	850	100	7/6/2012	950	800	50	850	850	6,307	530	5,822	485	−48
7/4/2012	0	0	840	100	7/7/2012	940	810	40	850	851	7,158	411	6,233	925	−50
7/5/2012	0	0	800	0	7/8/2012	800	950	16	966	964	8,122	594	6,827	1,295	−50
7/6/2012	0	0	754	0	7/9/2012	754	996	−16	980	981	9,103	511	7,338	1,765	−50
7/7/2012	0	0	702	0	7/10/2012	702	1,048	−48	1,000	1,006	10,109	596	7,934	2,175	−50
7/8/2012	0	0	700	0	7/11/2012	700	1,050	−50	1,000	1,001	11,110	691	8,625	2,485	−50
7/9/2012	0	0	750	0	7/12/2012	750	1,000	−50	950	949	12,059	839	9,464	2,595	−50
7/10/2012	0	142	658	0	7/13/2012	800	950	−50	900	893	12,952	483	9,947	3,005	−50
7/11/2012	250	0	650	0	7/14/2012	900	850	−50	800	798	13,750	588	10,535	3,215	−50
7/12/2012	250	0	600	0	7/15/2012	850	900	−50	850	848	14,598	788	11,323	3,275	−50
7/13/2012	190	0	600	50	7/16/2012	840	910	−50	860	862	15,460	632	11,955	3,505	−50
7/14/2012	190	0	600	85	7/17/2012	875	875	−50	825	826	16,286	266	12,221	4,065	−50
7/15/2012	190	0	600	245	7/18/2012	1,035	715	−50	665	665	16,951	340	12,561	4,390	−50

Table 11. New York City reservoir release design data, December 1, 2011, to November 30, 2012.—Continued

[River Master daily operations record. The Montague design rate was 1,750 ft³/s. Column (col.) 1 was furnished by electric utility PPL Corporation; col. 2 furnished by electric utility Eagle Creek Renewable Energy; col. 3 computed from index stations; col. 4 computed increase in runoff based on quantitative precipitation forecasts; col. 5 = col. 1 + col. 2 + col. 3 + col. 4; col. 6 = design rate − col. 5, when positive, otherwise col. 6 = 0; col. 7 = col. 14 (4 days earlier); col. 8, directed release amount from the Office of Delaware River Master = col. 6 + col. 7, when positive, otherwise col. 8 =0; col. 9 = col. 7 from table 12; col. 10 = summation of col. 9; col. 11 = flow objective − (col. 9 + col. 10 from table 12) when positive, otherwise col. 11 = 0; col. 12 = summation of col. 11; col. 13 = col. 10 − col. 12; col. 14 = col. 13 divided by −10, limited to ±50 ft³/s; cols. 10, 12, 13, and 14 are accumulated from the previous water year starting June 1, 2011, with these values being reset on June 1, 2012; X, a miscalculation of col. 12 − col 10 was recorded during the directed release design process; Y, the balancing adjustment was not reset on June 15, 2012. ft³/s, cubic foot per second; (ft³/s)-d, cubic foot per second for a day]

Date of advance estimate	Advance estimate of discharge of Delaware River at Montague, New Jersey, exclusive of New York City reservoir releases				Montague date	Discharge (ft³/s)	Indicated deficiency (ft³/s)	Balancing adjustment (ft³/s)	Directed release (ft³/s)	Computation of balancing adjustment					
	Powerplant release forecasts		Uncontrolled runoff							Adjusted directed release		Actual deficiency		Cumulative difference (ft³/s)-d	Balancing adjustment (ft³/s)
	Lake Wallenpaupack (ft³/s)	Rio Reservoir (ft³/s)	Current condition (ft³/s)	Weather adjustment (ft³/s)						Daily (ft³/s)	Cumulative ([ft³/s]-d)	Daily (ft³/s)	Cumulative ([ft³/s]-d)		
	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14
7/16/2012	190	0	600	160	7/19/2012	950	800	−50	750	752	17,703	702	13,263	4,440	−50
7/17/2012	190	0	600	338	7/20/2012	1,128	622	−50	572	572	18,275	602	13,865	4,410	−50
7/18/2012	330	89	600	100	7/21/2012	1,119	631	−50	581	581	18,856	86	13,951	4,905	−50
7/19/2012	190	106	600	372	7/22/2012	1,268	482	−50	432	432	19,288	507	14,458	4,830	−50
7/20/2012	127	0	700	148	7/23/2012	975	775	−50	725	729	20,013−X	595	15,053	4,960	−50
7/21/2012	127	0	900	35	7/24/2012	1,062	688	−50	638	643	20,656	483	15,536	5,120	−50
7/22/2012	127	0	850	85	7/25/2012	1,062	688	−50	638	644	21,300	254	15,790	5,510	−50
7/23/2012	51	0	800	149	7/26/2012	1,000	750	−50	700	701	22,001	501	16,291	5,710	−50
7/24/2012	51	0	850	160	7/27/2012	1,061	689	−50	639	636	22,637	56	16,347	6,290	−50
7/25/2012	51	0	850	849	7/28/2012	1,750	0	−50	0	0	22,637	0	16,347	6,290	−50
7/26/2012	51	0	850	2,168	7/29/2012	3,069	0	−50	0	0	22,637	0	16,347	6,290	−50
7/27/2012	51	0	2,000	527	7/30/2012	2,578	0	−50	0	0	22,637	0	16,347	6,290	−50
7/28/2012	85	0	2,000	696	7/31/2012	2,781	0	−50	0	0	22,637	0	16,347	6,290	−50
7/29/2012	85	89	2,000	396	8/1/2012	2,570	0	−50	0	0	22,637	0	16,347	6,290	−50
7/30/2012	149	89	2,000	32	8/2/2012	2,270	0	−50	0	0	22,637	0	16,347	6,290	−50
7/31/2012	149	89	2,000	62	8/3/2012	2,300	0	−50	0	0	22,637	0	16,347	6,290	−50
8/1/2012	246	89	2,000	50	8/4/2012	2,385	0	−50	0	0	22,637	0	16,347	6,290	−50
8/2/2012	149	53	1,900	14	8/5/2012	2,116	0	−50	0	0	22,637	160	16,507	6,130	−50
8/3/2012	149	35	1,800	97	8/6/2012	2,081	0	−50	0	0	22,637	80	16,587	6,050	−50
8/4/2012	205	53	1,725	737	8/7/2012	2,720	0	−50	0	0	22,637	56	16,643	5,994	−50
8/5/2012	205	0	1,600	299	8/8/2012	2,104	0	−50	0	0	22,637	118	16,761	5,876	−50
8/6/2012	205	0	1,600	0	8/9/2012	1,805	0	−50	0	0	22,637	298	17,059	5,578	−50
8/7/2012	246	0	1,500	67	8/10/2012	1,813	0	−50	0	0	22,637	217	17,276	5,361	−50
8/8/2012	246	0	1,450	110	8/11/2012	1,806	0	−50	0	0	22,637	87	17,363	5,274	−50

Table 11. New York City reservoir release design data, December 1, 2011, to November 30, 2012.—Continued

[River Master daily operations record. The Montague design rate was 1,750 ft^3/s. Column (col.) 1 was furnished by electric utility PPL Corporation; col. 2 furnished by electric utility Eagle Creek Renewable Energy; col. 3 computed from index stations; col. 4 computed increase in runoff based on quantitative precipitation forecasts; col. 5 = col. 1 + col. 2 + col. 3 + col. 4; col. 6 = design rate − col. 5, when positive, otherwise col. 6 = 0; col. 7 = col. 14 (4 days earlier); col. 8, directed release amount from the Office of Delaware River Master = col. 6 + col. 7, when positive, otherwise col. 8 =0; col. 9 = col. 7 from table 12; col. 10 = summation of col. 9; col. 11 = flow objective − (col. 9 + col. 10 from table 12) when positive, otherwise col. 11 = 0; col. 12 = summation of col. 11; col. 13 = col. 10 − col. 12; col. 14 = col. 13 divided by −10, limited to ±50 ft^3/s; cols. 10, 12, 13, and 14 are accumulated from the previous water year starting June 1, 2011, with these values being reset on June 1, 2012; X, a miscalculation of col. 12 − col 10 was recorded during the directed release design process; Y, the balancing adjustment was not reset on June 15, 2012. ft^3/s, cubic foot per second; (ft^3/s)-d, cubic foot per second for a day]

Date of advance estimate	Advance estimate of discharge of Delaware River at Montague, New Jersey, exclusive of New York City reservoir releases				Montague date	Discharge (ft^3/s)	Indicated deficiency (ft^3/s)	Balancing adjustment (ft^3/s)	Directed release (ft^3/s)	Computation of balancing adjustment					
	Powerplant release forecasts		Uncontrolled runoff							Adjusted directed release		Actual deficiency		Cumulative difference (ft^3/s)-d	Balancing adjustment (ft^3/s)
	Lake Wallenpaupack (ft^3/s)	Rio Reservoir (ft^3/s)	Current condition (ft^3/s)	Weather adjustment (ft^3/s)						Daily (ft^3/s)	Cumulative ($[ft^3/s]$-d)	Daily (ft^3/s)	Cumulative ($[ft^3/s]$-d)		
	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14
8/9/2012	0	0	1,350	321	8/12/2012	1,671	79	−50	29	29	22,666	287	17,650	5,016	−50
8/10/2012	0	0	1,500	299	8/13/2012	1,799	0	−50	0	0	22,666	407	18,057	4,609	−50
8/11/2012	433	0	1,450	25	8/14/2012	1,908	0	−50	0	0	22,666	527	18,584	4,082	−50
8/12/2012	133	71	1,400	90	8/15/2012	1,694	0	−50	0	0	22,666	347	18,931	3,735	−50
8/13/2012	433	0	1,350	90	8/16/2012	1,873	0	−50	0	0	22,666	54	18,985	3,681	−50
8/14/2012	433	0	1,300	327	8/17/2012	2,060	0	−50	0	0	22,666	0	18,985	3,681	−50
8/15/2012	433	0	1,300	47	8/18/2012	1,780	0	−50	0	0	22,666	0	18,985	3,681	−50
8/16/2012	433	0	1,400	71	8/19/2012	1,904	0	−50	0	0	22,666	433	19,418	3,248	−50
8/17/2012	433	0	1,350	30	8/20/2012	1,813	0	−50	0	0	22,666	395	19,813	2,853	−50
8/18/2012	409	0	1,300	43	8/21/2012	1,752	0	−50	0	0	22,666	497	20,310	2,356	−50
8/19/2012	109	0	1,400	26	8/22/2012	1,535	215	−50	165	165	22,831	512	20,822	2,009	−50
8/20/2012	109	0	1,400	6	8/23/2012	1,515	235	−50	185	185	23,016	554	21,376	1,640	−50
8/21/2012	109	0	1,400	0	8/24/2012	1,509	241	−50	191	191	23,207	649	22,025	1,182	−50
8/22/2012	409	0	1,400	0	8/25/2012	1,809	0	−50	0	0	23,207	617	22,642	565	−50
8/23/2012	409	0	1,350	0	8/26/2012	1,759	0	−50	0	0	23,207	726	23,368	−161	16
8/24/2012	409	0	1,350	0	8/27/2012	1,759	0	−50	0	0	23,207	703	24,071	−864	50
8/25/2012	497	0	1,350	15	8/28/2012	1,862	0	−50	0	0	23,207	644	24,715	−1,508	50
8/26/2012	497	0	1,350	22	8/29/2012	1,869	0	−50	0	0	23,207	534	25,249	−2,042	50
8/27/2012	497	0	1,350	56	8/30/2012	1,903	0	16	0	0	23,207	232	25,481	−2,274	50
8/28/2012	347	0	1,000	5	8/31/2012	1,352	398	50	448	448	23,655	240	25,721	−2,066	50
8/29/2012	197	0	950	13	9/1/2012	1,160	590	50	640	640	24,295	270	25,991	−1,696	50
8/30/2012	197	71	900	0	9/2/2012	1,168	582	50	632	632	24,927	443	26,434	−1,507	50
8/31/2012	197	0	877	0	9/3/2012	1,074	676	50	726	726	25,653	727	27,161	−1,508	50
9/1/2012	253	0	1,042	0	9/4/2012	1,295	455	50	505	505	26,158	757	27,918	−1,760	50

Table 11. New York City reservoir release design data, December 1, 2011, to November 30, 2012.—Continued

[River Master daily operations record. The Montague design rate was 1,750 ft³/s. Column (col.) 1 was furnished by electric utility PPL Corporation; col. 2 furnished by electric utility Eagle Creek Renewable Energy; col. 3 computed from index stations; col. 4 computed increase in runoff based on quantitative precipitation forecasts; col. 5 = col. 1 + col. 2 + col. 3 + col. 4; col. 6 = design rate − col. 5, when positive, otherwise col. 6 = 0; col. 7 = col. 14 (4 days earlier); col. 8, directed release amount from the Office of Delaware River Master = col. 6 + col. 7, when positive, otherwise col. 8 =0; col. 9 = col. 7 from table 12; col. 10 = summation of col. 9; col. 11 = flow objective − (col. 9 + col. 10 from table 12) when positive, otherwise col. 11 = 0; col. 12 = summation of col. 11; col. 13 = col. 10 − col. 12; col. 14 = col. 13 divided by −10, limited to ±50 ft³/s; cols. 10, 12, 13, and 14 are accumulated from the previous water year starting June 1, 2011, with these values being reset on June 1, 2012; X, a miscalculation of col. 12 − col 10 was recorded during the directed release design process; Y, the balancing adjustment was not reset on June 15, 2012. ft³/s, cubic foot per second; (ft³/s)-d, cubic foot per second for a day]

Date of advance estimate	Advance estimate of discharge of Delaware River at Montague, New Jersey, exclusive of New York City reservoir releases				Montague date	Discharge (ft³/s)	Indicated deficiency (ft³/s)	Balancing adjustment (ft³/s)	Directed release (ft³/s)	Computation of balancing adjustment					
	Powerplant release forecasts		Uncontrolled runoff							Adjusted directed release		Actual deficiency		Cumulative difference (ft³/s)-d	Balancing adjustment (ft³/s)
	Lake Wallenpaupack (ft³/s)	Rio Reservoir (ft³/s)	Current condition (ft³/s)	Weather adjustment (ft³/s)						Daily (ft³/s)	Cumulative ([ft³/s]-d)	Daily (ft³/s)	Cumulative ([ft³/s]-d)		
	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14
9/2/2012	403	0	1,021	0	9/5/2012	1,424	326	50	376	376	26,534	0	27,918	−1,384	50
9/3/2012	403	0	1,001	1,775	9/6/2012	3,179	0	50	0	0	26,534	0	27,918	−1,384	50
9/4/2012	253	0	776	1,239	9/7/2012	2,268	0	50	0	0	26,534	0	27,918	−1,384	50
9/5/2012	253	0	776	35	9/8/2012	1,064	686	50	736	746	27,280	66	27,984	−704	50
9/6/2012	271	0	800	52	9/9/2012	1,123	627	50	677	680	27,960	260	28,244	−284	28
9/7/2012	253	0	1,162	134	9/10/2012	1,549	201	50	251	251	28,211	366	28,610	−399	40
9/8/2012	0	0	995	219	9/11/2012	1,214	536	50	586	584	28,795	594	29,204	−409	41
9/9/2012	0	0	981	0	9/12/2012	981	769	50	819	820	29,615	820	30,024	−409	41
9/10/2012	185	0	800	0	9/13/2012	985	765	50	815	820	30,435	550	30,574	−139	14
9/11/2012	185	0	900	0	9/14/2012	1,085	665	50	715	715	31,150	635	31,209	−59	6
9/12/2012	185	20	893	0	9/15/2012	1,098	652	50	702	697	31,847	657	31,866	−19	2
9/13/2012	98	30	877	7	9/16/2012	1,012	738	50	788	797	32,644	1,017	32,883	−239	24
9/14/2012	98	0	893	3	9/17/2012	994	756	50	806	850	33,444−X	1,020	33,903	−459	46
9/15/2012	0	0	900	0	9/18/2012	900	850	50	900	873	34,317	633	34,536	−219	22
9/16/2012	0	0	850	1,152	9/19/2012	2,002	0	50	0	0	34,317	0	34,536	−219	22
9/17/2012	0	0	831	4,523	9/20/2012	5,354	0	50	0	0	34,317	0	34,536	−219	22
The estimated Montague discharge was greater than the Montague design rate from 9/21/2012 to 11/30/2012															

Table 12. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, New Jersey.

[River Master daily operations record. All provided measurements are the mean discharge in cubic feet per second for 24 hours. Column (col.) 1 = actual release by New York City in response to directed release ordered by the Office of Delaware River Master; col. 2 = 24 hours beginning 1200 of date shown; col. 3 = 24 hours ending 2400 one day later; col. 4 = 24 hours beginning 1500 one day later; col. 5 = 24 hours beginning 0800 of date shown; col. 6 = 24 hours beginning 1600 of date shown; col. 7 = col. 2 + col. 3 + col. 4 in response to direction (col. 1); col. 8 = col. 2 + col. 3 + col. 4 − col. 7; col. 9 = col. 5 + col. 6; col. 10 = col. 11 − col. 7 − col. 8 − col. 9; col. 11 = 24 hours of calendar day shown; col. 12 = IERQ bank releases. Col., column; IERQ, Interim Excess Release Quantity; —, not applicable]

Controlled releases from New York City reservoirs					Controlled releases from power reservoirs			Segregation of flow, Delaware River at Montague, New Jersey						
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled releases			Computed uncontrolled	Total	IERQ bank releases
									New York City reservoirs		Power-plants			
Date	Amount								Directed	Other				
	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6		Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
11/28/2011	0	701	224	190	11/30/2011	1,621	496	12/1/2011	0	1,346	1,665	9,889	12,900	0
11/29/2011	0	701	455	190	12/1/2011	1,133	532	12/2/2011	0	1,592	1,050	7,858	10,500	0
11/30/2011	0	701	701	190	12/2/2011	483	567	12/3/2011	0	1,592	644	6,904	9,140	0
12/1/2011	0	701	701	190	12/3/2011	183	461	12/4/2011	0	1,592	858	6,290	8,740	0
12/2/2011	0	701	701	190	12/4/2011	255	603	12/5/2011	0	1,592	1,113	5,735	8,440	0
12/3/2011	0	701	701	190	12/5/2011	510	603	12/6/2011	0	1,592	1,186	6,942	9,720	0
12/4/2011	0	701	701	190	12/6/2011	725	461	12/7/2011	0	1,592	1,823	24,485	27,900	0
12/5/2011	0	701	701	190	12/7/2011	1,362	461	12/8/2011	0	1,592	2,368	19,840	23,800	0
12/6/2011	0	701	701	190	12/8/2011	1,517	851	12/9/2011	0	1,850	1,746	14,704	18,300	0
12/7/2011	0	701	959	190	12/9/2011	895	851	12/10/2011	0	2,378	1,600	11,922	15,900	0
12/8/2011	0	701	1,487	190	12/10/2011	749	851	12/11/2011	0	2,381	1,560	9,859	13,800	0
12/9/2011	0	701	1,490	190	12/11/2011	709	851	12/12/2011	0	2,390	1,591	8,419	12,400	0
12/10/2011	0	701	1,499	190	12/12/2011	740	851	12/13/2011	0	2,395	1,273	7,332	11,000	0
12/11/2011	0	701	1,504	190	12/13/2011	546	727	12/14/2011	0	2,395	1,234	6,671	10,300	0
12/12/2011	0	701	1,504	190	12/14/2011	507	727	12/15/2011	0	2,392	1,389	6,419	10,200	0
12/13/2011	0	701	1,501	190	12/15/2011	662	727	12/16/2011	0	2,389	1,144	6,107	9,640	0
12/14/2011	0	701	1,499	189	12/16/2011	435	709	12/17/2011	0	2,388	646	5,426	8,460	0
12/15/2011	0	701	1,497	190	12/17/2011	185	461	12/18/2011	0	2,388	605	4,957	7,950	0
12/16/2011	0	701	1,497	190	12/18/2011	233	372	12/19/2011	0	2,311	764	4,215	7,290	0
12/17/2011	0	701	1,420	190	12/19/2011	569	195	12/20/2011	0	1,941	634	4,635	7,210	0
12/18/2011	0	702	1,049	190	12/20/2011	634	0	12/21/2011	0	1,617	1,304	5,759	8,680	0
12/19/2011	0	701	726	190	12/21/2011	630	674	12/22/2011	0	1,776	664	3,440	5,880	0
12/20/2011	0	701	1,501	101	12/22/2011	569	585	12/23/2011	0	1,592	1,154	7,654	10,400	0
12/21/2011	0	701	1,502	101	12/23/2011	523	567	12/24/2011	0	1,590	1,090	9,020	11,700	0
12/22/2011	0	701	1,497	101	12/24/2011	289	372	12/25/2011	0	1,592	661	7,427	9,680	0
12/23/2011	0	702	1,501	101	12/25/2011	302	408	12/26/2011	0	1,594	710	6,666	8,970	0

Table 12. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, New Jersey.—Continued

[River Master daily operations record. All provided measurements are the mean discharge in cubic feet per second for 24 hours. Column (col.) 1 = actual release by New York City in response to directed release ordered by the Office of Delaware River Master; col. 2 = 24 hours beginning 1200 of date shown; col. 3 = 24 hours ending 2400 one day later; col. 4 = 24 hours beginning 1500 one day later; col. 5 = 24 hours beginning 0800 of date shown; col. 6 = 24 hours beginning 1600 of date shown; col. 7 = col. 2 + col. 3 + col. 4 in response to direction (col. 1); col. 8 = col. 2 + col. 3 + col. 4 − col. 7; col. 9 = col. 5 + col. 6; col. 10 = col. 11 − col. 7 − col. 8 − col. 9; col. 11 = 24 hours of calendar day shown; col. 12 = IERQ bank releases. Col., column; IERQ, Interim Excess Release Quantity; —, not applicable]

Controlled releases from New York City reservoirs					Controlled releases from power reservoirs			Segregation of flow, Delaware River at Montague, New Jersey						
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled releases			Computed uncontrolled	Total	IERQ bank releases
									New York City reservoirs		Power-plants			
Date	Amount								Directed	Other				
	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6		Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
12/24/2011	0	702	702	190	12/26/2011	527	585	12/27/2011	0	1,594	1,112	6,134	8,840	0
12/25/2011	0	701	702	190	12/27/2011	570	461	12/28/2011	0	1,593	1,031	10,876	13,500	0
12/26/2011	0	701	777	190	12/28/2011	1,212	248	12/29/2011	0	1,668	1,460	11,072	14,200	0
12/27/2011	0	699	1,151	190	12/29/2011	970	603	12/30/2011	0	2,040	1,573	8,387	12,000	0
12/28/2011	0	702	1,474	193	12/30/2011	459	656	12/31/2011	0	2,369	1,115	6,816	10,300	0
12/29/2011	0	702	1,501	186	12/31/2011	222	426	1/1/2012	0	2,389	648	6,633	9,670	0
12/30/2011	0	702	1,499	190	1/1/2012	259	390	1/2/2012	0	2,437	649	6,424	9,510	0
12/31/2011	0	702	1,499	189	1/2/2012	492	514	1/3/2012	0	2,390	1,006	5,774	9,170	0
1/1/2012	0	701	1,496	190	1/3/2012	469	390	1/4/2012	0	2,387	859	4,774	8,020	0
1/2/2012	0	701	1,496	189	1/4/2012	360	390	1/5/2012	0	2,386	750	4,314	7,450	0
1/3/2012	0	702	1,411	190	1/5/2012	352	443	1/6/2012	0	2,303	795	4,122	7,220	0
1/4/2012	0	701	893	190	1/6/2012	466	195	1/7/2012	0	1,784	661	4,035	6,480	0
1/5/2012	0	701	707	190	1/7/2012	0	213	1/8/2012	0	1,598	213	4,039	5,850	0
1/6/2012	0	701	707	190	1/8/2012	36	266	1/9/2012	0	1,598	302	3,930	5,830	0
1/7/2012	0	701	684	190	1/9/2012	434	390	1/10/2012	0	1,575	824	3,311	5,710	0
1/8/2012	0	701	364	190	1/10/2012	403	390	1/11/2012	0	1,255	793	3,262	5,310	0
1/9/2012	0	701	224	190	1/11/2012	389	390	1/12/2012	0	1,115	779	3,946	5,840	0
1/10/2012	0	701	226	190	1/12/2012	446	390	1/13/2012	0	1,117	836	6,077	8,030	0
1/11/2012	0	701	226	190	1/13/2012	477	266	1/14/2012	0	1,117	743	6,340	8,200	0
1/12/2012	0	699	226	190	1/14/2012	491	177	1/15/2012	0	1,115	668	4,937	6,720	0
1/13/2012	0	701	226	190	1/15/2012	492	337	1/16/2012	0	1,117	829	3,904	5,850	0
1/14/2012	0	701	226	190	1/16/2012	499	461	1/17/2012	0	1,117	960	3,683	5,760	0
1/15/2012	0	701	226	190	1/17/2012	544	461	1/18/2012	0	1,117	1,005	4,528	6,650	0
1/16/2012	0	545	226	190	1/18/2012	538	426	1/19/2012	0	961	964	3,995	5,920	0
1/17/2012	0	591	226	190	1/19/2012	506	390	1/20/2012	0	1,007	896	3,687	5,590	0

Table 12. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, New Jersey.—Continued

[River Master daily operations record. All provided measurements are the mean discharge in cubic feet per second for 24 hours. Column (col.) 1 = actual release by New York City in response to directed release ordered by the Office of Delaware River Master; col. 2 = 24 hours beginning 1200 of date shown; col. 3 = 24 hours ending 2400 one day later; col. 4 = 24 hours beginning 1500 one day later; col. 5 = 24 hours beginning 0800 of date shown; col. 6 = 24 hours beginning 1600 of date shown; col. 7 = col. 2 + col. 3 + col. 4 in response to direction (col. 1); col. 8 = col. 2 + col. 3 + col. 4 − col. 7; col. 9 = col. 5 + col. 6; col. 10 = col. 11 − col. 7 − col. 8 − col. 9; col. 11 = 24 hours of calendar day shown; col. 12 = IERQ bank releases. Col., column; IERQ, Interim Excess Release Quantity; —, not applicable]

Controlled releases from New York City reservoirs					Controlled releases from power reservoirs			Segregation of flow, Delaware River at Montague, New Jersey					
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled releases			Computed uncontrolled	Total	IERQ bank releases
									New York City reservoirs		Power-plants			
Date	Amount								Directed	Other				
	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6		Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
1/18/2012	0	688	226	190	1/20/2012	467	266	1/21/2012	0	1,104	733	3,083	4,920	0
1/19/2012	0	600	226	189	1/21/2012	326	106	1/22/2012	0	1,015	432	3,333	4,780	0
1/20/2012	0	600	226	190	1/22/2012	403	124	1/23/2012	0	1,016	527	3,287	4,830	0
1/21/2012	0	600	226	190	1/23/2012	782	248	1/24/2012	0	1,016	1,030	4,114	6,160	0
1/22/2012	0	600	226	190	1/24/2012	879	248	1/25/2012	0	1,016	1,127	5,427	7,570	0
1/23/2012	0	600	226	190	1/25/2012	1,160	355	1/26/2012	0	1,016	1,515	4,609	7,140	0
1/24/2012	0	600	226	190	1/26/2012	1,012	337	1/27/2012	0	1,016	1,349	6,325	8,690	0
1/25/2012	0	600	486	190	1/27/2012	1,210	301	1/28/2012	0	1,276	1,511	14,013	16,800	0
1/26/2012	0	600	702	190	1/28/2012	1,158	355	1/29/2012	0	1,492	1,513	11,095	14,100	0
1/27/2012	0	602	705	190	1/29/2012	706	426	1/30/2012	0	1,497	1,132	8,471	11,100	0
1/28/2012	0	600	698	190	1/30/2012	377	461	1/31/2012	0	1,488	838	6,854	9,180	0
1/29/2012	0	600	948	190	1/31/2012	0	337	2/1/2012	0	1,738	337	6,725	8,800	0
1/30/2012	0	696	1,497	190	2/1/2012	0	284	2/2/2012	0	2,383	284	5,903	8,570	0
1/31/2012	0	699	1,497	190	2/2/2012	382	230	2/3/2012	0	2,386	612	5,472	8,470	0
2/1/2012	0	701	1,499	190	2/3/2012	180	248	2/4/2012	0	2,390	428	4,842	7,660	0
2/2/2012	0	702	1,497	190	2/4/2012	0	337	2/5/2012	0	2,389	337	4,394	7,120	0
2/3/2012	0	702	1,496	190	2/5/2012	0	319	2/6/2012	0	2,388	319	3,983	6,690	0
2/4/2012	0	702	1,497	190	2/6/2012	119	213	2/7/2012	0	2,389	332	3,669	6,390	0
2/5/2012	0	701	1,216	190	2/7/2012	171	195	2/8/2012	0	2,107	366	3,117	5,590	0
2/6/2012	0	701	701	190	2/8/2012	127	195	2/9/2012	0	1,592	322	3,346	5,260	0
2/7/2012	0	702	500	190	2/9/2012	301	53	2/10/2012	0	1,392	354	3,044	4,790	0
2/8/2012	0	702	227	190	2/10/2012	412	0	2/11/2012	0	1,119	412	2,949	4,480	0
2/9/2012	0	702	224	190	2/11/2012	574	0	2/12/2012	0	1,116	574	2,770	4,460	0
2/10/2012	0	699	226	190	2/12/2012	360	89	2/13/2012	0	1,115	449	2,586	4,150	0
2/11/2012	0	701	226	190	2/13/2012	380	142	2/14/2012	0	1,117	522	2,431	4,070	0
2/12/2012	0	701	226	190	2/14/2012	370	142	2/15/2012	0	1,117	512	2,411	4,040	0

Table 12. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, New Jersey.—Continued

[River Master daily operations record. All provided measurements are the mean discharge in cubic feet per second for 24 hours. Column (col.) 1 = actual release by New York City in response to directed release ordered by the Office of Delaware River Master; col. 2 = 24 hours beginning 1200 of date shown; col. 3 = 24 hours ending 2400 one day later; col. 4 = 24 hours beginning 1500 one day later; col. 5 = 24 hours beginning 0800 of date shown; col. 6 = 24 hours beginning 1600 of date shown; col. 7 = col. 2 + col. 3 + col. 4 in response to direction (col. 1); col. 8 = col. 2 + col. 3 + col. 4 − col. 7; col. 9 = col. 5 + col. 6; col. 10 = col. 11 − col. 7 − col. 8 − col. 9; col. 11 = 24 hours of calendar day shown; col. 12 = IERQ bank releases. Col., column; IERQ, Interim Excess Release Quantity; —, not applicable]

Controlled releases from New York City reservoirs					Controlled releases from power reservoirs			Segregation of flow, Delaware River at Montague, New Jersey						
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled releases			Computed uncontrolled	Total	IERQ bank releases
									New York City reservoirs		Power-plants			
Date	Amount								Directed	Other				
	Col. 1	Col. 2	Col. 3	Col. 4	2012	Col. 5	Col. 6		Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
2/13	0	687	226	189	2/15	440	142	2/16/2012	0	1,102	582	2,286	3,970	0
2/14	0	500	226	189	2/16	391	53	2/17/2012	0	915	444	2,391	3,750	0
2/15	0	500	226	189	2/17	330	0	2/18/2012	0	915	330	2,485	3,730	0
2/16	0	500	226	192	2/18	189	0	2/19/2012	0	918	189	2,443	3,550	0
2/17	0	500	226	192	2/19	170	89	2/20/2012	0	918	259	2,313	3,490	0
2/18	0	500	226	190	2/20	388	160	2/21/2012	0	916	548	2,106	3,570	0
2/19	0	500	226	190	2/21	394	160	2/22/2012	0	916	554	1,960	3,430	0
2/20	0	473	226	189	2/22	340	160	2/23/2012	0	888	500	1,922	3,310	0
2/21	0	150	226	190	2/23	482	106	2/24/2012	0	566	588	2,316	3,470	0
2/22	0	150	224	189	2/24	463	35	2/25/2012	0	563	498	2,619	3,680	0
2/23	0	150	224	190	2/25	294	0	2/26/2012	0	564	294	2,582	3,440	0
2/24	0	150	224	190	2/26	265	18	2/27/2012	0	564	283	2,343	3,190	0
2/25	0	150	224	190	2/27	442	89	2/28/2012	0	564	531	2,225	3,320	0
2/26	0	150	224	190	2/28	463	89	2/29/2012	0	564	552	2,314	3,430	0
2/27	0	152	224	190	2/29	216	160	3/1/2012	0	566	376	2,538	3,480	0
2/28	0	152	224	190	3/1	194	160	3/2/2012	0	566	354	2,800	3,720	0
2/29	0	152	224	190	3/2	225	53	3/3/2012	0	566	278	3,156	4,000	0
3/1	0	150	224	190	3/3	0	0	3/4/2012	0	564	0	5,106	5,670	0
3/2	0	150	221	190	3/4	0	106	3/5/2012	0	561	106	4,943	5,610	0
3/3	0	150	224	190	3/5	366	160	3/6/2012	0	564	526	3,810	4,900	0
3/4	0	150	224	190	3/6	314	160	3/7/2012	0	564	474	3,362	4,400	0
3/5	0	150	226	192	3/7	402	160	3/8/2012	0	568	562	3,460	4,590	0
3/6	0	150	226	190	3/8	437	160	3/9/2012	0	566	597	4,947	6,110	0
3/7	0	150	226	169	3/9	399	53	3/10/2012	0	545	452	7,523	8,520	0
3/8	0	150	226	74	3/10	0	656	3/11/2012	0	450	656	6,144	7,250	0

Table 12. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, New Jersey.—Continued

[River Master daily operations record. All provided measurements are the mean discharge in cubic feet per second for 24 hours. Column (col.) 1 = actual release by New York City in response to directed release ordered by the Office of Delaware River Master; col. 2 = 24 hours beginning 1200 of date shown; col. 3 = 24 hours ending 2400 one day later; col. 4 = 24 hours beginning 1500 one day later; col. 5 = 24 hours beginning 0800 of date shown; col. 6 = 24 hours beginning 1600 of date shown; col. 7 = col. 2 + col. 3 + col. 4 in response to direction (col. 1); col. 8 = col. 2 + col. 3 + col. 4 − col. 7; col. 9 = col. 5 + col. 6; col. 10 = col. 11 − col. 7 − col. 8 − col. 9; col. 11 = 24 hours of calendar day shown; col. 12 = IERQ bank releases. Col., column; IERQ, Interim Excess Release Quantity; —, not applicable]

Controlled releases from New York City reservoirs					Controlled releases from power reservoirs			Segregation of flow, Delaware River at Montague, New Jersey						
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled releases			Computed uncontrolled	Total	IERQ bank releases
									New York City reservoirs		Power-plants			
Date	Amount								Directed	Other				
	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6		Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
3/9/2012	0	150	226	73	3/11/2012	0	106	3/12/2012	0	449	106	5,275	5,830	0
3/10/2012	0	144	218	76	3/12/2012	205	160	3/13/2012	0	438	365	4,937	5,740	0
3/11/2012	0	150	226	76	3/13/2012	221	230	3/14/2012	0	452	451	4,927	5,830	0
3/12/2012	0	150	227	76	3/14/2012	160	230	3/15/2012	0	453	390	4,997	5,840	0
3/13/2012	0	145	198	76	3/15/2012	184	230	3/16/2012	0	419	414	4,597	5,430	0
3/14/2012	0	101	176	76	3/16/2012	231	160	3/17/2012	0	353	391	4,376	5,120	0
3/15/2012	0	101	176	76	3/17/2012	0	106	3/18/2012	0	353	106	4,171	4,630	0
3/16/2012	0	101	176	76	3/18/2012	15	177	3/19/2012	0	353	192	3,875	4,420	0
3/17/2012	0	101	176	76	3/19/2012	159	230	3/20/2012	0	353	389	3,718	4,460	0
3/18/2012	0	101	176	76	3/20/2012	168	266	3/21/2012	0	353	434	3,873	4,660	0
3/19/2012	0	101	176	76	3/21/2012	170	230	3/22/2012	0	353	400	3,707	4,460	0
3/20/2012	0	99	176	76	3/22/2012	245	248	3/23/2012	0	351	493	3,306	4,150	0
3/21/2012	0	101	176	76	3/23/2012	132	213	3/24/2012	0	353	345	3,102	3,800	0
3/22/2012	0	101	175	76	3/24/2012	0	89	3/25/2012	0	352	89	2,879	3,320	0
3/23/2012	0	101	173	76	3/25/2012	0	106	3/26/2012	0	350	106	2,754	3,210	0
3/24/2012	0	102	176	76	3/26/2012	365	230	3/27/2012	0	354	595	2,501	3,450	0
3/25/2012	0	101	178	76	3/27/2012	202	213	3/28/2012	0	355	415	2,310	3,080	0
3/26/2012	0	101	178	76	3/28/2012	220	71	3/29/2012	0	355	291	2,314	2,960	0
3/27/2012	0	101	178	76	3/29/2012	189	71	3/30/2012	0	355	260	2,235	2,850	0
3/28/2012	0	101	176	76	3/30/2012	199	71	3/31/2012	0	353	270	2,197	2,820	0
3/29/2012	0	101	179	76	3/31/2012	0	71	4/1/2012	0	356	71	2,583	3,010	0
3/30/2012	0	101	178	76	4/1/2012	0	71	4/2/2012	0	355	71	3,054	3,480	0
3/31/2012	0	101	178	73	4/2/2012	0	106	4/3/2012	0	352	106	3,212	3,670	0
4/1/2012	0	101	175	50	4/3/2012	0	35	4/4/2012	0	326	35	2,849	3,210	0
4/2/2012	0	73	175	50	4/4/2012	0	0	4/5/2012	0	298	0	2,582	2,880	0

Table 12. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, New Jersey.—Continued

[River Master daily operations record. All provided measurements are the mean discharge in cubic feet per second for 24 hours. Column (col.) 1 = actual release by New York City in response to directed release ordered by the Office of Delaware River Master; col. 2 = 24 hours beginning 1200 of date shown; col. 3 = 24 hours ending 2400 one day later; col. 4 = 24 hours beginning 1500 one day later; col. 5 = 24 hours beginning 0800 of date shown; col. 6 = 24 hours beginning 1600 of date shown; col. 7 = col. 2 + col. 3 + col. 4 in response to direction (col. 1); col. 8 = col. 2 + col. 3 + col. 4 − col. 7; col. 9 = col. 5 + col. 6; col. 10 = col. 11 − col. 7 − col. 8 − col. 9; col. 11 = 24 hours of calendar day shown; col. 12 = IERQ bank releases. Col., column; IERQ, Interim Excess Release Quantity; —, not applicable]

Controlled releases from New York City reservoirs					Controlled releases from power reservoirs			Segregation of flow, Delaware River at Montague, New Jersey					
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled releases			Computed uncontrolled	Total	IERQ bank releases
									New York City reservoirs		Power-plants			
Date	Amount								Directed	Other				
	Col. 1	Col. 2	Col. 3	Col. 4	2012	Col. 5	Col. 6		Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
4/3/2012	0	71	175	50	4/5/2012	0	0	4/6/2012	0	296	0	2,354	2,650	0
4/4/2012	0	71	173	50	4/6/2012	0	0	4/7/2012	0	294	0	2,216	2,510	0
4/5/2012	0	70	176	50	4/7/2012	0	0	4/8/2012	0	296	0	2,074	2,370	0
4/6/2012	0	70	176	50	4/8/2012	0	0	4/9/2012	0	296	0	1,994	2,290	0
4/7/2012	0	70	176	50	4/9/2012	0	0	4/10/2012	0	296	0	1,904	2,200	0
4/8/2012	0	70	176	50	4/10/2012	0	106	4/11/2012	0	296	106	1,898	2,300	0
4/9/2012	0	70	176	50	4/11/2012	0	71	4/12/2012	0	296	71	1,903	2,270	0
4/10/2012	0	70	176	50	4/12/2012	0	89	4/13/2012	0	296	89	1,855	2,240	0
4/11/2012	0	70	176	50	4/13/2012	0	53	4/14/2012	0	296	53	1,771	2,120	0
4/12/2012	0	70	176	50	4/14/2012	0	142	4/15/2012	0	296	142	1,612	2,050	0
4/13/2012	0	71	176	50	4/15/2012	11	0	4/16/2012	0	297	11	1,732	2,040	0
4/14/2012	0	71	176	50	4/16/2012	0	53	4/17/2012	0	297	53	1,640	1,990	0
4/15/2012	0	71	176	48	4/17/2012	0	0	4/18/2012	0	295	0	1,555	1,850	0
4/16/2012	0	68	156	45	4/18/2012	1	0	4/19/2012	0	269	1	1,490	1,760	0
4/17/2012	78	59	139	45	4/19/2012	27	0	4/20/2012	78	165	27	1,440	1,710	0
4/18/2012	128	59	139	45	4/20/2012	0	0	4/21/2012	128	115	0	1,417	1,660	0
4/19/2012	448	60	343	45	4/21/2012	0	0	4/22/2012	448	0	0	1,532	1,980	0
4/20/2012	350	60	248	45	4/22/2012	0	106	4/23/2012	350	3	106	5,471	5,930	0
4/21/2012	0	62	141	43	4/23/2012	0	142	4/24/2012	0	246	142	9,812	10,200	0
4/22/2012	0	60	102	40	4/24/2012	0	177	4/25/2012	0	202	177	7,491	7,870	0
4/23/2012	0	56	85	40	4/25/2012	0	160	4/26/2012	0	181	160	5,959	6,300	0
4/24/2012	0	56	88	40	4/26/2012	0	160	4/27/2012	0	184	160	5,066	5,410	0
4/25/2012	0	57	87	40	4/27/2012	0	230	4/28/2012	0	184	230	4,436	4,850	0
4/26/2012	0	77	48	40	4/28/2012	0	0	4/29/2012	0	165	0	3,955	4,120	0
4/27/2012	0	70	87	40	4/29/2012	0	106	4/30/2012	0	197	106	3,467	3,770	0

Table 12. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, New Jersey.—Continued

[River Master daily operations record. All provided measurements are the mean discharge in cubic feet per second for 24 hours. Column (col.) 1 = actual release by New York City in response to directed release ordered by the Office of Delaware River Master; col. 2 = 24 hours beginning 1200 of date shown; col. 3 = 24 hours ending 2400 one day later; col. 4 = 24 hours beginning 1500 one day later; col. 5 = 24 hours beginning 0800 of date shown; col. 6 = 24 hours beginning 1600 of date shown; col. 7 = col. 2 + col. 3 + col. 4 in response to direction (col. 1); col. 8 = col. 2 + col. 3 + col. 4 − col. 7; col. 9 = col. 5 + col. 6; col. 10 = col. 11 − col. 7 − col. 8 − col. 9; col. 11 = 24 hours of calendar day shown; col. 12 = IERQ bank releases. Col., column; IERQ, Interim Excess Release Quantity; —, not applicable]

Controlled releases from New York City reservoirs					Controlled releases from power reservoirs			Segregation of flow, Delaware River at Montague, New Jersey					
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled releases			Computed uncontrolled	Total	IERQ bank releases
									New York City reservoirs		Power-plants			
Date	Amount								Directed	Other				
	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6		Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
4/28/2012	0	54	85	40	4/30/2012	0	177	5/1/2012	0	179	177	3,104	3,460	0
4/29/2012	0	57	87	45	5/1/2012	0	0	5/2/2012	0	189	0	3,311	3,500	0
4/30/2012	0	60	130	56	5/2/2012	0	89	5/3/2012	0	246	89	3,605	3,940	0
5/1/2012	0	76	153	56	5/3/2012	0	160	5/4/2012	0	285	160	4,525	4,970	0
5/2/2012	0	76	152	56	5/4/2012	0	89	5/5/2012	0	284	89	6,947	7,320	0
5/3/2012	0	74	150	56	5/5/2012	0	0	5/6/2012	0	280	0	5,510	5,790	0
5/4/2012	0	74	150	56	5/6/2012	0	0	5/7/2012	0	280	0	4,600	4,880	0
5/5/2012	0	76	150	56	5/7/2012	0	71	5/8/2012	0	282	71	4,217	4,570	0
5/6/2012	0	74	150	56	5/8/2012	0	266	5/9/2012	0	280	266	10,254	10,800	0
5/7/2012	0	74	150	56	5/9/2012	610	603	5/10/2012	0	280	1,213	10,807	12,300	0
5/8/2012	0	74	149	56	5/10/2012	659	638	5/11/2012	0	279	1,297	7,944	9,520	0
5/9/2012	0	76	150	56	5/11/2012	406	301	5/12/2012	0	282	707	5,921	6,910	0
5/10/2012	0	76	150	56	5/12/2012	0	142	5/13/2012	0	282	142	5,086	5,510	0
5/11/2012	0	76	150	56	5/13/2012	18	195	5/14/2012	0	282	213	4,655	5,150	0
5/12/2012	0	76	150	56	5/14/2012	678	372	5/15/2012	0	282	1,050	8,528	9,860	0
5/13/2012	0	76	150	56	5/15/2012	1,344	355	5/16/2012	0	282	1,699	35,619	37,600	0
5/14/2012	0	76	150	56	5/16/2012	1,647	621	5/17/2012	0	282	2,268	17,750	20,300	0
5/15/2012	0	53	200	85	5/17/2012	1,664	621	5/18/2012	0	338	2,285	10,977	13,600	0
5/16/2012	0	93	398	90	5/18/2012	630	443	5/19/2012	0	581	1,073	7,406	9,060	0
5/17/2012	0	99	401	90	5/19/2012	0	337	5/20/2012	0	590	337	6,153	7,080	0
5/18/2012	0	101	404	90	5/20/2012	63	355	5/21/2012	0	595	418	5,497	6,510	0
5/19/2012	0	101	404	90	5/21/2012	680	284	5/22/2012	0	595	964	5,061	6,620	0
5/20/2012	0	104	404	90	5/22/2012	499	284	5/23/2012	0	598	783	5,169	6,550	0
5/21/2012	0	125	404	90	5/23/2012	370	266	5/24/2012	0	619	636	5,735	6,990	0
5/22/2012	0	125	401	90	5/24/2012	474	319	5/25/2012	0	616	793	5,071	6,480	0

Table 12. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, New Jersey.—Continued

[River Master daily operations record. All provided measurements are the mean discharge in cubic feet per second for 24 hours. Column (col.) 1 = actual release by New York City in response to directed release ordered by the Office of Delaware River Master; col. 2 = 24 hours beginning 1200 of date shown; col. 3 = 24 hours ending 2400 one day later; col. 4 = 24 hours beginning 1500 one day later; col. 5 = 24 hours beginning 0800 of date shown; col. 6 = 24 hours beginning 1600 of date shown; col. 7 = col. 2 + col. 3 + col. 4 in response to direction (col. 1); col. 8 = col. 2 + col. 3 + col. 4 − col. 7; col. 9 = col. 5 + col. 6; col. 10 = col. 11 − col. 7 − col. 8 − col. 9; col. 11 = 24 hours of calendar day shown; col. 12 = IERQ bank releases. Col., column; IERQ, Interim Excess Release Quantity; —, not applicable]

Controlled releases from New York City reservoirs					Controlled releases from power reservoirs			Segregation of flow, Delaware River at Montague, New Jersey						
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled releases			Computed uncontrolled	Total	IERQ bank releases
									New York City reservoirs		Power-plants			
Date	Amount								Directed	Other				
	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6		Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
5/23/2012	0	125	401	93	5/25/2012	189	408	5/26/2012	0	619	597	4,724	5,940	0
5/24/2012	0	127	476	108	5/26/2012	0	266	5/27/2012	0	711	266	4,183	5,160	0
5/25/2012	0	169	526	119	5/27/2012	5	195	5/28/2012	0	814	200	3,496	4,510	0
5/26/2012	0	248	526	121	5/28/2012	84	160	5/29/2012	0	895	244	3,051	4,190	0
5/27/2012	0	229	524	114	5/29/2012	359	426	5/30/2012	0	867	785	3,078	4,730	0
5/28/2012	0	150	526	101	5/30/2012	262	106	5/31/2012	0	777	368	3,785	4,930	0
5/29/2012	0	150	526	101	5/31/2012	71	319	6/1/2012	0	777	390	3,063	4,230	0
5/30/2012	0	150	526	113	6/1/2012	247	319	6/2/2012	0	789	566	3,605	4,960	0
5/31/2012	0	150	574	141	6/2/2012	1,244	89	6/3/2012	0	865	1,333	3,892	6,090	0
6/1/2012	0	150	596	141	6/3/2012	35	89	6/4/2012	0	887	124	3,649	4,660	0
6/2/2012	0	150	594	131	6/4/2012	428	106	6/5/2012	0	875	534	3,751	5,160	0
6/3/2012	0	149	529	110	6/5/2012	443	124	6/6/2012	0	788	567	3,625	4,980	0
6/4/2012	0	141	500	110	6/6/2012	540	89	6/7/2012	0	751	629	3,060	4,440	0
6/5/2012	0	141	500	110	6/7/2012	523	53	6/8/2012	0	751	576	2,963	4,290	0
6/6/2012	0	141	500	110	6/8/2012	337	89	6/9/2012	0	751	426	2,573	3,750	0
6/7/2012	0	141	500	110	6/9/2012	0	177	6/10/2012	0	751	177	2,342	3,270	0
6/8/2012	0	141	500	110	6/10/2012	71	124	6/11/2012	0	751	195	2,384	3,330	0
6/9/2012	0	141	500	110	6/11/2012	484	301	6/12/2012	0	751	785	2,254	3,790	0
6/10/2012	0	141	500	110	6/12/2012	529	195	6/13/2012	0	751	724	3,585	5,060	0
6/11/2012	0	141	498	110	6/13/2012	449	142	6/14/2012	0	749	591	4,460	5,800	0
6/12/2012	0	141	498	110	6/14/2012	820	160	6/15/2012	0	749	980	3,131	4,860	0
6/13/2012	0	141	498	110	6/15/2012	290	142	6/16/2012	0	749	432	2,549	3,730	0
6/14/2012	0	141	498	110	6/16/2012	130	142	6/17/2012	0	749	272	2,289	3,310	0
6/15/2012	0	141	498	110	6/17/2012	523	89	6/18/2012	0	749	612	2,019	3,380	0
6/16/2012	0	141	497	110	6/18/2012	419	0	6/19/2012	0	748	419	1,933	3,100	0

Table 12. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, New Jersey.—Continued

[River Master daily operations record. All provided measurements are the mean discharge in cubic feet per second for 24 hours. Column (col.) 1 = actual release by New York City in response to directed release ordered by the Office of Delaware River Master; col. 2 = 24 hours beginning 1200 of date shown; col. 3 = 24 hours ending 2400 one day later; col. 4 = 24 hours beginning 1500 one day later; col. 5 = 24 hours beginning 0800 of date shown; col. 6 = 24 hours beginning 1600 of date shown; col. 7 = col. 2 + col. 3 + col. 4 in response to direction (col. 1); col. 8 = col. 2 + col. 3 + col. 4 − col. 7; col. 9 = col. 5 + col. 6; col. 10 = col. 11 − col. 7 − col. 8 − col. 9; col. 11 = 24 hours of calendar day shown; col. 12 = IERQ bank releases. Col., column; IERQ, Interim Excess Release Quantity; —, not applicable]

Controlled releases from New York City reservoirs					Controlled releases from power reservoirs			Segregation of flow, Delaware River at Montague, New Jersey					
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled releases			Computed uncontrolled	Total	IERQ bank releases
									New York City reservoirs		Power-plants			
Date	Amount								Directed	Other				
2012	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6		Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
6/17/2012	0	141	498	110	6/19/2012	474	106	6/20/2012	0	749	580	1,861	3,190	0
6/18/2012	0	141	498	110	6/20/2012	496	160	6/21/2012	0	749	656	2,075	3,480	97
6/19/2012	0	141	597	110	6/21/2012	492	124	6/22/2012	0	848	616	1,626	3,090	196
6/20/2012	0	141	696	110	6/22/2012	440	266	6/23/2012	0	947	706	1,257	2,910	0
6/21/2012	0	141	501	110	6/23/2012	242	0	6/24/2012	0	752	242	1,446	2,440	0
6/22/2012	0	141	501	110	6/24/2012	262	0	6/25/2012	0	752	262	1,456	2,470	0
6/23/2012	0	141	501	110	6/25/2012	6	0	6/26/2012	0	752	6	1,522	2,280	0
6/24/2012	0	141	501	110	6/26/2012	8	0	6/27/2012	0	752	8	1,400	2,160	0
6/25/2012	0	141	498	110	6/27/2012	66	0	6/28/2012	0	749	66	1,265	2,080	0
6/26/2012	0	141	500	110	6/28/2012	182	106	6/29/2012	0	751	288	1,221	2,260	0
6/27/2012	0	139	500	110	6/29/2012	298	71	6/30/2012	0	749	369	1,082	2,200	0
6/28/2012	851	141	600	110	6/30/2012	277	0	7/1/2012	851	0	277	1,122	2,250	0
6/29/2012	952	141	701	110	7/1/2012	251	124	7/2/2012	952	0	375	993	2,320	0
6/30/2012	949	141	698	110	7/2/2012	335	53	7/3/2012	949	0	388	903	2,240	0
7/1/2012	850	141	599	110	7/3/2012	247	0	7/4/2012	850	0	247	903	2,000	0
7/2/2012	851	141	600	110	7/4/2012	351	0	7/5/2012	851	0	351	868	2,070	0
7/3/2012	850	141	599	110	7/5/2012	353	53	7/6/2012	850	0	406	814	2,070	0
7/4/2012	851	141	600	110	7/6/2012	518	71	7/7/2012	851	0	589	750	2,190	0
7/5/2012	964	141	713	110	7/7/2012	313	89	7/8/2012	964	0	402	754	2,120	0
7/6/2012	981	141	730	110	7/8/2012	323	89	7/9/2012	981	0	412	827	2,220	0
7/7/2012	1,006	141	755	110	7/9/2012	270	160	7/10/2012	1,006	0	430	724	2,160	0
7/8/2012	1,001	141	750	110	7/10/2012	264	53	7/11/2012	1,001	0	317	742	2,060	0
7/9/2012	949	141	698	110	7/11/2012	191	0	7/12/2012	949	0	191	720	1,860	0
7/10/2012	893	286	497	110	7/12/2012	625	0	7/13/2012	893	0	625	642	2,160	0
7/11/2012	798	190	498	110	7/13/2012	342	0	7/14/2012	798	0	342	820	1,960	0

Table 12. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, New Jersey.—Continued

[River Master daily operations record. All provided measurements are the mean discharge in cubic feet per second for 24 hours. Column (col.) 1 = actual release by New York City in response to directed release ordered by the Office of Delaware River Master; col. 2 = 24 hours beginning 1200 of date shown; col. 3 = 24 hours ending 2400 one day later; col. 4 = 24 hours beginning 1500 one day later; col. 5 = 24 hours beginning 0800 of date shown; col. 6 = 24 hours beginning 1600 of date shown; col. 7 = col. 2 + col. 3 + col. 4 in response to direction (col. 1); col. 8 = col. 2 + col. 3 + col. 4 − col. 7; col. 9 = col. 5 + col. 6; col. 10 = col. 11 − col. 7 − col. 8 − col. 9; col. 11 = 24 hours of calendar day shown; col. 12 = IERQ bank releases. Col., column; IERQ, Interim Excess Release Quantity; —, not applicable]

Controlled releases from New York City reservoirs					Controlled releases from power reservoirs			Segregation of flow, Delaware River at Montague, New Jersey					
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled releases			Computed uncontrolled	Total	IERQ bank releases
									New York City reservoirs		Power-plants			
Date	Amount								Directed	Other				
	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6		Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
7/12/2012	848	240	498	110	7/14/2012	229	0	7/15/2012	0	229	733	1,810	3,770	0
7/13/2012	862	240	512	110	7/15/2012	222	0	7/16/2012	0	222	896	1,980	3,190	0
7/14/2012	826	204	512	110	7/16/2012	214	0	7/17/2012	0	214	1,270	2,310	3,100	0
7/15/2012	665	139	501	110	7/17/2012	204	35	7/18/2012	85	239	1,171	2,160	3,270	0
7/16/2012	752	141	501	110	7/18/2012	121	0	7/19/2012	0	121	927	1,800	3,040	0
7/17/2012	572	141	501	110	7/19/2012	159	0	7/20/2012	180	159	989	1,900	3,100	0
7/18/2012	581	141	498	107	7/20/2012	266	106	7/21/2012	165	372	1,292	2,410	3,190	0
7/19/2012	432	141	435	101	7/21/2012	17	0	7/22/2012	245	17	1,226	1,920	3,220	0
7/20/2012	729	141	487	101	7/22/2012	89	0	7/23/2012	0	89	1,066	1,880	2,850	0
7/21/2012	643	141	401	101	7/23/2012	66	0	7/24/2012	0	66	1,201	1,910	3,050	0
7/22/2012	644	141	402	101	7/24/2012	51	0	7/25/2012	0	51	1,445	2,140	3,480	0
7/23/2012	701	141	459	101	7/25/2012	42	0	7/26/2012	0	42	1,207	1,950	3,790	0
7/24/2012	636	141	394	101	7/26/2012	104	0	7/27/2012	0	104	1,590	2,330	3,370	0
7/25/2012	0	141	326	99	7/27/2012	100	0	7/28/2012	566	100	2,184	2,850	3,050	0
7/26/2012	0	141	328	99	7/28/2012	49	0	7/29/2012	568	49	2,373	2,990	3,270	0
7/27/2012	0	141	328	99	7/29/2012	47	35	7/30/2012	568	82	3,950	4,600	3,200	0
7/28/2012	0	141	328	101	7/30/2012	98	89	7/31/2012	570	187	3,113	3,870	2,950	0
7/29/2012	0	141	328	101	7/31/2012	125	89	8/1/2012	570	214	2,196	2,980	2,900	0
7/30/2012	0	141	328	101	8/1/2012	97	89	8/2/2012	570	186	1,804	2,560	2,670	0
7/31/2012	0	141	328	101	8/2/2012	153	160	8/3/2012	570	313	1,587	2,470	2,740	0
8/1/2012	0	139	328	101	8/3/2012	277	53	8/4/2012	568	330	1,442	2,340	2,980	0
8/2/2012	0	141	328	101	8/4/2012	273	71	8/5/2012	570	344	1,246	2,160	2,890	0
8/3/2012	0	141	328	101	8/5/2012	334	0	8/6/2012	570	334	1,336	2,240	7,370	0
8/4/2012	0	139	326	101	8/6/2012	273	0	8/7/2012	566	273	1,421	2,260	8,550	0
8/5/2012	0	141	326	101	8/7/2012	118	106	8/8/2012	568	224	1,408	2,200	7,180	0

Table 12. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, New Jersey.—Continued

[River Master daily operations record. All provided measurements are the mean discharge in cubic feet per second for 24 hours. Column (col.) 1 = actual release by New York City in response to directed release ordered by the Office of Delaware River Master; col. 2 = 24 hours beginning 1200 of date shown; col. 3 = 24 hours ending 2400 one day later; col. 4 = 24 hours beginning 1500 one day later; col. 5 = 24 hours beginning 0800 of date shown; col. 6 = 24 hours beginning 1600 of date shown; col. 7 = col. 2 + col. 3 + col. 4 in response to direction (col. 1); col. 8 = col. 2 + col. 3 + col. 4 − col. 7; col. 9 = col. 5 + col. 6; col. 10 = col. 11 − col. 7 − col. 8 − col. 9; col. 11 = 24 hours of calendar day shown; col. 12 = IERQ bank releases. Col., column; IERQ, Interim Excess Release Quantity; —, not applicable]

Controlled releases from New York City reservoirs					Controlled releases from power reservoirs			Segregation of flow, Delaware River at Montague, New Jersey					
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled releases			Computed uncontrolled	Total	IERQ bank releases
									New York City reservoirs		Power-plants			
Date	Amount								Directed	Other				
	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6		Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
8/6/2012	0	141	326	101	8/8/2012	203	71	8/9/2012	0	568	274	1,178	2,020	0
8/7/2012	0	141	325	101	8/9/2012	171	0	8/10/2012	0	567	171	1,362	2,100	0
8/8/2012	0	141	325	101	8/10/2012	274	0	8/11/2012	0	567	274	1,389	2,230	0
8/9/2012	29	141	325	101	8/11/2012	135	0	8/12/2012	29	538	135	1,328	2,030	0
8/10/2012	0	141	325	101	8/12/2012	149	0	8/13/2012	0	567	149	1,194	1,910	0
8/11/2012	0	141	325	101	8/13/2012	137	0	8/14/2012	0	567	137	1,086	1,790	0
8/12/2012	0	141	325	101	8/14/2012	111	0	8/15/2012	0	567	111	1,292	1,970	0
8/13/2012	0	141	322	101	8/15/2012	96	0	8/16/2012	0	564	96	1,600	2,260	0
8/14/2012	0	139	323	101	8/16/2012	114	0	8/17/2012	0	563	114	1,663	2,340	0
8/15/2012	0	139	323	101	8/17/2012	143	99	8/18/2012	0	563	242	1,555	2,360	0
8/16/2012	0	139	323	101	8/18/2012	32	0	8/19/2012	0	563	32	1,285	1,880	0
8/17/2012	0	141	323	101	8/19/2012	81	106	8/20/2012	0	565	187	1,168	1,920	0
8/18/2012	0	141	325	101	8/20/2012	0	71	8/21/2012	0	567	71	1,182	1,820	0
8/19/2012	165	141	330	101	8/21/2012	101	0	8/22/2012	165	407	101	1,137	1,810	0
8/20/2012	185	141	382	101	8/22/2012	135	0	8/23/2012	185	439	135	1,061	1,820	0
8/21/2012	191	141	407	101	8/23/2012	124	0	8/24/2012	191	458	124	977	1,750	0
8/22/2012	0	141	405	101	8/24/2012	216	0	8/25/2012	0	647	216	917	1,780	0
8/23/2012	0	141	404	101	8/25/2012	168	0	8/26/2012	0	646	168	856	1,670	0
8/24/2012	0	141	401	101	8/26/2012	218	0	8/27/2012	0	643	218	829	1,690	0
8/25/2012	0	141	402	101	8/27/2012	268	0	8/28/2012	0	644	268	838	1,750	0
8/26/2012	0	141	402	101	8/28/2012	253	106	8/29/2012	0	644	359	857	1,860	0
8/27/2012	0	141	450	97	8/29/2012	318	71	8/30/2012	0	692	389	1,129	2,210	50
8/28/2012	448	141	398	90	8/30/2012	479	106	8/31/2012	448	192	585	925	2,150	0
8/29/2012	640	141	398	90	8/31/2012	569	177	9/1/2012	640	0	746	734	2,120	0
8/30/2012	632	141	511	90	9/1/2012	529	71	9/2/2012	632	121	600	707	2,060	100

Table 12. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, New Jersey.—Continued

[River Master daily operations record. All provided measurements are the mean discharge in cubic feet per second for 24 hours. Column (col.) 1 = actual release by New York City in response to directed release ordered by the Office of Delaware River Master; col. 2 = 24 hours beginning 1200 of date shown; col. 3 = 24 hours ending 2400 one day later; col. 4 = 24 hours beginning 1500 one day later; col. 5 = 24 hours beginning 0800 of date shown; col. 6 = 24 hours beginning 1600 of date shown; col. 7 = col. 2 + col. 3 + col. 4 in response to direction (col. 1); col. 8 = col. 2 + col. 3 + col. 4 − col. 7; col. 9 = col. 5 + col. 6; col. 10 = col. 11 − col. 7 − col. 8 − col. 9; col. 11 = 24 hours of calendar day shown; col. 12 = IERQ bank releases. Col., column; IERQ, Interim Excess Release Quantity; —, not applicable]

Controlled releases from New York City reservoirs					Controlled releases from power reservoirs			Segregation of flow, Delaware River at Montague, New Jersey					
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled releases				IERQ bank releases
									New York City reservoirs		Power-plants	Computed uncontrolled	Total	
Date	Amount								Directed	Other				
	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6		Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
8/31/2012	726	141	589	97	9/2/2012	286	0	9/3/2012	726	101	286	737	1,850	100
9/1/2012	505	141	326	90	9/3/2012	193	0	9/4/2012	505	52	193	800	1,550	0
9/2/2012	376	141	326	90	9/4/2012	461	0	9/5/2012	376	181	461	1,402	2,420	0
9/3/2012	0	141	325	90	9/5/2012	482	0	9/6/2012	0	556	482	1,322	2,360	0
9/4/2012	0	141	325	90	9/6/2012	427	106	9/7/2012	0	556	533	1,331	2,420	0
9/5/2012	746	141	515	90	9/7/2012	485	89	9/8/2012	746	0	574	1,110	2,430	0
9/6/2012	680	141	449	90	9/8/2012	337	0	9/9/2012	680	0	337	1,153	2,170	0
9/7/2012	251	141	325	90	9/9/2012	80	0	9/10/2012	251	305	80	1,304	1,940	0
9/8/2012	584	141	353	90	9/10/2012	0	0	9/11/2012	584	0	0	1,156	1,740	0
9/9/2012	820	141	589	90	9/11/2012	25	0	9/12/2012	820	0	25	905	1,750	0
9/10/2012	820	141	589	90	9/12/2012	230	106	9/13/2012	820	0	336	864	2,020	0
9/11/2012	715	141	484	90	9/13/2012	211	71	9/14/2012	715	0	282	833	1,830	0
9/12/2012	697	141	466	90	9/14/2012	209	106	9/15/2012	697	0	315	778	1,790	0
9/13/2012	797	141	566	90	9/15/2012	0	0	9/16/2012	797	0	0	733	1,530	0
9/14/2012	850	141	619	90	9/16/2012	0	0	9/17/2012	850	0	0	730	1,580	50
9/15/2012	873	133	650	90	9/17/2012	18	0	9/18/2012	873	0	18	1,069	1,960	0
9/16/2012	0	99	300	90	9/18/2012	59	142	9/19/2012	0	489	201	14,410	15,100	0
9/17/2012	0	101	303	90	9/19/2012	660	301	9/20/2012	0	494	961	10,745	12,200	0
9/18/2012	0	73	300	90	9/20/2012	1,400	160	9/21/2012	0	463	1,560	5,427	7,450	0
9/19/2012	0	101	299	90	9/21/2012	1,400	89	9/22/2012	0	490	1,489	3,761	5,740	0
9/20/2012	0	101	300	90	9/22/2012	1,403	0	9/23/2012	0	491	1,403	3,306	5,200	0
9/21/2012	0	101	302	90	9/23/2012	663	106	9/24/2012	0	493	769	2,918	4,180	0
9/22/2012	0	99	295	90	9/24/2012	4	230	9/25/2012	0	484	234	2,562	3,280	0
9/23/2012	0	99	294	90	9/25/2012	0	230	9/26/2012	0	483	230	2,177	2,890	0
9/24/2012	0	99	303	90	9/26/2012	0	195	9/27/2012	0	492	195	1,913	2,600	0

Table 12. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, New Jersey.—Continued

[River Master daily operations record. All provided measurements are the mean discharge in cubic feet per second for 24 hours. Column (col.) 1 = actual release by New York City in response to directed release ordered by the Office of Delaware River Master; col. 2 = 24 hours beginning 1200 of date shown; col. 3 = 24 hours ending 2400 one day later; col. 4 = 24 hours beginning 1500 one day later; col. 5 = 24 hours beginning 0800 of date shown; col. 6 = 24 hours beginning 1600 of date shown; col. 7 = col. 2 + col. 3 + col. 4 in response to direction (col. 1); col. 8 = col. 2 + col. 3 + col. 4 − col. 7; col. 9 = col. 5 + col. 6; col. 10 = col. 11 − col. 7 − col. 8 − col. 9; col. 11 = 24 hours of calendar day shown; col. 12 = IERQ bank releases. Col., column; IERQ, Interim Excess Release Quantity; —, not applicable]

Controlled releases from New York City reservoirs					Controlled releases from power reservoirs			Segregation of flow, Delaware River at Montague, New Jersey						
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled releases			Computed uncontrolled	Total	IERQ bank releases
									New York City reservoirs		Power-plants			
Date	Amount								Directed	Other				
	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6		Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
9/25/2012	0	99	305	90	9/27/2012	0	195	9/28/2012	0	494	195	1,981	2,670	0
9/26/2012	0	99	303	90	9/28/2012	0	89	9/29/2012	0	492	89	4,189	4,770	0
9/27/2012	0	101	305	90	9/29/2012	0	89	9/30/2012	0	496	89	4,545	5,130	0
9/28/2012	0	101	303	90	9/30/2012	0	0	10/1/2012	0	494	0	3,416	3,910	0
9/29/2012	0	101	297	80	10/1/2012	0	0	10/2/2012	0	478	0	3,062	3,540	0
9/30/2012	0	101	201	56	10/2/2012	0	0	10/3/2012	0	358	0	3,572	3,930	0
10/1/2012	0	101	150	56	10/3/2012	0	89	10/4/2012	0	307	89	3,454	3,850	0
10/2/2012	0	101	150	56	10/4/2012	0	106	10/5/2012	0	307	106	3,537	3,950	0
10/3/2012	0	101	150	56	10/5/2012	0	177	10/6/2012	0	307	177	3,636	4,120	0
10/4/2012	0	101	150	56	10/6/2012	0	124	10/7/2012	0	307	124	3,179	3,610	0
10/5/2012	0	101	152	56	10/7/2012	0	230	10/8/2012	0	309	230	2,891	3,430	0
10/6/2012	0	101	153	56	10/8/2012	0	177	10/9/2012	0	310	177	2,653	3,140	0
10/7/2012	0	101	152	56	10/9/2012	11	177	10/10/2012	0	309	188	2,463	2,960	0
10/8/2012	0	101	153	56	10/10/2012	13	106	10/11/2012	0	310	119	2,371	2,800	0
10/9/2012	0	101	153	56	10/11/2012	0	89	10/12/2012	0	310	89	2,271	2,670	0
10/10/2012	0	101	153	56	10/12/2012	0	177	10/13/2012	0	310	177	2,063	2,550	0
10/11/2012	0	101	153	56	10/13/2012	0	89	10/14/2012	0	310	89	1,931	2,330	0
10/12/2012	0	101	153	56	10/14/2012	0	0	10/15/2012	0	310	0	1,900	2,210	0
10/13/2012	0	101	153	56	10/15/2012	0	0	10/16/2012	0	310	0	1,980	2,290	0
10/14/2012	0	101	153	56	10/16/2012	13	89	10/17/2012	0	310	102	1,888	2,300	0
10/15/2012	0	101	153	56	10/17/2012	26	213	10/18/2012	0	310	239	1,821	2,370	0
10/16/2012	0	101	153	56	10/18/2012	0	266	10/19/2012	0	310	266	3,484	4,060	0
10/17/2012	0	101	153	56	10/19/2012	0	266	10/20/2012	0	310	266	18,924	19,500	0
10/18/2012	0	101	152	56	10/20/2012	0	230	10/21/2012	0	309	230	11,961	12,500	0
10/19/2012	0	101	153	56	10/21/2012	98	89	10/22/2012	0	310	187	8,033	8,530	0
10/20/2012	0	101	152	56	10/22/2012	538	195	10/23/2012	0	309	733	5,988	7,030	0

Table 12. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, New Jersey.—Continued

[River Master daily operations record. All provided measurements are the mean discharge in cubic feet per second for 24 hours. Column (col.) 1 = actual release by New York City in response to directed release ordered by the Office of Delaware River Master; col. 2 = 24 hours beginning 1200 of date shown; col. 3 = 24 hours ending 2400 one day later; col. 4 = 24 hours beginning 1500 one day later; col. 5 = 24 hours beginning 0800 of date shown; col. 6 = 24 hours beginning 1600 of date shown; col. 7 = col. 2 + col. 3 + col. 4 in response to direction (col. 1); col. 8 = col. 2 + col. 3 + col. 4 − col. 7; col. 9 = col. 5 + col. 6; col. 10 = col. 11 − col. 7 − col. 8 − col. 9; col. 11 = 24 hours of calendar day shown; col. 12 = IERQ bank releases. Col., column; IERQ, Interim Excess Release Quantity; —, not applicable]

Controlled releases from New York City reservoirs					Controlled releases from power reservoirs			Segregation of flow, Delaware River at Montague, New Jersey						
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled releases			Computed uncontrolled	Total	IERQ bank releases
									New York City reservoirs		Power-plants			
Date	Amount								Directed	Other				
	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6		Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
10/21/2012	0	101	153	56	10/23/2012	580	89	10/24/2012	0	310	669	5,921	6,900	0
10/22/2012	0	101	152	56	10/24/2012	548	124	10/25/2012	0	309	672	6,979	7,960	0
10/23/2012	0	101	152	56	10/25/2012	1,000	266	10/26/2012	0	309	1,266	6,615	8,190	0
10/24/2012	0	101	150	118	10/26/2012	1,529	426	10/27/2012	0	307	1,923	6,120	8,350	0
10/25/2012	0	101	150	190	10/27/2012	1,022	71	10/28/2012	0	369	1,955	5,916	8,240	0
10/26/2012	0	101	150	183	10/28/2012	1,529	426	10/29/2012	0	441	1,955	5,104	7,500	0
10/27/2012	0	101	150	99	10/29/2012	1,022	71	10/30/2012	0	434	1,093	6,023	7,550	0
10/28/2012	0	101	150	190	10/30/2012	746	0	10/31/2012	0	350	746	11,304	12,400	0
10/29/2012	0	101	150	190	10/31/2012	679	0	11/1/2012	0	441	679	10,780	11,900	0
10/30/2012	0	101	150	190	11/1/2012	748	0	11/2/2012	0	441	748	8,491	9,680	0
10/31/2012	0	101	152	189	11/2/2012	498	0	11/3/2012	0	442	498	6,980	7,920	0
11/1/2012	0	101	149	190	11/3/2012	0	0	11/4/2012	0	440	0	6,190	6,630	0
11/2/2012	0	101	149	198	11/4/2012	0	195	11/5/2012	0	448	195	5,447	6,090	0
11/3/2012	0	104	155	190	11/5/2012	456	177	11/6/2012	0	449	633	4,758	5,840	0
11/4/2012	0	107	195	190	11/6/2012	537	177	11/7/2012	0	492	714	4,254	5,460	0
11/5/2012	0	150	226	190	11/7/2012	539	177	11/8/2012	0	566	716	3,808	5,090	0
11/6/2012	0	150	226	190	11/8/2012	527	160	11/9/2012	0	566	687	3,537	4,790	0
11/7/2012	0	150	226	190	11/9/2012	441	177	11/10/2012	0	566	618	3,176	4,360	0
11/8/2012	0	150	226	190	11/10/2012	0	177	11/11/2012	0	566	177	2,997	3,740	0
11/9/2012	0	150	226	190	11/11/2012	92	177	11/12/2012	0	566	269	2,815	3,650	0
11/10/2012	0	150	226	190	11/12/2012	104	106	11/13/2012	0	566	210	3,264	4,040	0
11/11/2012	0	150	226	190	11/13/2012	290	106	11/14/2012	0	566	396	4,898	5,860	0
11/12/2012	0	150	224	190	11/14/2012	245	106	11/15/2012	0	564	351	4,625	5,540	0
11/13/2012	0	149	226	190	11/15/2012	187	89	11/16/2012	0	565	276	3,929	4,770	0
11/14/2012	0	150	226	190	11/16/2012	331	71	11/17/2012	0	566	402	3,442	4,410	0
11/15/2012	0	150	226	190	11/17/2012	0	71	11/18/2012	0	566	71	3,253	3,890	0

Table 12. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, New Jersey.—Continued

[River Master daily operations record. All provided measurements are the mean discharge in cubic feet per second for 24 hours. Column (col.) 1 = actual release by New York City in response to directed release ordered by the Office of Delaware River Master; col. 2 = 24 hours beginning 1200 of date shown; col. 3 = 24 hours ending 2400 one day later; col. 4 = 24 hours beginning 1500 one day later; col. 5 = 24 hours beginning 0800 of date shown; col. 6 = 24 hours beginning 1600 of date shown; col. 7 = col. 2 + col. 3 + col. 4 in response to direction (col. 1); col. 8 = col. 2 + col. 3 + col. 4 − col. 7; col. 9 = col. 5 + col. 6; col. 10 = col. 11 − col. 7 − col. 8 − col. 9; col. 11 = 24 hours of calendar day shown; col. 12 = IERQ bank releases. Col., column; IERQ, Interim Excess Release Quantity; —, not applicable]

Controlled releases from New York City reservoirs					Controlled releases from power reservoirs			Segregation of flow, Delaware River at Montague, New Jersey						
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled releases			Computed uncontrolled	Total	IERQ bank releases
									New York City reservoirs		Power-plants			
Date	Amount								Directed	Other				
	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6		Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
11/16/2012	0	150	226	190	11/18/2012	63	35	11/19/2012	0	566	98	3,086	3,750	0
11/17/2012	0	150	226	190	11/19/2012	485	195	11/20/2012	0	566	680	2,914	4,160	0
11/18/2012	0	150	223	190	11/20/2012	426	124	11/21/2012	0	563	550	2,767	3,880	0
11/19/2012	0	150	223	190	11/21/2012	347	124	11/22/2012	0	563	471	2,586	3,620	0
11/20/2012	0	150	229	190	11/22/2012	0	0	11/23/2012	0	569	0	2,581	3,150	0
11/21/2012	0	150	229	190	11/23/2012	0	89	11/24/2012	0	569	89	2,442	3,100	0
11/22/2012	0	150	224	190	11/24/2012	0	0	11/25/2012	0	564	0	2,426	2,990	0
11/23/2012	0	150	223	190	11/25/2012	79	18	11/26/2012	0	563	97	2,310	2,970	0
11/24/2012	0	150	224	190	11/26/2012	456	124	11/27/2012	0	564	580	2,176	3,320	0
11/25/2012	0	149	224	190	11/27/2012	510	106	11/28/2012	0	563	616	2,121	3,300	0
11/26/2012	0	150	224	190	11/28/2012	349	89	11/29/2012	0	564	438	2,098	3,100	0
11/27/2012	0	150	224	190	11/29/2012	293	195	11/30/2012	0	564	488	1,938	2,990	0
Monthly totals														
Dec. 2011	0	21,733	30,827	5,892	—	20,704	17,516	—	0	58,452	38,220	272,388	369,060	0
Jan. 2012	0	20,446	18,462	5,883	—	16,355	10,532	—	0	44,837	26,887	162,326	234,050	0
Feb. 2012	0	15,471	16,631	5,509	—	8,427	3,885	—	0	37,611	12,312	89,947	139,870	0
Mar. 2012	0	3,909	6,206	3,472	—	5,618	5,265	—	0	13,587	10,883	119,840	144,310	0
Apr. 2012	1,004	2,136	4,832	1,481	—	39	1,878	—	1,004	7,445	1,917	90,324	100,690	0
May 2012	0	3,074	8,401	2,296	—	10,641	8,549	—	0	13,771	19,190	215,769	248,730	0
June 2012	0	4,281	15,623	3,377	—	10,549	3,582	—	0	23,281	14,131	73,338	110,750	293
July 2012	21,637	4,824	16,449	3,311	—	6,738	957	—	21,637	2,947	7,695	38,215	70,490	0
Aug. 2012	1,018	4,361	10,816	3,116	—	5,576	1,198	—	1,018	17,290	6,774	39,248	64,330	50
Sept. 2012	10,712	3,702	12,014	2,729	—	10,131	2,552	—	10,712	7,733	12,683	75,602	106,730	300
Oct. 2012	0	3,131	5,052	2,294	—	9,150	4,717	—	0	10,343	13,867	150,460	174,670	300
Nov. 2012	0	4,164	6,283	5,707	—	8,682	3,065	—	0	16,154	11,747	116,089	143,990	300

Table 13. Daily mean discharge of the Delaware River at Montague, New Jersey (station number 01438500), for report year ending November 30, 2012.

[Data from U.S. Geological Survey, 2019d. All values except the year's total discharge volume are in cubic feet per second (ft^3/s). The total volume discharged is given in cubic feet per second for a day ([ft^3/s]-d). —, not applicable]

Day	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
1	17,200	9,670	[1]9,000	3,710	3,010	3,460	4,230	2,250	2,930	2,030	3,910	11,900
2	12,900	19,270	8,890	3,940	3,480	3,500	4,960	2,320	2,500	1,960	3,540	9,680
3	10,500	18,970	8,790	4,240	3,670	3,940	6,090	2,240	2,390	1,750	3,930	7,920
4	9,140	17,730	7,970	5,940	3,210	4,970	4,660	2,000	2,260	1,460	3,850	6,630
5	8,740	17,160	7,420	5,880	2,880	7,320	5,160	2,070	2,070	2,340	3,950	6,090
6	8,440	7,220	6,990	5,160	2,650	5,790	4,980	2,060	2,150	2,280	4,120	5,840
7	9,720	6,480	6,680	4,650	2,510	4,880	4,440	2,180	2,180	2,330	3,610	5,460
8	27,900	5,850	5,860	4,840	2,370	4,570	4,290	2,110	2,110	2,350	3,430	5,090
9	23,800	5,830	5,520	6,400	2,290	10,800	3,750	2,200	1,920	2,080	3,140	4,790
10	18,300	5,710	5,040	8,850	2,200	12,300	3,270	2,140	2,000	1,840	2,960	4,360
11	15,900	5,310	4,730	7,550	2,300	9,520	3,330	2,040	2,140	1,640	2,800	3,740
12	13,800	5,840	4,710	6,110	2,270	6,910	3,790	1,830	1,930	1,650	2,670	3,650
13	12,400	8,030	4,400	5,860	2,240	5,510	5,060	2,130	1,810	1,920	2,550	4,040
14	11,000	8,200	4,310	5,830	2,120	5,150	5,800	1,930	1,690	1,730	2,330	5,860
15	10,300	[1]6,700	4,280	5,840	2,050	9,860	4,860	1,780	1,870	1,690	2,210	5,540
16	10,200	[1]5,410	4,200	5,430	2,040	37,600	3,730	1,940	2,170	1,440	2,290	4,770
17	9,640	5,760	3,980	5,120	1,990	20,300	3,310	2,270	2,260	1,490	2,300	4,410
18	8,460	6,650	3,960	4,630	1,850	13,600	3,380	2,120	2,270	1,880	2,370	3,890
19	7,950	5,920	3,780	4,420	1,760	9,060	3,100	1,750	1,780	15,100	4,060	3,750
20	7,290	5,590	3,720	4,460	1,710	7,080	3,190	1,850	1,820	12,200	19,500	4,160
21	7,210	4,920	3,790	4,660	1,660	6,510	3,480	2,370	1,720	7,450	12,500	3,880
22	8,680	[1]4,310	3,660	4,460	1,980	6,620	3,090	1,870	1,710	5,740	8,530	3,620
23	10,400	4,830	3,520	4,150	5,930	6,550	2,910	1,820	1,720	5,200	7,030	3,150
24	11,700	6,160	3,690	3,800	10,200	6,990	2,440	1,840	1,660	4,180	6,900	3,100
25	9,680	7,570	3,910	3,320	7,870	6,480	2,470	2,080	1,680	3,280	7,960	2,990
26	8,970	7,140	3,660	3,210	6,300	5,940	2,280	1,880	1,580	2,890	8,190	2,970
27	8,840	8,690	3,400	3,450	5,410	5,160	2,160	2,270	1,600	2,600	8,350	3,320
28	13,500	16,800	3,540	3,080	4,850	4,510	2,080	2,810	1,650	2,670	8,240	3,300
29	14,200	14,100	3,660	2,960	4,120	4,190	2,260	2,950	1,760	4,770	7,500	3,100
30	12,000	11,100	—	2,850	3,770	4,730	2,200	4,600	2,120	5,130	7,550	2,990
31	10,300	9,180	—	2,820	—	4,930	—	3,860	2,050	—	12,400	—
Total[2]	369,060	232,100	147,060	147,620	100,690	248,730	110,750	69,560	61,500	105,070	174,670	143,990
Mean[3]	11,905	7,487	5,071	4,762	3,356	8,024	3,692	2,244	1,984	3,502	5,635	4,800

[1]Estimated.

[2]The year's total is 1,910,800 cubic feet per second for a day.

[3]The combined mean is 5,201 cubic feet per second.

Table 14. Daily mean discharge of the East Branch Delaware River at Downsville, New York (station number 01417000), for report year ending November 30, 2012.

[Data from U.S. Geological Survey, 2019a. All values except the year's total discharge volume are in cubic feet per second (ft^3/s). The total volume discharge is given in cubic feet per second for a day ([ft^3/s]-d). —, not applicable]

Day	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
1	691	680	691	146	98	70	163	129	131	130	96	103
2	691	680	692	146	85	76	156	129	131	129	96	103
3	689	680	692	144	71	76	149	129	132	129	98	103
4	683	680	692	143	71	76	143	129	132	129	98	103
5	680	680	692	143	70	76	139	129	132	129	98	132
6	680	680	692	143	69	76	138	129	132	129	101	150
7	680	680	692	143	69	76	136	129	132	129	101	149
8	680	684	692	143	69	77	134	129	133	129	101	148
9	977	688	692	143	69	77	132	129	133	129	103	148
10	1,570	688	692	143	69	77	132	199	134	129	103	148
11	1,620	691	692	143	70	77	131	222	133	129	103	148
12	1,440	692	691	143	71	78	130	199	133	129	103	148
13	1,140	691	691	143	71	78	129	221	133	129	103	149
14	958	692	574	114	71	78	129	203	132	129	103	148
15	806	692	482	97	71	70	129	157	132	129	103	148
16	747	691	484	98	70	72	129	129	132	103	103	148
17	678	423	485	98	63	101	129	129	132	92	103	149
18	673	690	485	98	58	102	129	129	132	88	103	149
19	673	626	487	98	59	108	129	129	132	75	105	149
20	677	588	488	98	60	146	129	130	131	92	103	149
21	678	588	293	98	62	226	129	129	131	92	103	149
22	679	588	143	98	62	540	129	129	131	92	103	149
23	680	588	144	98	58	748	129	129	131	92	104	149
24	680	588	144	98	57	760	129	130	130	92	103	147
25	680	588	143	99	57	639	129	129	130	92	103	147
26	679	588	145	98	58	438	129	130	129	92	103	148
27	680	588	146	98	90	290	129	130	130	93	103	148
28	680	588	146	98	54	178	129	130	131	95	103	148
29	680	588	147	98	56	150	129	131	130	95	103	148
30	680	635	—	98	58	187	129	130	130	95	103	149
31	680	691	—	98	—	160	—	131	130	—	103	—
Total[1]	24,909	19,914	13,929	3,644	2,017	5,979	4,005	4,436	4,077	3,319	3,159	4,254
Mean[2]	803.5	642.4	480.3	117.5	67.2	192.9	133.5	143.1	131.5	110.6	101.9	141.8

[1]The year's total is 93,642 cubic feet per second for a day.

[2]The combined mean is 255.9 cubic feet per second.

Table 15. Daily mean discharge of the West Branch Delaware River at Stilesville, New York (station number 01425000), for report year ending November 30, 2012.

[Data from U.S. Geological Survey, 2019b. All values except the year's total discharge volume are in cubic feet per second (ft^3/s). The total volume discharge is given in cubic feet per second for a day ([ft^3/s]-d). —, not applicable]

Day	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
1	676	1,500	1,480	225	172	114	577	725	350	613	220	153
2	676	1,500	1,480	224	169	144	604	612	350	352	147	152
3	676	1,500	1,480	225	170	145	604	615	350	350	146	150
4	676	1,430	1,480	226	169	144	543	616	349	350	149	150
5	676	919	1,480	227	169	142	519	613	350	351	149	198
6	676	700	1,230	227	170	142	519	737	350	522	150	248
7	682	700	690	227	170	142	519	770	349	478	151	250
8	921	679	520	229	170	146	517	790	345	355	151	249
9	1,480	382	227	237	170	145	519	789	347	377	150	250
10	1,480	241	227	235	170	144	519	728	350	607	150	250
11	1,490	240	225	232	171	143	515	518	346	607	150	250
12	1,500	242	221	232	170	143	516	515	345	511	150	250
13	1,500	241	221	233	171	142	515	519	345	490	150	251
14	1,500	241	221	199	171	145	513	534	346	580	150	250
15	1,500	239	221	169	171	158	511	548	349	647	150	250
16	1,500	240	221	170	171	198	512	529	345	688	150	250
17	1,500	241	221	170	150	407	514	527	345	334	150	250
18	1,440	240	221	170	129	407	514	524	345	336	149	250
19	1,060	241	221	171	128	446	515	519	346	331	156	250
20	727	241	221	170	342	598	620	461	353	330	150	247
21	688	241	221	170	268	683	722	501	403	331	150	250
22	688	241	221	171	140	585	510	425	427	333	149	250
23	692	241	221	169	116	550	510	429	423	327	151	251
24	688	241	223	167	90	570	510	483	420	325	150	245
25	688	241	220	171	90	571	511	414	420	333	148	247
26	688	461	221	169	90	541	510	356	420	337	146	248
27	761	697	221	171	69	529	509	350	421	333	147	250
28	1,130	698	221	171	81	529	510	350	473	344	146	250
29	1,470	694	222	171	87	529	618	354	421	337	147	250
30	1,500	911	—	171	88	529	732	350	421	331	148	250
31	1,500	1,480	—	172	—	527	—	350	518	—	153	—
Total[1]	32,829	18,103	14,499	6,071	4,592	10,338	16,327	16,551	11,722	12,540	4,703	7,039
Mean[2]	1,059.0	584.0	500.0	195.8	153.1	333.5	544.2	533.9	378.1	418.0	151.7	234.6

[1]The year's total is 155,314 cubic feet per second for a day.

[2]The combined mean is 424.4 cubic feet per second.

Table 16. Daily mean discharge of the Neversink River at Neversink, New York (station number 01436000), for report year ending November 30, 2012.

[Data from U.S. Geological Survey, 2019c. All values except the year's total discharge volume are in cubic feet per second (ft^3/s). The total volume discharge is given in cubic feet per second for a day ([ft^3/s]-d). —, not applicable]

Day	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
1	186	318	343	183	77	51	140	110	102	94	67	762
2	187	345	354	183	62	56	152	110	102	91	57	536
3	187	306	306	182	48	56	147	111	102	91	57	426
4	187	221	272	183	48	57	118	111	103	91	57	343
5	187	232	254	181	48	57	108	111	104	91	57	301
6	187	225	240	183	48	57	108	111	102	91	57	264
7	189	226	231	183	48	57	108	112	102	91	57	250
8	203	236	202	183	48	58	108	113	102	92	57	261
9	505	188	207	121	48	57	108	113	102	91	57	216
10	553	205	180	73	49	57	108	114	102	91	57	187
11	433	187	180	75	49	57	108	114	102	91	57	184
12	368	197	190	79	49	57	109	113	102	91	56	186
13	327	298	184	80	50	57	109	114	102	91	57	226
14	288	266	179	82	50	58	110	114	102	91	57	251
15	281	225	179	86	50	58	110	114	102	91	57	223
16	353	186	179	86	50	67	110	114	102	91	56	204
17	292	187	179	86	46	110	110	113	102	91	57	189
18	251	251	181	87	45	91	111	114	102	94	57	185
19	230	187	183	87	46	91	111	114	102	91	58	185
20	226	191	180	87	46	91	110	108	102	92	58	185
21	235	187	180	86	46	91	110	105	102	91	57	187
22	356	187	180	87	46	91	111	105	103	91	57	186
23	429	187	180	87	43	91	110	105	103	91	58	187
24	374	189	181	86	41	281	111	105	102	91	58	208
25	298	230	180	87	40	305	110	105	102	91	111	192
26	289	210	182	75	41	402	109	105	103	91	187	188
27	273	997	182	75	39	340	109	102	104	91	187	187
28	691	1,260	181	77	40	291	111	103	103	91	149	187
29	477	621	183	74	39	312	110	105	102	91	194	187
30	372	448	—	76	40	505	111	104	102	91	827	186
31	339	354	—	77	—	283	—	103	102	—	1,290	—
Total[1]	9,753	9,547	6,032	3,379	1,421	4,293	3,405	3,395	3,171	2,744	4,326	7,459
Mean[2]	314.6	308.0	208.0	109.0	47.4	138.5	113.5	109.5	102.3	91.5	139.5	248.6

[1]The year's total is 58,925 cubic feet per second for a day.

[2]The combined mean is 160.9 cubic feet per second.

Quality of Water in the Delaware River Estuary

This section describes water-quality monitoring programs for the Delaware River estuary during the 2012 report year. Selected data are presented, and water-quality conditions are summarized.

Water-Quality Monitoring Programs

U.S. Geological Survey Continuous Water-Quality Monitoring Program

As part of a long-term program, in cooperation with the DRBC, the USGS operates continuous water-quality monitors at four locations in the Delaware River estuary between Trenton, New Jersey, and Reedy Island Jetty, Delaware (fig. 6).

Continuous water temperature, specific conductance, dissolved oxygen, and pH data were collected at four sites: Delaware River at Trenton, New Jersey (station number 01463500); Delaware River at Benjamin Franklin Bridge at Philadelphia, Pennsylvania (station number 01467200); Delaware River at Chester, Pennsylvania (station number 01477050); and Delaware River at Reedy Island Jetty, Delaware (station number 01482800). Continuous turbidity data also were collected at the Trenton, Benjamin Franklin Bridge (until December 12, 2011), and Reedy Island Jetty stations. The DRBC and others use these data to assess water-quality conditions and track the movement of the "salt front" in the Delaware River estuary. Continuous monitor data are processed and stored in the USGS National Water Information System database (NWIS; U.S. Geological Survey, 2019g) and are available at https://waterdata.usgs.gov/nwis. Selected monitor data from the 2012 report year are included in this section of the report.

Delaware River Estuary Boat Run Monitoring Program

Each year, the DBRC contracts with the Delaware Department of Natural Resources and Environmental Control to collect water samples at 22 sites on the Delaware River estuary (fig. 6, sites A through W; Delaware River Basin Commission, 2016). Samples are collected once a month from April to October. The goals of this program are to provide accurate, precise, and defensible estimates of the surface-water quality of the Delaware River estuary and to allow assessment of compliance with water-quality criteria. Sample analysis includes routine and bacterial parameters, nutrients, heavy metals, chlorophyll a, dissolved silica, and volatile organics. Water-quality data for these DBRC sampling sites are not presented in this report but are accessible from the DRBC Delaware Estuary Water Quality Monitoring Program (Boat Run) Data Explorer (https://www.nj.gov/drbc/programs/quality/boat-run_explorer-app.html).

Water Quality During the 2012 Report Year

Streamflow

Streamflow has a major effect on the quality of water in the Delaware River estuary. Large freshwater inflows commonly result in improved water quality by limiting upstream movement of seawater and reducing the concentration of dissolved substances. High inflows also aid in maintaining lower water temperatures during warm weather and in supporting higher concentrations of dissolved oxygen. Under certain conditions, however, high streamflows can transport large quantities of nutrients to the estuary, which could result in excessive levels of algae.

Streamflow from the Delaware River Basin upstream from Trenton, New Jersey, is the major source of freshwater inflow to the Delaware River estuary. During the report year, monthly mean streamflow measured at the USGS streamgage 01463500, Delaware River at Trenton, New Jersey, was highest during December 2011 (25,732 ft^3/s) and lowest during July 2012 (4,121 ft^3/s; table 17). Long-term monthly mean streamflow was computed for the period from October 1912 through November 2011 (U.S. Geological Survey, 2019g). Monthly mean streamflows were less than the long-term mean monthly streamflows from February through April, and from June through August 2012. The greatest percentage of flow deficiency was in April 2012, when the monthly mean streamflow was 29.7 percent of the long-term mean monthly flow. The highest daily mean streamflow during the report year was 60,000 ft^3/s on December 9, 2011, and the lowest daily mean streamflow was 2,910 ft^3/s on August 30, 2012 (table 17).

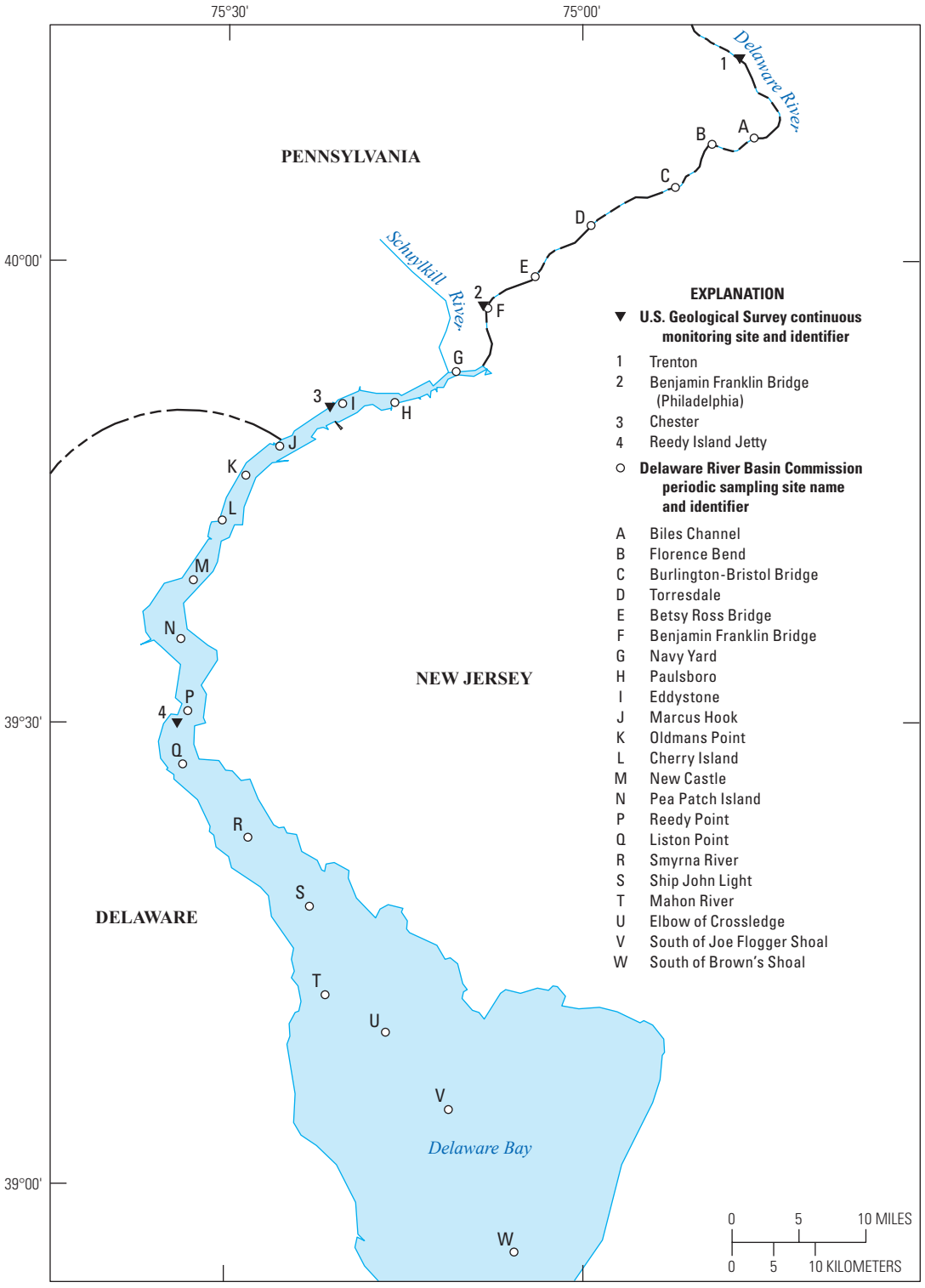

Figure 6. Map showing location of U.S. Geological Survey and Delaware River Basin Commission water-quality monitoring sites on the Delaware River estuary. Modified from Delaware River Basin Commission (2021).

Water Temperature

Water temperature has an important influence on water quality, as it affects various physical, chemical, and biological properties of water (U.S. Geological Survey, 2020c). Generally, increases in water temperature have detrimental effects on water quality by decreasing the saturation level of dissolved oxygen and by increasing the biological activity of aquatic organisms. Although the primary factors that affect water temperature in the Delaware River estuary are climatic, various kinds of water use, especially powerplant cooling, also can have substantial effects.

Water temperature data for the monitor site at the Benjamin Franklin Bridge, Philadelphia, Pennsylvania, were collected almost continuously from April to November 2012. The procedures used to create figure 7 of this report were started for the 2011 report (DiFrenna and others, 2020). The available long-term mean daily temperature data were retrieved from the USGS NWIS database for the months of April through November; and the mean value was computed for each month. Long-term mean water temperatures were computed using data for the period from 1964 to 2012 (fig. 7). From April through September 2012, the monthly mean temperatures were greater than the long-term mean monthly temperature (fig. 7). Monthly mean temperatures were less than the respective long-term means in October and November 2012 (fig. 7). The maximum daily mean water temperature of 28.3 degrees Celsius was recorded on July 18 and 19, 2012 (U.S. Geological Survey, 2020d).

Specific Conductance and Chloride

Specific conductance is a measure of the capacity of water to conduct an electrical current and is a function of the types and quantities of dissolved substances in water (U.S. Environmental Protection Agency, 2016). As concentrations of dissolved ions increase, specific conductance of the water also increases. Specific conductance measurements are good indicators of dissolved solids content and total ion concentrations, including chloride. Seawater and some artificial constituents can cause the specific conductance of estuary water to increase substantially. Dilution associated with high freshwater inflows results in decreased levels of dissolved solids and lower specific conductance, whereas low inflows have the opposite effect.

The upstream movement of seawater and the accompanying increase in chloride concentrations is an important concern for water supplies obtained from the Delaware River estuary (Kauffman and others, 2009). Water with chloride concentrations greater than 250 milligrams per liter (mg/L) is considered undesirable for domestic use, and water with concentrations exceeding 50 mg/L is unsatisfactory for chemically sensitive consumers and some industrial processes. Chloride concentrations in the estuary increase in a downstream direction with proximity to the Atlantic Ocean.

Specific conductance, not chloride concentration, was measured by the USGS at the site at Reedy Island Jetty, Delaware. Chloride concentrations at Chester, Pennsylvania (table 19), were measured by Kimberly Clark Chester Operations. Those data were provided by the Delaware River Basin Commission, and are not derived from specific conductance data.

At Reedy Island Jetty, the greatest daily maximum specific conductance was 20,900 microsiemens per centimeter at 25 degrees Celsius (µS/cm) on October 30, 2012 (table 18). Daily maximum specific conductance during the report year exceeded 3,780 µS/cm on approximately 93 percent of the 355 days with measured specific conductance values in report year 2012. The lowest daily minimum specific conductance was 214 µS/cm on December 11, 2011. Daily minimum specific conductance exceeded 3,780 µS/cm on 58 percent of the 355 days with measured specific conductance values in report year 2012.

At Chester, the greatest daily maximum chloride concentration was 201 mg/L on September 4, 2012 (table 19). During the report year, daily maximum concentrations exceeded 50 mg/L on about 35 percent of the days. The lowest daily minimum chloride concentration was 20 mg/L on December 13, 2011. Daily minimum concentrations exceeded 50 mg/L on about 23 percent of the days. Chloride concentrations were relatively high for 3 weeks in mid-April 2012 and from the second week of July through the third week of September 2012 (table 19), when daily minimum concentrations exceeded 50 mg/L on most days.

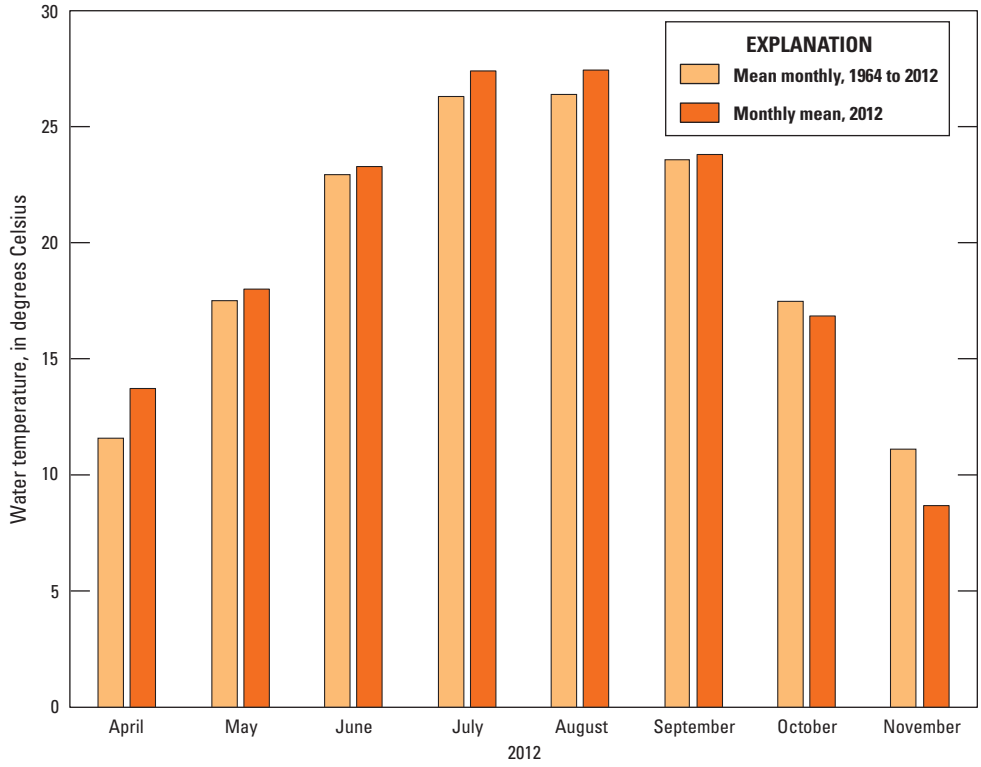

Figure 7. Bar chart showing monthly mean water temperatures in 2012 and long-term mean monthly water temperatures from 1964 to 2012, for the months of April through November, in the Delaware River estuary at Benjamin Franklin Bridge at Philadelphia, Pennsylvania.

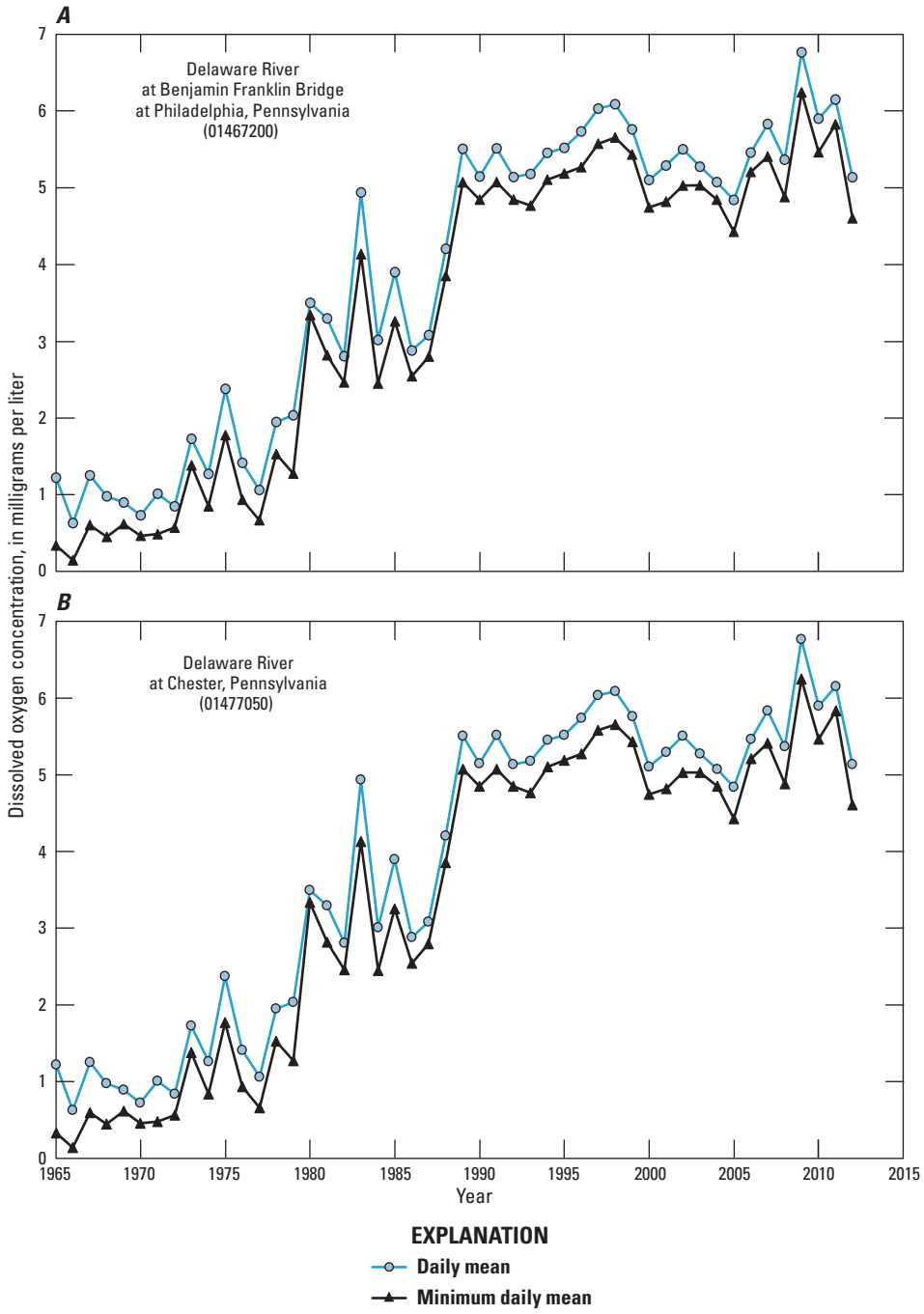

Figure 8. Graphs showing the daily mean and minimum daily mean dissolved-oxygen concentrations averaged from the months of July to September, annually, at two sites on the Delaware River estuary, 1965–2012, at *A*, Delaware River at Benjamin Franklin Bridge at Philadelphia, Pennsylvania (01457200); and *B*, Delaware River at Chester, Pennsylvania (01477050).

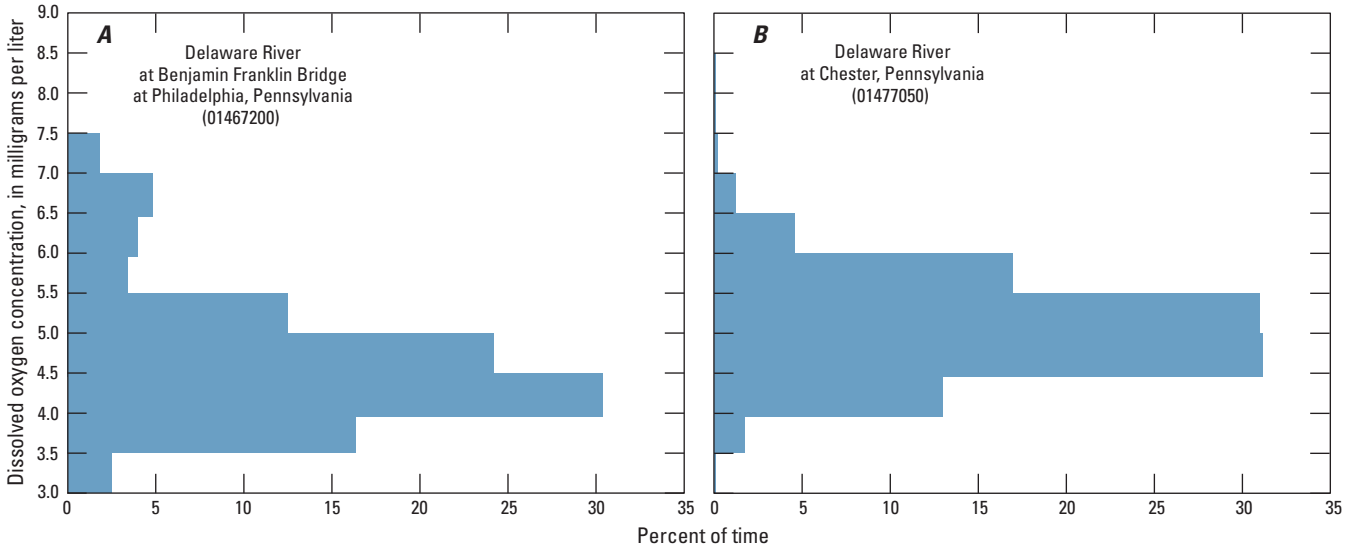

Figure 9. Graphs showing percent distribution of half-hourly dissolved-oxygen concentrations at two sites on the Delaware River estuary, from July to September 2012 for *A*, Delaware River at Benjamin Franklin Bridge at Philadelphia, Pennsylvania (01467200); and *B*, Delaware River at Chester, Pennsylvania (01477050).

Table 17. Daily mean discharge, Delaware River at Trenton, New Jersey (station number 01463500), for report year ending November 30, 2012.

[Data from U.S. Geological Survey, 2019f. All values except the year's total discharge volume are in cubic feet per second (ft^3/s). The total volume discharge is given in cubic feet per second for a day ([ft^3/s]-d). —, not applicable]

Day	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
1	35,600	20,200	18,700	8,790	6,030	7,260	11,400	4,160	7,520	3,190	8,520	28,600
2	32,700	18,800	17,900	8,810	6,120	7,260	18,000	4,030	6,120	3,260	7,300	26,500
3	26,400	17,900	16,900	9,310	6,560	7,420	20,900	3,950	5,200	3,520	11,400	21,300
4	22,000	16,800	16,200	9,990	6,740	8,430	18,600	4,070	4,430	3,610	10,800	17,600
5	19,800	15,000	14,800	10,700	6,260	9,100	15,700	3,910	4,300	4,660	10,300	14,900
6	18,800	14,000	13,900	10,900	5,610	11,500	14,500	3,710	4,450	10,200	9,600	13,200
7	22,200	13,700	13,200	10,300	5,150	10,200	13,000	3,670	4,740	7,410	9,050	12,500
8	50,000	13,000	12,700	9,540	4,830	8,970	11,300	3,700	4,340	5,890	8,260	11,700
9	60,000	11,900	11,800	9,200	4,590	9,260	10,100	3,960	4,110	5,470	7,690	10,800
10	45,400	11,500	11,100	9,990	4,380	15,400	9,400	3,830	4,250	5,390	7,110	10,100
11	36,100	11,500	10,600	13,000	4,260	17,200	8,160	3,640	4,820	4,500	6,600	9,390
12	31,200	15,500	9,980	11,900	4,200	14,500	7,670	3,550	5,150	3,970	6,350	8,400
13	27,100	18,400	9,750	10,500	4,330	12,000	10,500	3,430	4,580	3,530	5,760	8,260
14	24,000	18,200	9,090	9,810	4,210	9,970	11,800	3,180	4,090	3,430	5,490	10,700
15	21,900	16,700	8,900	9,580	4,190	10,400	11,500	3,520	4,020	3,510	5,220	11,900
16	20,400	14,200	8,910	9,640	4,010	28,400	10,100	3,550	4,150	3,180	5,470	11,700
17	19,800	12,500	8,990	9,430	3,940	46,900	8,320	3,660	4,220	2,990	5,540	10,500
18	18,600	13,200	8,920	9,030	3,900	30,100	7,260	3,720	4,830	2,960	5,330	9,430
19	16,900	13,400	8,600	8,260	3,740	21,700	6,960	4,010	4,570	17,500	5,990	8,610
20	15,700	12,400	8,250	7,870	3,580	15,900	6,580	4,160	4,390	29,700	15,400	8,160
21	15,100	11,600	7,870	7,860	3,460	13,300	6,210	4,420	3,800	22,800	28,900	8,280
22	15,300	10,700	7,880	7,680	3,800	12,300	6,390	4,110	3,610	15,900	20,700	8,090
23	20,800	10,100	7,770	7,800	11,600	12,800	6,290	4,280	3,370	12,000	16,300	7,650
24	21,300	13,000	7,630	7,310	15,100	14,000	5,990	3,690	3,190	10,500	14,500	6,910
25	20,600	15,100	8,060	6,850	16,600	14,200	5,630	4,240	3,090	9,110	13,300	6,680
26	18,000	16,000	8,360	6,460	13,200	13,100	5,230	4,040	2,960	7,100	13,800	6,400
27	17,000	18,400	7,890	5,900	11,100	16,500	4,910	4,200	3,430	6,350	13,500	6,340
28	26,600	24,400	7,520	6,000	9,710	16,500	4,520	4,340	3,400	6,180	13,400	6,700
29	28,800	29,900	7,530	5,730	8,780	13,000	4,290	6,290	2,960	6,260	14,400	6,840
30	26,600	25,100	—	5,550	7,920	12,700	4,130	6,320	2,910	6,940	[1]20,500	6,400
31	23,000	21,200	—	5,670	—	12,800	—	6,410	2,980	—	25,800	—
Total[2]	566,860	199,950	298,880	1,400,100	942,800	787,900	406,340	316,140	756,420	1,514,300	771,700	545,700
Mean[3]	18,286.0	6,450.0	10,674.0	45,165.0	31,427.0	25,416.0	13,545.0	10,198.0	24,401.0	50,477.0	24,894.0	18,190.0

[1]Estimated.

[2]2The year's total is 3,982,930 cubic feet per second for a day.

[3]The combined mean is 10,858 cubic feet per second.

Table 18. Daily maximum and minimum specific conductance, Delaware River at Reedy Island Jetty, Delaware (station number 01482800), for report year ending November 30, 2012.

[Data from U.S. Geological Survey, 2020j. Specific conductance measurements provided in microsiemens per centimeter at 25 degrees Celsius. *, missing data; —, not applicable; max, maximum; min, minimum]

Day	Dec.		Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	1,170	502	2,240	280	4,820	644	11,500	3,630	*	*	14,100	6,480	11,500	2,540	14,900	6,900	19,000	11,000	16,200	10,100	—	—	10,600	3,200
2	2,740	480	1,240	280	8,210	868	11,400	3,780	*	*	14,000	7,220	11,100	3,100	14,900	7,090	18,500	10,800	17,400	10,700	13,100	6,540	8,390	2,910
3	3,370	407	5,640	254	8,870	1,220	11,800	5,060	*	*	13,900	6,820	11,300	2,670	14,700	7,460	18,300	10,600	17,400	10,700	13,500	6,420	10,600	2,650
4	4,190	431	10,900	935	9,990	2,020	11,100	4,670	*	*	13,800	7,160	9,850	2,580	15,500	7,990	17,200	10,500	15,800	10,200	13,500	6,320	12,600	2,480
5	4,630	420	11,600	3,230	11,600	2,570	10,900	3,700	*	*	13,800	7,160	11,600	2,960	15,200	8,300	16,900	10,100	14,500	9,580	14,200	6,290	13,100	3,130
6	5,350	591	12,700	2,910	11,900	2,910	12,100	3,210	15,700	8,370	14,600	7,270	10,800	2,930	15,700	8,380	14,900	9,620	15,500	9,260	13,800	6,420	13,300	4,150
7	6,320	706	12,600	3,020	8,450	2,340	10,900	3,710	15,800	8,040	14,500	7,230	9,500	2,980	15,700	8,730	15,700	9,600	15,400	9,210	15,400	6,140	17,000	6,880
8	1,970	305	12,000	3,640	11,000	2,280	9,760	3,140	15,500	8,950	13,700	7,320	8,990	2,720	14,800	8,690	16,200	9,480	15,600	9,270	15,000	6,340	19,500	9,530
9	1,640	247	11,600	3,550	9,960	2,880	8,300	2,460	16,300	8,300	13,600	6,630	9,090	2,700	15,000	9,000	16,400	9,990	15,400	8,330	17,800	8,130	16,700	7,740
10	1,030	242	11,300	3700	9,390	2,930	8,830	2,280	14,700	7,610	13,000	6,010	8,880	2,670	15,000	9,130	15,600	10,600	16,900	8,540	18,700	9,850	19,000	8,620
11	2,360	214	10,100	3,550	9,440	3,070	10,500	2,660	13,900	7,920	12,700	5,940	9,800	2,810	14,600	9,450	16,100	8,980	18,000	8,950	18,300	8,320	17,800	8,690
12	1,910	223	11,100	3,620	8,710	2,620	8,370	2,560	15,600	7,960	11,700	5,470	9,270	3,410	15,400	9,430	15,600	8,830	19,500	9,260	18,300	9,060	16,500	8,940
13	1,990	221	9,000	2,750	10,200	2,720	8,240	2,550	14,200	6,680	11,600	5,150	8,270	2,690	15,900	9,390	17,300	9,060	19,200	9,480	18,800	9,040	15,200	8,160
14	4,050	225	3,870	1,560	10,300	2,630	8,580	2,470	14,300	8,400	11,500	4,920	9,810	3,530	16,900	8,920	17,800	9,100	19,200	9,860	18,500	9,860	16,900	8,490
15	3,600	265	4,260	1,160	10,900	2,730	9,580	2,590	14,000	7,690	11,400	5,130	9,860	3,190	17,100	8,660	17,700	8,860	19,200	10,400	17,200	8,750	17,400	8,620
16	675	243	6,900	1,280	10,500	3,040	10,200	2,710	15,000	8,210	9,970	4,540	11,600	3,500	17,800	8,340	18,200	9,710	18,900	10,500	16,600	8,290	16,900	8,720
17	3,450	223	5,180	1,270	11,700	3,520	9,680	3,020	15,500	8,600	9,840	3,500	11,800	3,580	18,100	8,990	18,400	9,850	18,500	10,700	18,400	8,630	16,400	8,060
18	4,150	246	3,660	768	11,400	3,550	8,420	2,920	14,600	8,780	9,840	2,900	12,500	3,060	18,600	9,580	17,600	9,630	19,700	12,100	17,600	9,340	16,500	8,160
19	6,550	300	7,430	907	10,600	3,220	8,180	2,940	14,100	8,780	8,970	2,690	11,800	3,920	17,800	9,260	18,200	10,100	17,200	9,530	17,800	9,580	16,500	8,300
20	3.75	573	5,850	1,430	11,800	3,530	8,090	2,620	13,800	9,250	9,140	2,500	11,400	3,860	18,300	10,500	17,200	10,200	16,800	8,780	16,600	9,430	16,300	8,740
21	6,890	619	8,770	1,530	11,700	3,660	7,800	2,780	14,300	9,130	7,920	2,640	10,900	3,780	19,500	10,600	17,100	10,100	16,000	8,240	15,200	8,600	15,800	8,580
22	5,110	516	9,270	1,650	10,600	4,130	6,030	2,520	14,200	8,840	9,720	2,690	11,500	4,320	18,700	10,100	17,300	9,900	15,100	8,320	13,500	7,310	17,300	9,020
23	4.67	643	9,430	2,160	11,200	4,280	6,930	2,580	15,000	9,710	9,500	2,730	11,400	4,440	17,600	10,800	17,300	9,010	14,500	7,490	14,700	6,660	16,600	8,760
24	4.95	572	7,410	2,200	10,900	4,380	8.63	2,990	15,900	8,790	9,950	2,920	11,400	4,640	17,300	10,800	17,300	10,300	14,700	7,040	14,500	6,450	13,300	8,700
25	4,520	562	5,520	1,950	11,000	3,490	9,400	3,740	13,800	8,210	9,160	2,800	11,700	5,000	18,100	10,600	17,800	10,500	14,200	7,110	13,600	6,190	15,300	8,230
26	2,290	520	5,560	1,820	5,100	2,370	11,900	3,340	15,200	7,540	8,960	2,580	12,000	4,890	17,700	11,000	17,700	10,900	12,700	6,070	13,600	6,060	15,500	7,500
27	4,470	637	6,210	1,970	8,550	2,960	11,500	3,340	14,100	6,770	7,670	2,400	12,900	5,610	18,200	10,500	17,400	11,000	*	*	14,500	6,740	16,700	7,900
28	2,950	432	3,640	1,530	8,860	2,790	12,000	4,600	13,700	6,380	7,630	2,290	14,700	6,100	18,800	10,300	16,500	10,400	*	*	16,900	7,960	17,900	8,340
29	634	297	1,980	1,190	9,450	3,120	13,300	4,680	13,200	6,310	8,350	2,330	14,700	5.95	18,900	10,700	17,600	10,000	*	*	20,000	9,240	17,900	8,800
30	583	276	1,600	849	—	—	*	*	14,100	6,610	9,780	2,130	15,300	6,860	19,400	11,000	18,000	10,500	*	*	20,900	5,100	15,500	8,350
31	1,820	271	3,690	805	—	—	*	*	—	—	10,200	2,250	—	—	18,700	11,300	17,400	10,400	—	—	12,400	4,100	—	—
Mean	3,348	401	7,169	1,863	9,900	2,844	9,790	3,216	14,660	8,073	11,113	4,501	11,174	3,800	16,929	9,416	17,232	10,017	16,673	9,220	16,097	7,572	15,633	7,345
Max	6,890	706	12,700	3,700	11,900	4,380	13,300	5,060	16,300	9,710	14,600	7,320	15,300	6,860	19,500	11,300	19,000	11,000	19,700	12,100	20,900	9,860	19,500	9,530
Min	583	214	1,240	254	4,820	644	6,030	2,280	13,200	6,310	7,630	2,130	8,270	2,540	14,600	6,900	14,900	8,830	12,700	6,070	12,400	4,100	8,390	2,480

Table 19. Daily maximum and minimum chloride concentrations, Delaware River at Chester, Pennsylvania (station number 01477050), for report year ending November 30, 2012.

[Record furnished by Kimberly Clark Chester Operations. Concentrations are in milligrams per liter. *, missing data; —, not applicable; max, maximum; min, minimum]

Day	Dec.		Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct		Nov.	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	42	28	42	35	49	42	57	49	42	35	53	46	33	32	46	38	88	88	109	98	46	33	32	28
2	49	28	35	29	49	42	57	49	49	35	53	46	33	32	46	39	120	88	132	109	46	46	35	28
3	35	29	35	29	49	42	49	42	49	42	53	46	32	28	39	32	109	88	171	120	46	40	35	28
4	35	29	35	29	49	49	49	42	49	42	46	39	40	33	46	39	100	98	201	88	46	46	35	28
5	35	35	35	29	49	42	49	49	49	42	46	39	32	32	46	32	98	79	157	88	46	46	28	28
6	42	35	29	29	49	42	57	42	92	49	46	39	33	32	46	39	98	79	120	98	46	40	28	28
7	42	35	35	29	45	42	49	42	49	49	46	39	33	32	53	49	120	61	109	98	46	40	35	28
8	35	29	29	29	49	42	49	42	49	49	53	39	33	33	53	46	88	70	109	98	46	40	28	28
9	35	29	29	29	49	49	49	49	49	49	49	46	40	33	88	53	109	79	98	88	46	33	28	28
10	35	29	35	29	49	42	49	45	49	49	46	39	33	33	70	61	88	79	88	70	46	33	28	28
11	29	29	92	35	49	42	49	42	57	49	46	39	33	33	70	61	88	61	79	70	46	33	28	28
12	29	29	74	29	49	42	49	42	57	49	49	39	40	33	70	53	88	70	79	70	40	33	28	28
13	29	20	35	29	49	42	49	42	74	57	46	39	40	33	70	53	98	61	79	53	46	40	28	28
14	35	29	49	35	49	35	49	42	74	49	46	39	40	33	61	53	88	53	79	53	46	40	35	28
15	29	24	35	29	72	39	57	49	65	57	46	39	40	33	70	53	120	70	79	53	56	42	35	28
16	29	29	35	29	42	39	49	42	57	49	39	32	33	32	79	61	88	61	88	61	56	42	28	28
17	29	29	35	35	49	42	49	42	70	46	39	39	36	32	79	61	88	53	83	61	49	42	35	28
18	29	29	35	35	42	42	49	42	71	53	39	32	39	32	98	61	79	70	98	70	49	35	35	35
19	35	29	35	35	49	42	49	42	70	53	39	32	32	32	79	70	88	61	109	70	57	42	42	35
20	29	29	42	35	49	42	49	42	70	61	39	32	39	32	88	70	98	70	110	70	49	42	35	35
21	35	29	42	35	49	42	49	42	70	61	39	32	32	32	88	70	98	88	79	61	49	42	42	35
22	35	29	42	35	57	49	49	42	79	61	32	32	39	32	98	68	132	98	70	61	49	42	35	35
23	42	35	42	35	49	49	49	42	88	70	32	32	44	32	98	88	120	98	53	46	42	35	42	35
24	42	29	49	35	57	35	74	42	70	70	32	32	46	39	98	88	144	79	79	53	42	35	35	35
25	42	35	49	35	49	42	49	42	70	61	32	32	35	35	90	88	132	79	46	39	42	35	35	35
26	35	29	49	42	49	42	83	42	53	46	39	32	39	32	120	109	132	98	46	39	42	35	42	35
27	42	29	49	42	49	49	49	42	53	46	32	32	39	32	157	88	157	88	46	39	49	42	35	35
28	42	29	83	49	49	49	42	39	53	39	32	32	39	32	185	98	132	88	46	39	42	35	42	35
29	42	29	49	49	49	49	49	42	46	46	32	32	39	32	98	98	120	88	53	46	42	35	49	35
30	35	29	49	42	—	—	49	42	53	46	39	32	39	39	120	88	120	88	53	39	42	39	42	35
31	35	29	72	42	—	—	49	42	—	—	39	32	—	—	144	79	120	109	—	—	35	32	—	—
Mean	36	29	39	34	50	43	52	43	61	50	42	37	37	33	84	64	108	79	92	68	46	39	35	31
Max	49	35	92	49	72	49	83	49	92	70	53	46	46	39	185	109	157	109	201	120	57	46	49	35
Min	29	20	29	29	42	35	42	39	42	35	32	32	32	28	39	32	79	53	46	39	35	32	28	28

Dissolved Oxygen

Dissolved oxygen in water is necessary for the respiratory processes of aquatic organisms and for chemical reactions in aquatic environments (U.S. Geological Survey, 2020a). Fish and many other clean-water species consistently require relatively high dissolved-oxygen concentrations. The major source of dissolved oxygen in the Delaware River estuary is diffusion from the atmosphere and, to a lesser extent, photosynthetic activity of aquatic plants. The principal factors that affect dissolved-oxygen concentrations in the estuary are water temperature, biochemical oxygen demand, freshwater inflow, phytoplankton, turbidity, salinity, and tidal and wind-driven mixing.

Concentrations of dissolved oxygen at several sites on the Delaware River estuary have been measured since 1961 by the USGS. Two of these sites, Delaware River at Benjamin Franklin Bridge at Philadelphia, Pennsylvania and Delaware River at Chester, Pennsylvania, have nearly continuous records and are in the reach of the estuary most affected by effluent discharges, which can lead to reduced dissolved oxygen concentrations because of increasing biological oxygen demand by aerobic bacteria in water. For these stations, the daily mean and minimum daily mean dissolved-oxygen concentrations for the 3-month period of July to September during the 1965–2012 report years are shown in figure 8. Although dissolved-oxygen concentrations have increased considerably over this 48-year period, mean concentrations can vary substantially from year to year. Due to changes in technology and other factors, the process used to calculate mean dissolved-oxygen concentrations and the values of those data have changed slightly through time. The procedures used to create figure 8 of this report were started for the 2009–10 River Master report (Russell and others, 2019). The available mean and minimum daily dissolved-oxygen concentration data were downloaded from the USGS NWIS database for the months of July, August, and September, and the average mean and average minimum dissolved-oxygen concentrations of the daily values were computed over the 3-month period of each report year.

Concentrations of dissolved oxygen in the Delaware River estuary generally are greatest near Trenton and decrease in a downstream direction. In an area just downstream from the Benjamin Franklin Bridge, concentrations commonly reach minimum levels. During the report year, the lowest recorded daily mean concentration was 3.7 mg/L on July 15 and 16, 2012 (table 20). Daily mean concentrations of dissolved oxygen were consistently 6.1 mg/L or greater on all days from April 1 through June 29, 2012, and from September 21 through November 30, 2012. At Chester, the lowest recorded daily mean dissolved-oxygen concentration was 4.2 mg/L on July 15, and August 4, 2012 (table 21).

Histograms of half-hourly dissolved-oxygen concentrations during the critical summer period (July 1 through September 30, 2012) at the Benjamin Franklin Bridge and Chester monitoring sites are presented in figure 9. During the 2012 critical summer period, half-hourly dissolved-oxygen concentrations were 4.0 mg/L or less for a combined time duration of 17 days (19 percent of the time) at the Benjamin Franklin Bridge site, and for a combined time duration of 2 days (2 percent of the time) at Chester (U.S. Geological Survey, 2020l, i).

Hydrogen-Ion Activity (pH)

The pH of a solution is a measure of the effective concentration (activity) of dissolved hydrogen ions. Solutions having pH less than 7 are acidic, whereas solutions with pH greater than 7 are basic or alkaline. The pH of uncontaminated surface water generally ranges from 6.5 to 8.5. Major factors affecting the pH of surface water include the geologic composition of the drainage basin and human inputs, including effluent discharges. In addition, photosynthetic activity and dissolved gases, including carbon dioxide, hydrogen sulfide, and ammonia, can have a considerable effect on pH. The pH of water determines the solubility (amount that can be dissolved in the water) and biological availability (amount that can be utilized by aquatic life) of chemical constituents such as nutrients (phosphorus, nitrogen, and carbon) and heavy metals (for example, lead, copper, and cadmium; U.S. Geological Survey, 2020b). During the report year, pH was measured seasonally (April through November) at the Benjamin Franklin Bridge and Chester monitor sites, and continuously at the Reedy Island Jetty site. During these periods, the ranges of daily median pH measured at these stations are as follows: Benjamin Franklin Bridge, 6.7 to 7.6; Chester, 6.9 to 7.6; and Reedy Island Jetty, 7.3 to 8.3 (U.S. Geological Survey, 2020f, h, k). Generally, the pH of water in the Delaware River estuary is lowest near Trenton, New Jersey, and increases (water becomes more alkaline) in the downstream direction. The pH of water in the Delaware River estuary between the Benjamin Franklin Bridge and Reedy Island Jetty was not a limiting factor for aquatic health or other beneficial uses of the water during the report year.

Table 20. Daily mean dissolved-oxygen concentrations, Delaware River at Benjamin Franklin Bridge at Philadelphia, Pennsylvania (station number 01467200), from April 1 to November 30, 2012.

[Data from U.S. Geological Survey, 2020e. Concentrations are in milligrams per liter. *, missing data; —, not applicable]

Day	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
1	10.1	7.8	7.6	5.5	4.8	4.7	6.4	8.7
2	10.0	8.0	7.4	5.2	4.6	4.6	6.3	8.6
3	10.0	8.0	7.1	4.8	4.5	4.5	6.2	8.8
4	9.9	8.0	6.8	4.6	4.3	4.3	6.2	9.1
5	9.9	8.1	6.5	4.4	4.4	4.3	6.2	9.3
6	9.9	8.2	*	4.3	4.5	4.2	6.3	9.5
7	9.8	8.0	*	4.1	4.4	4.3	6.4	9.8
8	9.8	7.9	6.4	3.9	4.3	4.5	6.4	9.9
9	9.9	7.8	6.4	3.9	4.3	4.5	6.5	10.3
10	9.9	7.8	6.4	3.8	4.4	4.7	6.6	10.3
11	9.8	8.1	6.5	3.8	4.4	4.9	7.0	10.3
12	9.8	8.1	6.4	3.9	4.5	5.1	7.1	10.3
13	9.9	8.0	6.3	3.9	4.5	5.1	7.2	10.3
14	10.0	7.7	6.6	3.8	4.5	5.0	7.3	10.4
15	10.1	7.2	7.0	3.7	4.2	5.1	7.4	10.5
16	10.1	6.7	7.3	3.7	4.0	5.2	7.3	10.5
17	10.2	7.2	7.6	3.8	4.1	5.2	7.2	10.6
18	10.1	7.4	7.9	4.1	4.1	5.4	7.1	10.6
19	9.8	7.2	8.0	4.2	4.1	5.4	7.1	10.6
20	9.6	7.2	8.1	4.3	4.1	5.7	7.0	10.5
21	9.2	7.3	8.1	4.5	4.0	6.1	7.8	10.4
22	8.9	7.2	8.0	4.5	4.0	6.4	8.4	10.3
23	8.5	7.1	7.4	4.7	4.1	6.7	8.5	10.2
24	8.4	7.1	7.5	4.9	4.1	6.8	8.4	10.3
25	8.4	7.2	7.4	5.2	4.3	6.9	8.3	10.4
26	8.1	7.2	7.3	5.3	4.6	7.0	8.2	10.4
27	7.6	7.2	7.2	5.1	4.7	6.9	8.1	10.3
28	7.5	7.4	6.9	5.0	4.7	6.6	8.1	10.3
29	7.6	7.5	6.4	4.9	4.7	6.5	8.4	10.3
30	7.7	7.5	5.9	4.8	4.6	6.3	8.5	10.4
31	—	7.5	—	4.9	4.6	—	8.8	—
Mean	9.4	7.6	7.1	4.4	4.4	5.4	7.3	10.1
Maximum	10.2	8.2	8.1	5.5	4.8	7.0	8.8	10.6
Minimum	7.5	6.7	5.9	3.7	4.0	4.2	6.2	8.6

Table 21. Daily mean dissolved-oxygen concentrations, Delaware River at Chester, Pennsylvania (station number 01477050), from April 1 to November 30, 2012.

[Data from U.S. Geological Survey, 2020g. Concentrations are in milligrams per liter. *, missing data; —, not applicable]

Day	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
1	9.0	*	7.7	5.6	4.6	5.2	6.1	8.4
2	9.8	*	7.3	5.3	4.4	5.1	5.9	8.6
3	9.6	6.7	6.5	5.2	4.3	5.4	5.8	8.9
4	9.4	6.3	6.1	5.1	4.2	5.5	5.5	9.1
5	9.2	6.0	5.9	5.0	4.6	5.4	5.3	9.1
6	9.1	5.7	5.7	4.8	4.9	4.8	5.6	9.2
7	9.1	5.4	5.7	4.9	4.9	4.7	5.7	9.3
8	9.1	5.5	5.6	4.7	4.9	4.9	5.7	9.6
9	9.2	*	5.6	4.7	4.7	5.1	5.8	9.8
10	9.1	*	5.9	4.7	5.0	5.2	6.0	9.6
11	9.1	5.7	6.4	4.6	5.4	5.6	6.1	9.5
12	9.1	5.9	6.6	4.7	5.0	5.7	6.4	9.4
13	9.1	6.1	6.5	4.5	4.9	5.6	6.6	9.4
14	9.1	6.0	6.5	4.3	5.0	5.5	7.1	9.5
15	8.9	5.9	6.7	4.2	5.0	5.5	7.3	9.5
16	8.7	5.9	7.1	4.4	4.9	5.5	7.2	9.5
17	8.4	*	7.5	4.5	5.0	5.7	7.2	9.6
18	8.0	*	7.7	4.6	5.2	6.2	7.2	9.7
19	7.7	*	7.8	4.6	5.1	6.2	7.4	9.8
20	7.4	*	7.9	4.9	4.9	5.7	7.1	9.7
21	7.1	*	7.9	5.3	4.8	5.4	6.8	9.7
22	6.8	*	8.0	5.2	4.8	5.4	7.1	9.7
23	6.9	6.7	7.7	5.3	4.9	5.6	6.9	9.6
24	7.1	6.8	7.7	5.4	4.8	5.7	6.7	9.8
25	7.2	6.9	7.6	5.5	5.0	5.9	6.8	10.1
26	6.9	6.9	7.2	5.8	5.4	6.2	6.8	10.2
27	6.8	6.8	6.9	5.8	5.5	*	7.0	10.1
28	6.8	7.2	6.7	5.5	5.5	*	7.2	10.2
29	6.7	7.7	6.3	5.1	5.3	6.2	7.7	10.2
30	6.8	7.7	5.9	5.0	5.3	5.9	8.5	10.2
31	—	7.8	—	4.9	5.2	—	8.3	—
Mean	8.3	6.5	6.8	5.0	5.0	5.5	6.7	9.6
Maximum	9.8	7.8	8.0	5.8	5.5	6.2	8.5	10.2
Minimum	6.7	5.4	5.6	4.2	4.2	4.7	5.3	8.4

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Appendixes 1–3

Appendix 1. Agreement of the Parties to the 1954 U.S. Supreme Court Decree, Effective June 1, 2012

Agreement of the Parties to the
1954 U.S. Supreme Court Decree
Effective June 1, 2012

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An Agreement, consented to by the Parties (the State of Delaware (Del.), the State of New Jersey (N.J.), the State of New York (N.Y.), the Commonwealth of Pennsylvania (Pa.), and the City of New York (NYC or City); hereafter Decree Parties) to the Amended Decree of the U.S. Supreme Court in New Jersey v. New York, 347 U.S. 995 (1954), (hereafter Decree) that succeeds for a one-year period the Flexible Flow Management Program (FFMP) that terminated on May 31, 2012, for managing diversions and releases under the Decree. The Decree Parties hereby agree to support all provisions of this Agreement.

1. FLEXIBLE FLOW MANAGEMENT PROGRAM

a. Program History

On September 26, 2007, the Decree Parties unanimously agreed to implement a Flexible Flow Management Program (FFMP) for operation of the three New York City reservoirs in the Delaware River Basin. The FFMP was designed to provide a more natural flow regime and a more adaptive means than the previous operating regime for managing releases and diversions from New York City's Pepacton, Cannonsville, and Neversink Reservoirs (City Delaware Basin Reservoirs). The FFMP addresses competing needs and uses including safe and reliable water supplies to serve the needs of more than 17 million people; drought management; flood mitigation; protection of the cold water fishery; a diverse array of habitat needs in the mainstem river, estuary, and bay; and salinity repulsion. The Decree, which resolved an interstate dispute related to these reservoirs, made no provision for spill mitigation, conservation, and ecological releases. The initial implementation cycle of the FFMP was from October 1, 2007 to May 31, 2011.

The conceptual framework of the FFMP eliminated the reservoir storage "banks" previously relied upon for habitat protection purposes and instead based releases on reservoir storage levels, resulting in larger releases when water is abundant and smaller releases when storage is at or below Normal levels. The discharge mitigation component of the FFMP was intended to reduce the likelihood that the three reservoirs could be full and spilling coincident with a major storm or thaw.

The FFMP was designed to provide an adaptive framework which allows increased flexibility for program modifications and adjustments compared to the previous operating regime. This framework provides a tool to inform program-management decisions as new scientific and technical information is accumulated. During the initial implementation cycle, notable revisions to the FFMP included the following:

Temporary Modifications – Such modifications have been made in support of increased reservoir releases for maintenance, inspection, and repair of the Delaware Aqueduct and appurtenant infrastructure; increased releases for supplemental flood mitigation; emergency thermal releases for protection of the cold water fishery; and enhanced

summer releases through the use of Interim Excess Release Quantity (IERQ) Extraordinary Needs Banks.

Permanent Changes – Such changes have been made to the FFMP agreement to allow for increased reservoir releases for habitat protection needs in late May and early September; to clarify the meaning of "temporary" releases schedules during periods of maintenance and repair of City Delaware Basin Reservoirs and appurtenant infrastructure; to address the issue of storage zone bouncing; and to allow the use of up to 100 percent of the water equivalent of snow pack for the calculation of combined storage to determine reservoir releases rates.

b. Current Program

The original FFMP, effective October 1, 2007 and its subsequent modifications on December 10, 2008 and February 14, 2011, expired on May 31, 2011. Collectively, these programs are referred to herein as the initial implementation cycle FFMP. The subsequent FFMP Agreement, effective June 1, 2011 and expiring on May 31, 2012, was a one-year program unanimously approved by the Decree Parties and built upon the framework of the previous FFMP agreements. The current FFMP is a one-year extension of the June 1, 2011 Agreement and was unanimously approved by the Decree Parties. The current FFMP shall be effective from June 1, 2012 to May 31, 2013. Although several limited studies and evaluations have been conducted to assess the effectiveness of selected elements of the initial implementation cycle FFMP and suggest opportunities for its improvement, some of which were incorporated in the June 1, 2011 agreement, additional analyses and studies are needed prior to the Decree Parties reaching a longer term agreement for managing diversions and releases under the Decree.

The current FFMP is informed by impact assessments of previous FFMP Agreements, information and experience accumulated during the previous programs, and input from various stakeholder groups and the public. The current FFMP differs from the initial implementation cycle FFMP mainly in the following key elements:

- Use of additional tables (i.e., schedules) of reservoir releases rates for the City Delaware Basin Reservoirs, developed on the basis of Forecast-based Available Water (FAW) not needed contemporaneously for New York City's water supply;
- Use of new releases tables that replace releases tables utilized in the initial implementation cycle FFMP;
- Use of new rule curves that replace rule curves utilized in the initial implementation cycle FFMP;
- Use of New York City's Operations Support Tool (OST) to guide selection of appropriate releases tables;

- Releases rates based, in part, upon recommendations provided jointly by the New York State Department of Environmental Conservation and the Pennsylvania Fish and Boat Commission Joint Fisheries Paper (January 12, 2010);
- Drought condition releases rates (L3-L5) that are consistent among the releases tables;
- Modifications to New Jersey's diversion during drought conditions and the establishment of a Diversion Offset Bank for New Jersey;
- Incorporation of the seasonal releases design of the FFMP Temporary Summer 2010 fisheries program;
- Redirection of the IERQ used to support the seasonal flow increment, which was intended to increase the Montague flow objective from 1,750 cfs to 1,850 cfs between June 15 and September 15;
- Use of 3.91 billion gallons (6,045 cfs-days) of IERQ to increase the base releases rates in the tables;
- Reattachment of the Montague flow objective with the location of the Delaware Estuary salt front (salinity vernier);
- Modified spill mitigation program that endeavors to maintain reservoir levels at the Conditional Storage Objective, creating a high probability of maintaining ten (10) percent void spaces from September 1, 2012 through March 15, 2013; and
- Postponement of a water-resources reassessment study until more information is available.

The additional releases tables and use of OST will facilitate the redirection of spilled water to managed water to benefit downstream interests when water in the City Delaware Basin Reservoirs is forecasted to be available for purposes other than New York City's water supply.

The current June 1, 2012 FFMP Agreement differs from the previous FFMP Agreement in the following elements:

- This section, 1.b., Current Program, has been updated to reflect the current FFMP one-year extension;
- The dates have been revised to correspond to the effective term of the current FFMP Agreement;
- Additional units of measurement for water volume have been provided; and
- The State of Delaware has one party signing the current FFMP Agreement, as opposed to two.

c. Criteria for Flexible Flow Management Program Modification

In reviewing proposed modifications to address the purposes of the FFMP, as provided in Sections 16 and 17 herein, the Decree Parties will consider criteria that may include, without any particular priority, and not limited to, the following:

i. Decree Party equity

ii. Net benefits and costs to environmental and economic resources

iii. Source and sustainability of water available to support modification and the environmental or economic resource(s)

iv. Habitat types—with naturally-occurring habitats receiving consideration over man-made habitats

v. Scientific basis for modification

vi. Impacts to drought management, water supply and flood mitigation, including but not limited to: 1) frequency, duration and seasonal timing of the various levels of drought; and 2) frequency, duration, levels of storage, diversions, releases and flows

vii. Extent to which the diversions and the Montague minimum basic rate of flow provided in the Decree are met

viii. Potential impacts to water quality, existing National and State Pollution Discharge Elimination System permits and the assimilative capacity of the Delaware River

ix. Ease and practicability of operation

x. Consistency with adaptive management principles

xi. Applicability and implementation of water conservation practices

xii. Impacts to salinity

The Decree Parties agree to evaluate these parameters as well as potential additional parameters, when considering modifications to this program.

2. DIVERSIONS

a. New York City

In accordance with Section III.A. of the Decree, and subject to the limitations provided herein, at no time during the twelve-month period, commencing June 1, 2012 shall the aggregate total quantity of water diverted by the City, divided by the number of days elapsed since May 31, 2012 exceed 800 million gallons per day (mgd). The City shall be subject to the conditions and obligations in connection with the diversions, and releases to maintain the Montague flow objective, set forth in Section III.B. of the Decree. For this Agreement, the City shall make releases from its Delaware Basin Reservoirs in accordance with the releases schedules incorporated herein.

b. New Jersey

In accordance with Section V. of the Decree, except with respect to limitations provided herein in Section 5, the State of New Jersey may divert outside the Delaware River watershed, from the Delaware River or its tributaries in New Jersey, without compensating releases, the equivalent of 100 mgd under the supervision of the Delaware River Master (River Master) established by the Decree and shall be subject to the following conditions and obligations:

i. Until the State of New Jersey builds and utilizes one or more reservoirs to store waters of the Delaware River or its tributaries for the purpose of diverting the same to another watershed, or purchases or leases reallocated water or new storage from an existing or new storage facility, the State of New Jersey may divert not to exceed 100 mgd as a monthly average, with the diversion on any day not to exceed 120 million gallons.

ii. If and when the State of New Jersey has built and is utilizing one or more reservoirs to store waters of the Delaware River or its tributaries for the purpose of diversion to another watershed, it may withdraw water from the Delaware River or its tributaries into such impounding reservoirs without limitation except during the months of July, August, September and October of any year, when not more than 100 mgd as a monthly average and not more than 120 million gallons in any day shall be withdrawn. This restriction may be modified upon unanimous consent of the Decree Parties should the State of New Jersey purchase or lease reallocated water or new storage from an existing or new facility.

iii. Regardless of whether the State of New Jersey builds and utilizes storage reservoirs for diversion, its total diversion for use outside of the Delaware River watershed without compensating releases shall not exceed an average of 100 mgd during any calendar year.

3. FLOW OBJECTIVES

a. Montague Flow Objective

Except with respect to limitations provided herein in Section 5, releases from the City Delaware Basin Reservoirs shall be in quantities designed to maintain, during Normal storage conditions, a minimum basic rate of flow at the gaging station of the U.S. Geological Survey (USGS) at Montague, N. J. of 1,750 cubic feet per second (cfs), as directed by the River Master in accordance with Section VII. of the Decree.

During Basinwide Drought Watch, Drought Warning, and Drought Emergency, in accordance with Section 5 of this Agreement and Section 2.5.3.B. and Tables 1 and 2 of the Delaware River Basin Water Code (Water Code), the Montague flow objective shall vary based upon the time of year and location of the salt front, and minimum compensating releases shall be made by the City of New York from its reservoirs in the upper Delaware Basin.

b. Trenton Equivalent Flow Objective

Section 2.5.3 of the Water Code establishes a set of equivalent flow objectives at Trenton, N.J. to control salinity intrusion in the Delaware Estuary. One means for salinity management is through releases from Beltzville and Blue Marsh Reservoirs. Blue Marsh Reservoir is located on the Schuylkill River and is downstream of the USGS gaging station at Trenton, N. J. Releases from Blue Marsh Reservoir, as well as bypass flows from Yardley and the Point Pleasant Pumping station, are considered to be as effective at repelling salinity as water entering the estuary from the main stem Delaware River at Trenton. The Trenton Equivalent Flow is computed as the sum of flows at the USGS Trenton gaging station, releases in excess of conservation releases from Blue Marsh Reservoir, and 70 cfs to account for bypass flows via Yardley and the Point Pleasant Pumping Station. This value is compared to the Trenton Equivalent Flow Objective to determine if the flow objective was satisfied.

During Basinwide Drought Watch, Drought Warning, and Drought Emergency, in accordance with Section 5 of this Agreement and Section 2.5.3.B. and Tables 1 and 2 of the Water Code, the Trenton Equivalent Flow Objective shall vary based upon the time of year and location of the salt front, and minimum compensating releases shall be made by the City of New York from its reservoirs in the upper Delaware Basin.

4. RELEASES

a. Conservation Releases from the City Delaware Basin Reservoirs

Conservation releases designed for protection of the ecology in the stream reaches below the City Delaware Basin Reservoirs, including water quality, fisheries, and aquatic habitat needs, shall be made at the rates described in the Habitat Protection Program in Section 6 below.

b. Excess Release Quantity

For the period of the current program, the Decree Parties agree to use the Excess Release Quantity, as defined in the Decree, in support of an Interim Excess Release Quantity (IERQ) as defined in Paragraph c. below.

c. Interim Excess Release Quantity

For the period of the current program, an IERQ equivalent to 10.0 billion gallons (15,468 cfs-days) shall be provided as computed in the initial implementation cycle of the FFMP based upon 83 percent of the difference between 1,257 mgd, the highest year's consumption of the NYC water supply system between 2002 and 2006 inclusive and NYC's estimate of continuous safe yield of the NYC water supply system at that time, of 1,290 mgd obtainable without pumping.

For the current program, 3.91 billion gallons (6,045 cfs-days) of the IERQ is incorporated in the releases tables to enhance base releases from the City Delaware Basin Reservoirs. The IERQ balance of 6.09 billion gallons (9,423 cfs-days) is reserved and may be used for additional releases to meet the Trenton Equivalent Flow Objective or to establish an Extraordinary Needs Bank as provided for in Section d., below.

Upon request by the Lower Basin States or DRBC, NYC shall release from the IERQ, water in sufficient quantities to maintain a flow at Trenton of 3,000 cfs during basinwide Normal conditions for the period commencing on June 15 and continuing through March 15 (seasonal period). The IERQ required to be released in any seasonal period shall not exceed 70 billion gallons. In releasing the IERQ, NYC shall not be required to release at rates exceeding the capacity of its release works. NYC shall make releases from the IERQ as provided above until May 31, 2013 or until the aggregate quantity of the IERQ is exhausted, whichever occurs first.

d. Interim Excess Release Quantity Extraordinary Needs Bank

In addition to the hydrologic criteria described in Section 2.5.6.A. of the Water Code and subject to other provisional uses of the IERQ as provided herein, the Decree Parties, the DRBC and the River Master may at any time review extraordinary water needs to support such research, aquatic-life, or other water-use activity as may be approved by the DRBC. Upon unanimous agreement, the Decree Parties may bank all or a portion of the IERQ remaining at such time, and such portion shall be placed in an IERQ Extraordinary Needs Bank and used to provide for such extraordinary water needs. Such quantity as may be so banked shall be deducted from the IERQ. Any unused Extraordinary Needs Bank water shall be returned to IERQ.

DROUGHT MANAGEMENT

Figure 1 defines six zones of combined reservoir usable storage relative to the three drought management rule curves (Drought Watch, Drought Warning, and Drought Emergency creating Zones L3, L4, and L5, respectively) and two additional curves that subdivide the Normal storage zone into three zones (L1, L2-a, and L2-b). The three drought management

rule curves are described below. The two Normal conditions rule curves are described in Section 6.

During the effective period of this Agreement, the following drought stage definitions and procedures will be in effect:

a. Drought Watch (L3)

The seasonally segmented line (shown as dashes) dividing the current Drought Warning in Figure 1 of DRBC Resolution No. 83-13 and DRBC Docket No. D-77-20 CP (Revised) is raised by four (4) billion gallons during the entire year. In addition, the upper half of the Drought Warning zone, previously referred to as DW1, is hereby designated Drought Watch, with diversions and flow objectives as shown in Table 1.

b. Drought Warning (L4)

The lower half of the Drought Warning zone (DW2), based upon the rule curves included in DRBC Resolution No. 83-13 and as modified by Paragraph a. above, is hereby designated Drought Warning, with diversions and flow objectives as shown in Table 1.

c. Drought Emergency (L5)

The operation level formerly named Drought in accordance with the rule curves included in DRBC Resolution No. 83-13 and Docket D-77-20 (Revised) is hereby designated Drought Emergency. During Drought Emergency, diversions shall be limited as shown in Table 1. The Montague and Trenton Equivalent Flow Objectives are shown in Tables 1 and 2.

New York City's diversions from the Delaware River Basin shall be in accordance with Table 1 (Interstate Operation Formula for Diversions and Flow Objectives). Minimum releases from the New York City Delaware Basin Reservoirs shall be in accordance with Table 3 (Schedule of Releases during Drought Operations).

New Jersey's maximum average monthly diversion from the Delaware River Basin via the Delaware and Raritan Canal shall be in accordance with Table 1, and shall not exceed 100 mgd, except when the Basin is in Drought Emergency, when said diversion shall not exceed a daily running average of 85 mgd commencing on the day such Drought Emergency becomes effective. Under all City Delaware Basin Reservoir combined storage conditions, New Jersey's diversion on any day shall not exceed 120 million gallons.

d. New Jersey Diversion Offset Bank

There is hereby established a Diversion Offset Bank, not to exceed 1.84 billion gallons (2,850 cfs-days) of water in the City Delaware Basin Reservoirs, for the purpose of offsetting the increased diversions by New Jersey as provided in Table 1 of this Agreement, during basinwide Drought Watch, Drought Warning, and Drought

Emergency conditions. The additional increases are in increments, not to be exceeded on any day, as follows: 0 mgd during Normal conditions; up to 15 mgd during Drought Watch; up to 30 mgd during Drought Warning; and up to 20 mgd during Drought Emergency. The differences in New Jersey's diversion, computed on the basis of Table 1 of the Good Faith Agreement, and the corresponding rates in Table 1 of this Agreement, establish the additional increments for New Jersey's diversion as incorporated herein.

This Diversion Offset Bank shall be created by selective reduced levels of releases in the L2 storage zones from Cannonsville Reservoir, during the periods June 1 to August 31, 2012 and May 21 to May 31, 2013, as provided in Tables 4g (L2-a and L2-b) and 4f (L2-a). Water saved by these reductions shall be accumulated in the Diversion Offset Bank and shall be available to offset New Jersey's incremental increases in diversions through the Delaware and Raritan Canal during drought periods.

If the accumulated incremental increased diversions by New Jersey, at any time, exceed the available water in the Diversion Offset Bank, the Lower Basin Reservoirs in Pennsylvania will provide the additional water to offset New Jersey's increased diversions. At no time shall New Jersey's accumulated incremental increased diversions exceed 1.84 billion gallons (2,850 cfs-days).

Any portion of the ERQ/IERQ or uncompensated storage in the downbasin reservoirs in Pennsylvania or in the New York City Delaware Basin Reservoirs which may be used to offset the increased New Jersey drought diversions provided herein is for the term of this agreement only and shall not be cited as precedent of any intention to provide such in future agreements.

Releases from the Diversion Offset Bank shall be at the direction of New Jersey in consultation with DRBC, and will be implemented by the River Master. Releases from the Lower Basin Reservoirs for New Jersey's diversion, if necessary, shall be at the direction of DRBC, in consultation with and at the request of New Jersey.

Releases from the Diversion Offset Bank or the Lower Basin Reservoirs to offset New Jersey's incremental increases in diversions through the Delaware and Raritan Canal shall be in accordance with timing procedures agreed upon by DRBC, New Jersey, and the River Master. No offsetting or accounting for offsetting is required for New Jersey's increased diversions on any day when DRBC determines that no water is required from Lower Basin Reservoirs to meet the current Trenton flow objective.

The River Master's office will maintain the ongoing accounting for releases made from this bank. At no time during the releases year commencing June 1, 2012 shall releases from the Diversion Offset Bank exceed the unused balance of the bank. The Diversion Offset Bank shall terminate automatically on June 1, 2013; provided that it may be terminated at an earlier date and the remaining balance added to the IERQ, by agreement of the Decree Parties.

Figure 1
New York City Delaware System Usable Combined Storage
(Cannonsville, Pepacton, and Neversink Reservoirs)

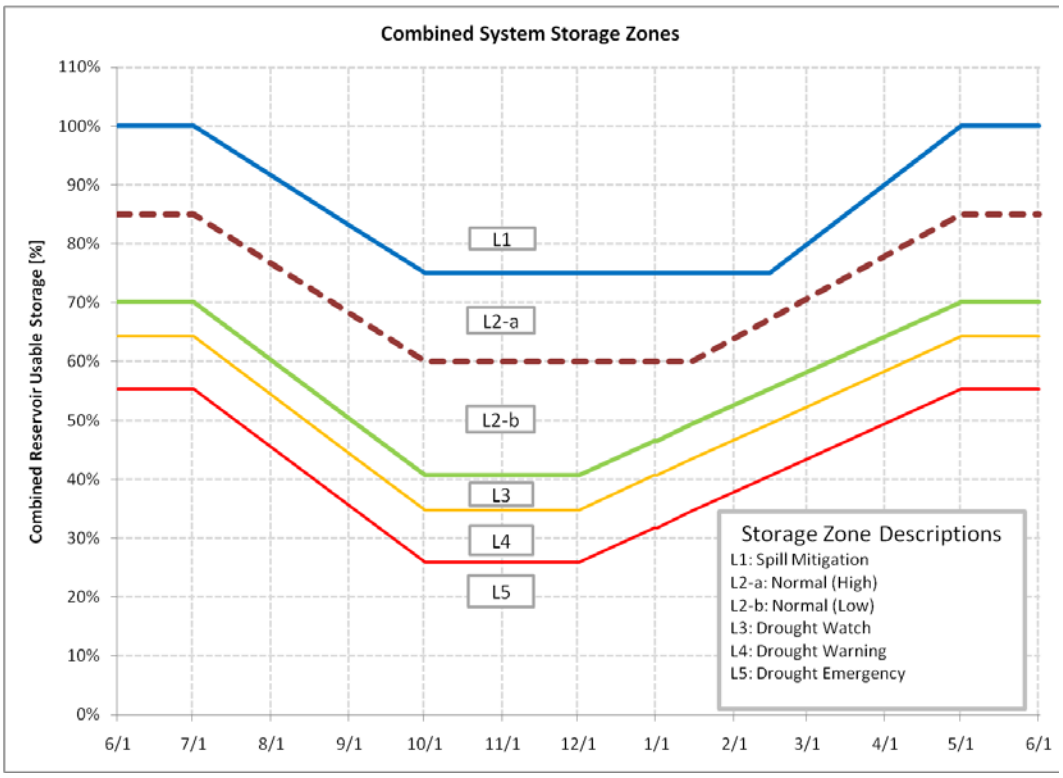


Table 1
Interstate Operation Formula for Diversions and Flow Objectives

NYC Storage Condition	*NYC Diversion (mgd)*	*NJ Diversion (mgd)*	*Montague Flow Objective (cfs)*	*Trenton Flow Objective (cfs)*
Normal (L1, L2)	800	100	1,750	3,000
Drought Watch (L3)	680	100	1,650	2,700
Drought Warning (L4)	560	100	1,550	2,700
Drought Emergency (L5)	520	85	1,100-1,650*	2,500-2,900*
Severe Drought	(to be negotiated depending upon conditions)			

* Varies with time of year and location of salt front, in accordance with Table 2.

Table 2
Interstate Operation Formula for Adjusting Montague and Trenton Flow Objectives during Drought Emergency (L5) Operations

	Flow objective, cubic feet per second at:					
	Montague, NJ			Trenton, NJ***		
7-day average location of Salt Front*, River Mile**	Dec-Apr.	May-Aug.	Sept-Nov.	Dec-Apr.	May-Aug.	Sept-Nov.
Upstream of R.M. 92.5	1,600	1,650	1,650	2,700	2,900	2,900
Between R.M. 87.0 and R.M. 92.5	1,350	1,600	1,500	2,700	2,700	2,700
Between R.M. 82.9 and R.M. 87.0	1,350	1,600	1,500	2,500	2,500	2,500
Downstream of R.M. 82.9	1,100	1,100	1,100	2,500	2,500	2,500

* Defined as the 250 milligrams per liter isochlor in the Delaware Estuary.

**Measured in statute miles along the navigation channel from the mouth of Delaware Bay.

*** The Trenton Equivalent Flow Objective is achieved if the sum of flows observed at the USGS Trenton gaging station, releases in excess of conservation releases from Blue Marsh Reservoir, and 70 cfs to account for bypass flows via Yardley and the Point Pleasant Pumping Station is greater than the Trenton Flow Objective listed above.

Table 3
Schedule of Releases (cfs) during Drought Operations

	Winter		Spring		Summer			Fall		
Cannonsville Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L3	55	55	85	85	135	135	135	85	85	55
L4	50	50	60	60	100	100	100	50	50	50
L5	40	40	40	40	90	90	90	40	40	40

	Winter		Spring		Summer			Fall		
Pepacton Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L3	45	45	60	60	75	75	75	45	45	45
L4	40	40	50	50	65	65	65	40	40	40
L5	35	35	35	35	60	60	60	35	35	35

	Winter		Spring		Summer			Fall		
Neversink Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L3	30	30	40	40	55	55	55	30	30	30
L4	25	25	30	30	45	45	45	25	25	25
L5	20	20	20	20	40	40	40	20	20	20

e. Entry and Exit Criteria

Criteria for entry into and exit from the various stages of drought operations shall be in accordance with Section 2.5.3.E. of the Water Code. Normal (L2 or higher) level releases will be restored when combined storage in the City Delaware Basin Reservoirs reaches 25 billion gallons above the L3 curve in Figure 1 and remains at or above that level for 15 consecutive days.

f. Balancing Adjustment

In order to conserve water, the River Master is requested to utilize a balancing adjustment, based upon procedures agreed upon by the Decree Parties, when calculating the releases to be directed to meet the Montague flow objectives in Tables 1 and 2. Additionally, during Drought Warning, the amount of the conservation releases (L4) from the City Delaware Basin Reservoirs that is greater than the basic conservation releases rates as set forth in Table 1 of Docket D-77-20 (Revised) shall be considered as directed releases for the purpose of calculating the balancing adjustment.

6. HABITAT PROTECTION PROGRAM

a. Applicability and Management Objectives

The overall management goal of the Habitat Protection Program (HPP) is to protect the cold water fishery while maintaining aquatic community diversity, structure, and function through improved ecological flow releases. A series of four categorical protection levels for describing cold water ecosystem management objectives for waters downstream of the City Delaware Basin Reservoirs was developed by New York and Pennsylvania fishery managers and is shown on Plate 1. These protection levels apply in non-drought years and are defined as follows:

Excellent: Excellent year-round cold water aquatic habitat protection. Summer water temperatures are routinely 68ºF or less and only very rarely exceed a daily maximum of 75ºF. Excellent protection level applies to the West Branch Delaware River from Cannonsville Reservoir to the junction with the East Branch Delaware River, the East Branch Delaware River from Pepacton Reservoir to the hamlet of East Branch, N.Y., and Neversink River from Neversink Reservoir to Bridgeville, N.Y.

Good: River section provides cold water aquatic habitat and thermal protection and maintains opportunities for a cold water fishery. Summer water temperatures will occasionally exceed a daily maximum of 75ºF for short periods and water

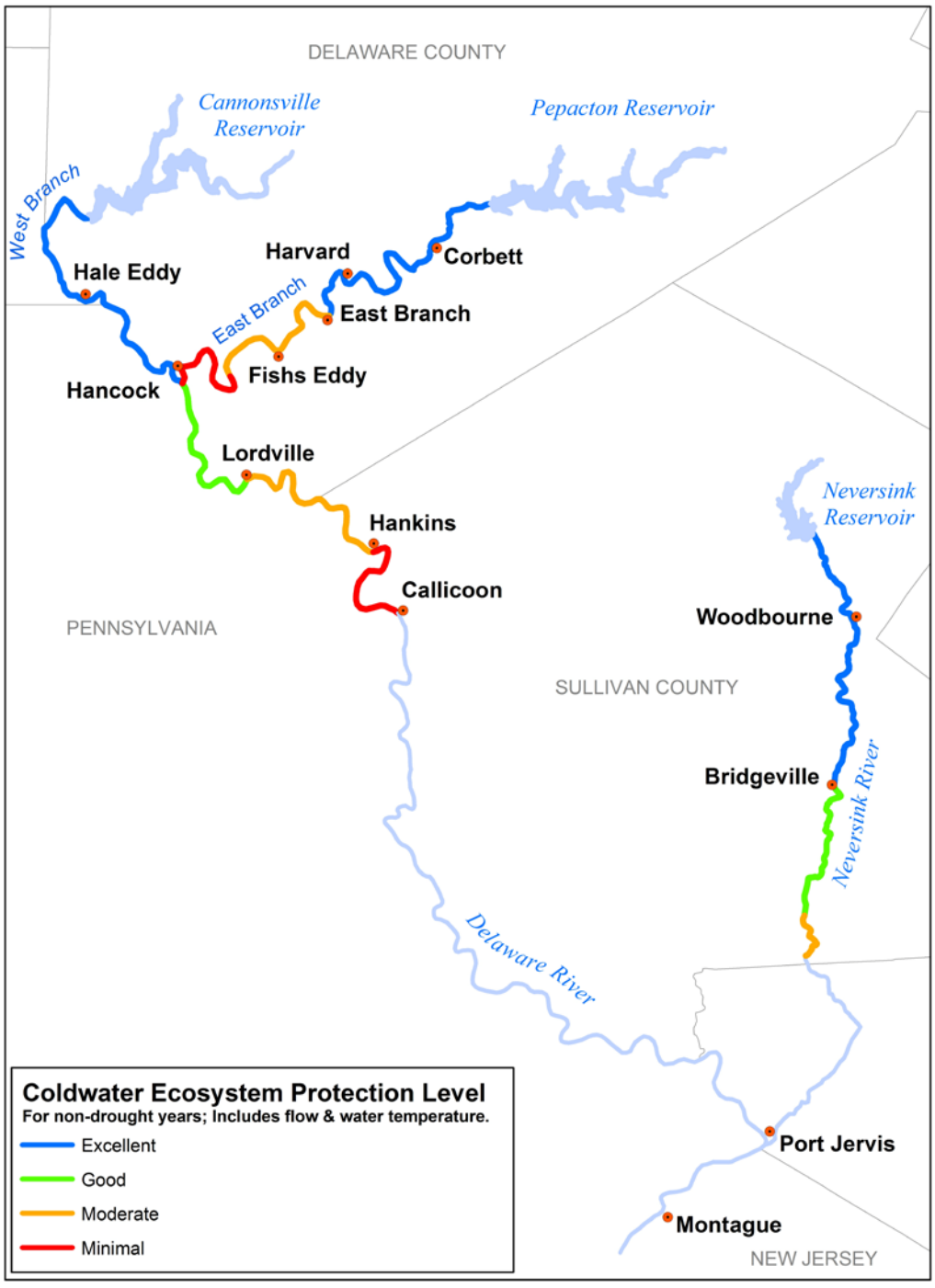
temperatures greater than 68ºF occur more frequently than with the Excellent protection level. Elevated temperatures will occasionally be an issue. Good protection level applies to the Delaware River main stem from the junction of the West and East Branches to Lordville, N.Y. and the Neversink River from Bridgeville, N.Y. to the mouth of Eden Brook near Oakland Valley, N.Y.

Moderate: River sections will experience adequate flow and some thermal protection for cold water species. Seasonal opportunities for a cold water fishery will occur, but thermal benefits will diminish. Moderate protection level applies to the East Branch Delaware River from East Branch, N.Y. to the mouth of Corn Creek near Peas Eddy, N.Y., the Neversink River from the mouth of Eden Brook near Oakland Valley, N.Y. to the Sullivan/Orange County, N.Y. boundary, and the Delaware River main stem from Lordville, N.Y. to Hankins, N.Y.

Minimal: River sections with this designation will experience adequate flow, but only limited thermal protection. The quality of the fishery will be generally seasonal and will vary from year to year. Flows should be adequate to allow trout to reach cold water refugia and to protect dwarf wedgemussel populations in the vicinity of Callicoon, N.Y. Minimal protection level applies to the East Branch Delaware River from the mouth of Corn Creek near Peas Eddy, N.Y. to the junction with the West Branch Delaware River, and the Delaware River main stem from Hankins, N.Y. to Callicoon, N.Y.

The Decree Parties recognize that the degree of protection in waters downstream of the City Delaware Basin Reservoirs will vary according to annual fluctuations in precipitation and temperature, reservoir releases rates, distance from the locations of reservoir releases, and tributary influences. Requirements for protection of the federally endangered dwarf wedgemussel are currently under study and are poorly defined.

Plate 1
Extent and Protection Level of the Cold Water Ecosystem



b. Controlled Releases for Habitat Protection Program

There is hereby established a Habitat Protection Program (HPP), which consists of conservation releases designed for the protection of the cold water fishery below the City Delaware Basin Reservoirs.

The HPP is designed to make enhanced releases, above the base releases given in Table 4a, when an assessment by New York City, using its Operations Support Tool (OST), determines that additional water is available for releases and that any risk to the City's water supply is at an acceptable level. The Base Releases table is designed for drought neutral minimum releases, i.e., no additional drought risk relative to DRBC Docket D-77-20 Revised (Rev. 1), which can be maintained under Normal conditions, independent of inflow or the City's demand.

The City is developing OST, a state-of-the-art forecast-driven analysis and decision support tool that will provide the City with probabilistic predictions of future system status. OST will be deployed in phases, as component modules become available, with the final version expected to be fully operational by 2013. In addition to its principal objective of improving operational decision making in providing a reliable supply of high quality drinking water for 9 million people, OST will also provide assurance that the actions taken to support downstream objectives, such as fish habitat, stream ecosystems, and better discharge mitigation, will not adversely impact water supply reliability. It will allow the City to compare different sets of operating scenarios using real-time system information (e.g., reservoir levels, water quality, streamflows) and forecasts (e.g., streamflows, meteorological drivers) to evaluate the impacts on water supply reliability so that objective risk-based decisions can be made quickly and efficiently.

Under this agreement the City will voluntarily make enhanced stream releases using the Forecast-based Available Water (FAW) as determined by an OST assessment and in accordance with Figures 1 and 2 and the appropriate FAW or the base releases shown in Table 4a. When the assessment indicates that no additional water is available, the City shall make releases in accordance with the currently sustainable base releases shown in Table 4a. The City is under no obligation to make enhanced releases beyond the base releases, when the risk to water supply, as determined by the City using its OST assessment, is unacceptable. Tables 4b through 4g present the releases tables under Normal conditions for pre-determined amounts of FAW.

The City will make available to the Decree Parties the inputs to the OST model, the outputs from the model, and the releases table selection guidelines, including the forecasted probabilistic inflows, the status of the City Delaware Reservoirs, and the operational assumptions applicable to OST-based decisions. OST assessments shall be performed as frequently as necessary to confirm confidence in the selected FAW table but generally not less than monthly. Prior to making a releases table change, the City will provide notification, along with a general description of the rationale of such change to

the Decree Parties, the River Master, and DRBC. The City shall provide the above information through the River Master's website.

As shown in Tables 4a through 4g, each reservoir has a schedule of seasonal releases based on the quantity of combined reservoir usable storage, and the quantity of water available for the HPP.

Figure 2
New York City Delaware System Usable Individual Storage
(Cannonsville, Pepacton, and Neversink Reservoirs)

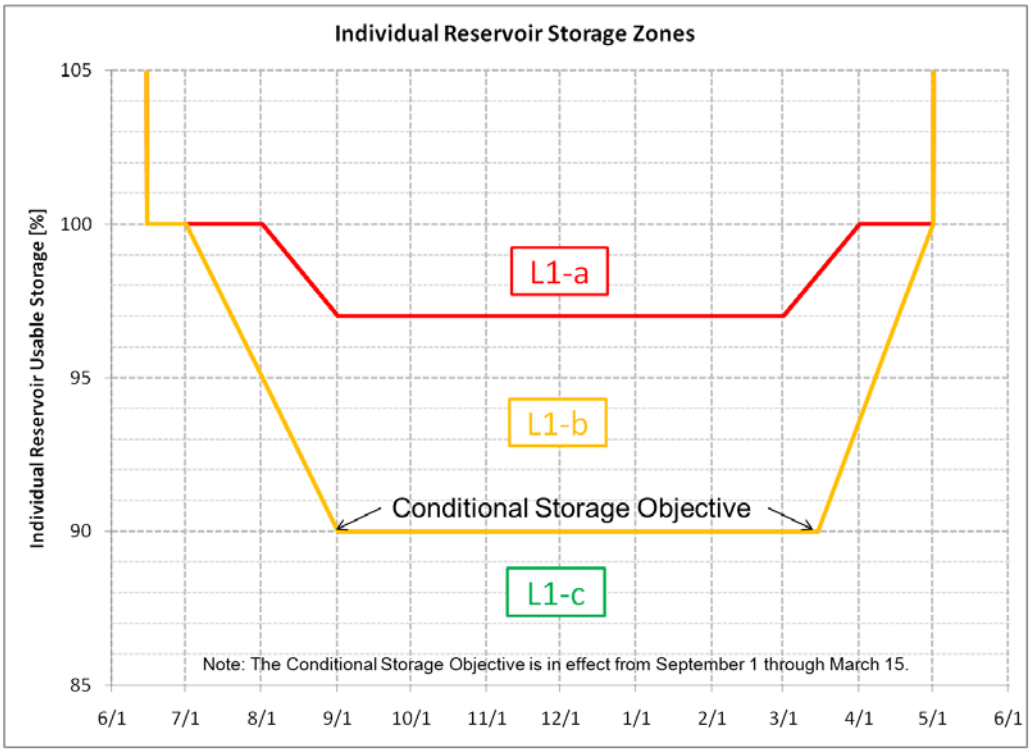


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Table 4a
Schedule of Releases (cfs) during Normal Conditions
Base Releases with no Forecast-based Available Water (FAW)

	Winter		Spring		Summer			Fall		
Cannonsville Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	1500	1500	*	*	*	1500	1500	1500	1500	1500
L1-b	400	400	*	*	*	*	400	400	400	400
L1-c	110	110	200	250	275	275	275	275	175	110
L2-a	75	75	150	200	225	225	225	225	150	75
L2-b	60	60	135	175	190	190	190	190	135	60

	Winter		Spring		Summer			Fall		
Pepacton Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	700	700	*	*	*	700	700	700	700	700
L1-b	300	300	*	*	*	*	300	300	300	300
L1-c	85	85	110	130	150	150	150	150	100	85
L2	50	50	75	90	100	100	100	100	60	50

	Winter		Spring		Summer			Fall		
Neversink Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	190	190	*	*	*	190	190	190	190	190
L1-b	125	110	*	*	*	*	150	150	150	125
L1-c	65	65	85	100	110	110	110	100	75	65
L2	35	35	55	65	75	75	75	65	50	35

* Indicates storage zone not present at this time period; release is entry in cell below.

Table 4b
Schedule of Releases (cfs) during Normal Conditions
Releases with 10 mgd Forecast-based Available Water (FAW)

	Winter		Spring		Summer			Fall		
Cannonsville Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	1500	1500	*	*	*	1500	1500	1500	1500	1500
L1-b	400	400	*	*	*	*	400	400	400	400
L1-c	125	125	225	300	300	300	300	300	200	125
L2-a	85	85	160	235	245	245	245	235	160	85
L2-b	70	70	140	200	210	210	210	200	140	70

	Winter		Spring		Summer			Fall		
Pepacton Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	700	700	*	*	*	700	700	700	700	700
L1-b	300	300	*	*	*	*	300	300	300	300
L1-c	85	85	110	130	150	150	150	150	110	85
L2	55	55	75	100	110	110	110	100	75	55

	Winter		Spring		Summer			Fall		
Neversink Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	190	190	*	*	*	190	190	190	190	190
L1-b	125	110	*	*	*	*	150	150	150	125
L1-c	70	70	85	100	110	110	110	100	85	70
L2	40	40	60	75	80	80	80	75	60	40

* Indicates storage zone not present at this time period; release is entry in cell below.

Table 4c
Schedule of Releases (cfs) during Normal Conditions
Releases with 20 mgd Forecast-based Available Water (FAW)

	Winter		Spring		Summer			Fall		
Cannonsville Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	1500	1500	*	*	*	1500	1500	1500	1500	1500
L1-b	500	500	*	*	*	*	500	500	500	500
L1-c	150	200	250	300	325	325	325	325	225	150
L2-a	90	140	175	260	275	275	275	260	170	90
L2-b	80	90	150	220	240	240	240	220	145	80

	Winter		Spring		Summer			Fall		
Pepacton Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	700	700	*	*	*	700	700	700	700	700
L1-b	300	300	*	*	*	*	300	300	300	300
L1-c	100	100	110	130	150	150	150	150	125	100
L2	60	60	85	110	125	125	125	110	85	60

	Winter		Spring		Summer			Fall		
Neversink Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	190	190	*	*	*	190	190	190	190	190
L1-b	125	110	*	*	*	*	150	150	150	125
L1-c	70	70	85	100	110	110	110	100	85	70
L2	45	45	65	80	90	90	90	80	65	45

* Indicates storage zone not present at this time period; release is entry in cell below.

Table 4d
Schedule of Releases (cfs) during Normal Conditions
Releases with 35 mgd Forecast-based Available Water (FAW)

	Winter		Spring		Summer			Fall		
Cannonsville Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	1500	1500	*	*	*	1500	1500	1500	1500	1500
L1-b	600	600	*	*	*	*	600	600	600	600
L1-c	175	250	300	375	400	400	400	375	275	175
L2-a	110	175	225	300	325	325	325	300	210	110
L2-b	90	115	175	250	275	275	275	250	150	90

	Winter		Spring		Summer			Fall		
Pepacton Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	700	700	*	*	*	700	700	700	700	700
L1-b	300	300	*	*	*	*	300	300	300	300
L1-c	100	100	110	130	150	150	150	150	125	100
L2	70	70	90	125	140	140	140	125	90	70

	Winter		Spring		Summer			Fall		
Neversink Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	190	190	*	*	*	190	190	190	190	190
L1-b	125	110	*	*	*	*	150	150	150	125
L1-c	75	75	100	100	125	125	125	100	100	75
L2	50	50	70	90	100	100	100	90	75	50

* Indicates storage zone not present at this time period; release is entry in cell below.

Table 4e
Schedule of Releases (cfs) during Normal Conditions
Releases with 50 mgd Forecast-based Available Water (FAW)

	Winter		Spring		Summer			Fall		
Cannonsville Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	1500	1500	*	*	*	1500	1500	1500	1500	1500
L1-b	700	700	*	*	*	*	700	700	700	700
L1-c	200	325	400	400	500	500	500	400	325	200
L2-a	125	200	250	325	400	400	400	325	250	125
L2-b	100	150	200	275	300	300	300	275	150	100

	Winter		Spring		Summer			Fall		
Pepacton Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	700	700	*	*	*	700	700	700	700	700
L1-b	500	500	*	*	*	*	500	500	500	500
L1-c	150	150	150	150	150	150	150	150	150	150
L2	80	80	100	125	140	140	140	140	100	80

	Winter		Spring		Summer			Fall		
Neversink Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	190	190	*	*	*	190	190	190	190	190
L1-b	125	110	*	*	*	*	150	150	150	125
L1-c	75	75	100	100	140	140	140	100	100	75
L2	50	50	75	90	100	100	100	90	75	50

* Indicates storage zone not present at this time period; release is entry in cell below.

Table 4f
Schedule of Releases (cfs) during Normal Conditions
Releases with 75 mgd Forecast-based Available Water (FAW)

	Winter		Spring		Summer			Fall		
Cannonsville Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	1500	1500	*	*	*	1500	1500	1500	1500	1500
L1-b	700	700	*	*	*	*	700	700	700	700
L1-c	225	475	475	525	600	600	600	475	375	225
L2-a	150	400	400	400/450+	500/525+	500/525+	500/525+	400	300	150
L2-b	100	150	200	275	300	300	300	275	200	100

	Winter		Spring		Summer			Fall		
Pepacton Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	700	700	*	*	*	700	700	700	700	700
L1-b	500	500	*	*	*	*	500	500	500	500
L1-c	150	150	150	150	150	150	150	150	150	150
L2	100	100	100	125	140	140	140	140	100	100

	Winter		Spring		Summer			Fall		
Neversink Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	190	190	*	*	*	190	190	190	190	190
L1-b	125	110	*	*	*	*	150	150	150	125
L1-c	75	75	100	100	140	140	140	100	100	75
L2	55	55	90	90	110	110	110	90	90	55

* Indicates storage zone not present at this time period; release is entry in cell below.
\+ Second entry after slash indicates reduction in release rate for New Jersey Diversion Offset Bank.

Table 4g
Schedule of Releases (cfs) during Normal Conditions
Releases with 100 mgd Forecast-based Available Water (FAW)

	Winter		Spring		Summer			Fall		
Cannonsville Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	1500	1500	*	*	*	1500	1500	1500	1500	1500
L1-b	700	700	*	*	*	*	700	700	700	700
L1-c	225	475	475	525	600	600	600	475	375	225
L2-a	150	400	400	400/450+	500/525+	500/525+	500/525+	400	300	150
L2-b	150	400	400	400/450+	500/525+	500/525+	500/525+	400	300	150

	Winter		Spring		Summer			Fall		
Pepacton Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	700	700	*	*	*	700	700	700	700	700
L1-b	500	500	*	*	*	*	500	500	500	500
L1-c	150	150	150	150	150	150	150	150	150	150
L2	100	100	100	140	140	140	140	140	100	100

	Winter		Spring		Summer			Fall		
Neversink Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	190	190	*	*	*	190	190	190	190	190
L1-b	125	110	*	*	*	*	150	150	150	125
L1-c	75	75	100	100	140	140	140	100	100	75
L2	55	55	90	90	110	110	110	90	90	55

* Indicates storage zone not present at this time period; release is entry in cell below.
\+ Second entry after slash indicates reduction in release rate for New Jersey Diversion Offset Bank.

7. DISCHARGE MITIGATION PROGRAM

In order to enhance flood mitigation provided by the City Delaware Basin Reservoirs, NYC agrees to establish a Conditional Storage Objective (CSO) rule curve in Figure 2. Consistent with good practices for water supply reservoirs, and in order to ensure that sufficient resources are available during an extended dry period to support both lower basin and NYC needs, it is essential to ensure that the City Delaware Basin Reservoirs are filled on or around June 1st every year. To accomplish this, the CSO (boundary between the L1-b and L1-c storage zones in Figure 2 must be limited and ramped. For the duration of the current program NYC shall endeavor, to the maximum extent possible without impacting water supply reliability, to maintain reservoir levels at the CSO, thus creating a high probability of maintaining ten (10) percent void spaces from September 1, 2012 through March 15, 2013 to help mitigate flooding events. In determining the releases needed to maintain the CSO, the following parameters are considered in the OST evaluation: forecasted inflows over the next seven (7) days, FAW table releases in effect over the next seven (7) days, anticipated diversions over the next seven (7) days, snow water equivalent in the watershed ranging from 50 percent to 100 percent as appropriate, and the current usable reservoir storage. Based on any projected seven (7) day storage surplus, new release rates, above the FAW table releases in effect, are calculated and spread over the upcoming 7-day period, within the limitations of the release works for each reservoir.

Discharge Mitigation Program releases are designed to help mitigate the effects of flooding immediately below the City Delaware Basin Reservoirs. When the combined reservoir usable storage in Figure 1 is in Zone L1, the spill mitigation zone, Figure 2 defines three zones of reservoir-specific storage (L1-a, L1-b and L1-c) relative to two rule curves for each reservoir. Tables 4a through 4g further define spill mitigation releases based on reservoir-specific storage when combined storage is in Zone L1. When combined usable reservoir storage is below Zone L1, reservoir-specific storage zones as defined in Figure 2 are not applicable, and the releases to be made, as set forth in the tables, are for conservation purposes only.

The City shall make discharge mitigation releases from the City Delaware Basin Reservoirs in accordance with the following:

i. For the period June 16 through April 30, if combined reservoir usable storage is in Zone L1 in accordance with Figure 1, discharge mitigation releases shall be made based upon individual reservoir usable storage in accordance with Zones L1-a, L1-b and L1-c as provided in Figure 2 and Tables 4a through 4g. During the period October 1 through April 30:

    a. Fifty percent (50%) of the water equivalent of snow pack in the watersheds above the reservoirs shall be included in the determination of combined and individual reservoir usable storage in relation to Figures 1 and 2.

    b. If, as a result of the combination of current snow pack and predicted meteorological conditions, in the opinion of the New York City Department of Environmental Protection (NYCDEP) any reservoir is anticipated to spill within a period of seven (7) days, then upon notification by NYCDEP to the Decree Parties, the River Master, and DRBC, NYCDEP may, in consideration of possible downstream impacts and the stage and discharge thresholds given in Section 6.a. and Table 5, herein, include up to one hundred percent (100%) of the water equivalent of snow pack in the watersheds above the reservoirs in the determination of combined and individual reservoir usable storage in relation to Figures 1 and 2, unless and until any Decree Party shall notify the NYCDEP, the River Master, and DRBC of its objection to such inclusion. As soon as practicable, NYCDEP shall transition back to the fifty percent (50%) snow pack water equivalent criterion with notification to the Decree Parties, the River Master, and DRBC.

ii. For the period May 1 through June 15, Zones L1-a and L1-b shall not be applicable in accordance with Figure 2, and discharge mitigation releases shall be made in accordance with Zone L1-c as provided in Figure 2 and Tables 4a through 4g.

iii. The NYCDEP and the New York State Department of Environmental Conservation (NYSDEC) reservoir releases managers, upon mutual agreement, may transfer spills to bottom releases to the extent possible at any reservoir.

iv. The current National Weather Service (NWS) flood stage for the West Branch

Delaware River at Hale Eddy is 11.0 feet. Accordingly, Zone L1discharge mitigation releases will not be made from Cannonsville Reservoir when the river stage for the West Branch Delaware River at Hale Eddy is above 9.0 feet, or is forecasted to be above 9.0 feet within 48 hours of planned discharge mitigation releases, and releases shall be made in accordance with Zone L2 through L5 as provided in Tables 4a through 4g. This guidance may be modified at any time upon unanimous consent by the Decree Parties, if additional information demonstrates that a different cautionary stage should be used to limit the discharge mitigation releases.

v. The current NWS flood stage for the East Branch Delaware River at Fishs Eddy is 13.0 ft. Accordingly, Zone L1 discharge mitigation releases will not be made from Pepacton Reservoir when the river stage for the East Branch Delaware River at Fishs Eddy is above 11.0 ft. or is forecast to be above 11.0 ft. within 48 hours of planned discharge mitigation releases, and releases shall be made in accordance with Zone L2 through L5 as provided in Tables 4a through 4g. This guidance may be modified at any time upon unanimous consent by the Decree Parties, if additional information demonstrates that a different cautionary stage should be used to limit the discharge mitigation releases.

vi. The current NWS flood stage for the Neversink River at Bridgeville is 13.0 feet. Accordingly, Zone L1 discharge mitigation releases will not be made from Neversink Reservoir when the river stage for the Neversink River at Bridgeville is above 12.0 feet, or is forecast to be above 12.0 feet within 48 hours of planned discharge mitigation releases, and releases shall be made in accordance with Zone L2 through L5 as provided in Tables 4a through 4g. This guidance may be modified at any time upon unanimous consent by the Decree Parties, if additional information demonstrates that a different cautionary stage should be used to limit the discharge mitigation releases.

vii. Discharge mitigation releases may be suspended from the respective reservoir if NYCDEP and NYSDEC, in consultation with the NWS, determine that ice conditions threaten flood prone areas of the West Branch Delaware River below Cannonsville Reservoir, East Branch Delaware River below Pepacton Reservoir, or Neversink River below Neversink Reservoir.

viii. Discharge mitigation releases will be designed so that the combined discharge from each reservoir's controlled release works and spillway does not exceed the maximum rate given in Table 5 below. Respective controlled releases will be reduced to L2 releases in Tables 4a through 4g, or lower.

ix. To more naturally effect downward or upward transitions between discharge mitigation releases rates identified in Tables 4a through 4g, discharge mitigation releases rates may be ramped, in cooperation with NYSDEC, generally over a period of three days at Cannonsville and Pepacton Reservoirs, and two days at Neversink Reservoir.

x. Modifications to the program necessary to accommodate emergencies, maintenance and repair operations or short-term needs are addressed herein in Section 17, Temporary Suspension or Modification.

Table 5
Maximum Combined Discharge Rates

Reservoir	*Maximum Combined Discharge Rate (cfs)*
Neversink	3,400
Pepacton	2,400
Cannonsville	4,200

8. SALINITY REPULSION

New York City will provide releases to protect the lower basin water supply from salt water movement up the Delaware River in accordance with Table 2 of the Interstate Water Management Recommendations of the Parties to the U.S. Supreme Court Decree of 1954 to the Delaware River Basin Commission pursuant to Delaware River Basin Commission Resolution 78-20 (Good Faith Agreement). As stipulated in the Good Faith Agreement and in accordance with Table 2, herein (Interstate Operation Formula For Adjusting Montague And Trenton Flow Objectives During Drought Emergency (L5) Operations), the City shall make releases to meet the Montague flow objectives according to the location of the salt front.

9. DWARF WEDGEMUSSELS

The Decree Parties will consider any modifications to the current program that may be necessary to avoid taking, harming, or adversely affecting dwarf wedgemussels based upon information from the U.S. Fish and Wildlife Service (USFWS). Studies currently underway by the USFWS and the USGS may inform such modifications, as new information becomes available. These studies will attempt to quantify any relationship between surface water discharge and groundwater flow and temperature at known dwarf wedgemussel sites in the upper Delaware during low flow conditions.

10. LAKE WALLENPAUPACK

The Decree Parties and the DRBC will consider any modifications to the Lake Wallenpaupack operations plan (DRBC Resolution 2002-33) proposed by the operators of Lake Wallenpaupack, if deemed feasible.

11. RECREATIONAL BOATING

The Decree Parties and the DRBC will review and evaluate proposed reservoir releases programs for supporting recreational boating activities in the upper basin, if deemed feasible.

12. ESTUARY AND BAY ECOLOGICAL HEALTH

The Decree Parties and the DRBC will review and evaluate available data during the implementation of the current program and will consider any modifications that may be necessary to maintain the ecological health of the Delaware Estuary and Bay including that of oysters, shellfish and endangered species. The focus of this FFMP element includes the upper Delaware Estuary, lower Delaware Estuary, and Delaware Bay, and such modifications shall be considered in accordance with the criteria described in Section 1.c.

13. WARM WATER AND MIGRATORY FISH

The Decree Parties and the DRBC will review and evaluate available information on the effects of implementation of the current program on warm water fishes that are found in the Delaware River and will consider any modifications to conserve native species of special concern and migratory species.

14. MONITORING AND REPORTING

During the term of this Agreement, temperature monitoring and accounting of IERQ use will be conducted as follows:

a. Temperature:
During the one-year term of the current Agreement, NYSDEC shall monitor water temperatures within the stream reaches defined and categorized in Section 6. NYSDEC will submit to the Decree Parties and to the DRBC, by April 30, 2013, a scientific report summarizing the observed temperatures and assessing biological implications with respect to the stated management goal and defined protection levels of the HPP.

b. IERQ:
In order to assess the extent to which the downbasin parties' rights in the IERQ are preserved under this Agreement, the River Master shall maintain an accounting of the quantity of daily releases from the NYC reservoirs in accordance with Tables 4a through 4g which are attributable to the 3.91 billion gallons (6,045 cfs-days) IERQ component of the tables.

15. REASSESSMENT STUDY

Decisions on the conduct of a water resources reassessment study will be informed by experience gained during the operation of the current program.

16. PERIODIC EVALUATION AND REVISION

The Decree Parties agree that during the entire effective period of this Agreement, as monitoring, reporting, and evaluation may show to be appropriate, the provisions of this Agreement specifying triggers for, and quantities of, releases may be revised through an adaptive management process to further enhance the overall natural resource and economic benefits derived from the releases from the City Delaware Basin Reservoirs. Any resultant action taken shall be subject to the unanimous approval of the Decree Parties.

New York City will continue to collaborate with the Decree Parties in the development of the OST as a flow management tool.

17. TEMPORARY SUSPENSION OR MODIFICATION

From time to time, the Decree Parties and the DRBC may agree that emergencies, maintenance and repair operations, short-term needs, or unanticipated effects of the FFMP may require temporary suspension or modification of one or more of the provisions herein. In considering such temporary suspensions or modifications, the Decree Parties and the DRBC may estimate probabilities and risks associated with such temporary suspensions or modifications. Any resultant action taken, other than modifications to the releases as provided below, shall require the unanimous approval of the Decree Parties.

The City shall provide reasonable advance notification to the Decree Parties, River Master and DRBC of any planned long-term cessation of diversions and/or changes in releases due to emergencies, maintenance and repair operations including possible tunnel shut downs. The City shall establish the scope of work and the work schedule for maintenance and repair operations and shall inform the Decree Parties and the DRBC of such plans as early as practicable. In the absence of unanimous approval of a modified releases schedule as may be required for purposes of necessary maintenance and repair, the City, acting in cooperation with the NYSDEC, will make releases to the best of its ability for the duration of the maintenance or repair work, provided, however, that releases shall be sufficient to meet the Montague flow objective in effect at the time.

Modifications to releases not to exceed seven (7) consecutive days for purposes of maintenance or repair of immediate necessity, or to avoid unreasonable fluctuations in releases, shall not require Decree Party approval, but shall be done in cooperation with NYSDEC, provided, however, that releases shall be sufficient to meet the Montague flow objective in effect at the time.

18. RESERVATIONS

Nothing contained herein shall be deemed to constitute a waiver or modification of, or limitation on, the Decree Parties rights under the Decree. This Agreement shall not be cited as precedent of any intention to waive or modify or limit such rights.

The Decree Parties have authorized certain actions, including but not limited to discharge mitigation releases, in this Agreement to assist in mitigating the impacts of flooding immediately below the NYC Delaware Basin Reservoirs. By incorporating flood mitigation as an objective and taking the actions provided herein, the Decree Parties do not create or assume any duties or obligations regarding flood mitigation or in any way modify any such duties or obligations that may be otherwise prescribed by law.

19. EFFECTIVE DATE

This Agreement shall take effect upon unanimous approval of the Decree Parties and shall expire on May 31, 2013, unless renewed as provided for in Section 20, or if the expiration date is revised.

20. RENEWAL AND REVISION

This Agreement may be revised only through the unanimous written agreement of the Decree Parties. This Agreement, and any unanimously agreed to revisions, may be renewed for an additional one-year period beginning June 1, 2013 by unanimous written agreement of the Decree Parties. If this Agreement is not renewed for an additional one-year period, prior to May 31, 2013, the Decree Parties agree to enter into good faith negotiations to determine a course of action in the absence of such renewal, as provided in Section 21, below.

21. REVERSION

Upon any failure by all Decree Parties to continue this Agreement, and any revisions to this Agreement, in accordance with Section 20, operations shall revert to those provided in DRBC Docket D-77-20 CP (Revised).

Agreement of the Parties to the 1954 U.S. Supreme Court Decree Effective June 1, 2012

STATE OF DELAWARE

The State of Delaware hereby approves this Agreement of the Parties to the U.S. Supreme Court Decree of 1954 for a Flexible Flow Management Program with Operations Support Tool integration and recommends that this Agreement be submitted to the Delaware River Basin Commission for implementation as appropriate through rules, dockets and/ or resolutions, subject in each instance to the further agreement of the Parties as required by Section 3.3(a) of the Delaware River Basin Compact.

_____

Agreement of the Parties to the 1954 U.S. Supreme Court Decree Effective June 1, 2012

STATE OF NEW JERSEY

The State of New Jersey hereby approves this Agreement of the Parties to the U.S. Supreme Court Decree of 1954 for a Flexible Flow Management Program with Operations Support Tool integration and recommends that this Agreement be submitted to the Delaware River Basin Commission for implementation as appropriate through rules, dockets and/ or resolutions, subject in each instance to the further agreement of the Parties as required by Section 3.3(a) of the Delaware River Basin Compact.

_____

Agreement of the Parties to the 1954 U.S. Supreme Court Decree Effective June 1, 2012

CITY OF NEW YORK

The City of New York hereby approves this Agreement of the Parties to the U.S. Supreme Court Decree of 1954 for a Flexible Flow Management Program with Operations Support Tool integration and recommends that this Agreement be submitted to the Delaware River Basin Commission for implementation as appropriate through rules, dockets and/ or resolutions, subject in each instance to the further agreement of the Parties as required by Section 3.3(a) of the Delaware River Basin Compact.

_____

Agreement of the Parties to the 1954 U.S. Supreme Court Decree Effective June 1, 2012

STATE OF NEW YORK

The State of New York hereby approves this Agreement of the Parties to the U.S. Supreme Court Decree of 1954 for a Flexible Flow Management Program with Operations Support Tool integration and recommends that this Agreement be submitted to the Delaware River Basin Commission for implementation as appropriate through rules, dockets and/ or resolutions, subject in each instance to the further agreement of the Parties as required by Section 3.3(a) of the Delaware River Basin Compact.

_____

Agreement of the Parties to the 1954 U.S. Supreme Court Decree Effective June 1, 2012

COMMONWEALTH OF PENNSYLVANIA

The Commonwealth of Pennsylvania hereby approves this Agreement of the Parties to the U.S. Supreme Court Decree of 1954 for a Flexible Flow Management Program with Operations Support Tool integration and recommends that this Agreement be submitted to the Delaware River Basin Commission for implementation as appropriate through rules, dockets and/ or resolutions, subject in each instance to the further agreement of the Parties as required by Section 3.3(a) of the Delaware River Basin Compact.

_____

Appendix 2. Temporary Thermal Release Program for Fishery Protection

AGREEMENT

Temporary Thermal Release Program
For Fishery Protection

Unseasonably high air temperatures in the upper and middle Delaware River Basin this week are expected to result in rapid and large increases in water temperatures in the main stem of the upper and middle Delaware River downstream of New York City Delaware Basin reservoirs. In response to the extraordinary thermal stress conditions on the cold-water fisheries, on June 20, 2012 the Pennsylvania Department of Environmental Protection requested the unanimous approval of the Decree Parties to implement a temporary program of Emergency releases from Cannonsville Reservoir to provide additional thermal protection for the main stem of the upper Delaware River.

On June 20, 2012, the Decree Parties agreed by email notification to the River Master's Office that during the period of June 20 – 21, 2012, emergency thermal releases would be made from Cannonsville Reservoir as follows:

Release an additional 350 cubic feet per second from Cannonsville Reservoir starting immediately upon receipt of the Decree Parties approval and continue the additional release through noon on June 21, 2012. Begin ramping down at noon Eastern time on June 21, 2012, according to established operational procedures, down to releases called for under the operative OST-FFMP release table.

The Interim Excess Release Quantity shall provide the water required for this temporary program.

_____		_____	
State of Delaware	Date	State of New Jersey	Date
_____		_____	
State of New York	Date	Commonwealth of Pennsylvania	Date
_____			
City of New York	Date		

Appendix 3. Temporary Modification to the Release Program for Discharge Mitigation Releases at the Neversink Reservoir Due to Potential Impacts From Hurricane Sandy, Effective October 25, 2012

Temporary Modification to the Release Program For Discharge Mitigation Releases at the Neversink Reservoir Due to Potential Impacts from Hurricane Sandy, Effective October 25, 2012

In order to allow for higher releases, intended to enhance the existing flood mitigation benefits already provided by the Neversink Reservoir, the City seeks agreement from the Decree Parties to begin making discharge mitigation releases proactively in anticipation of the impacts from Hurricane Sandy. The need for a program modification due to unanticipated effects of the FFMP is addressed as follows in Section 17 of the agreement:

17. TEMPORARY SUSPENSION OR MODIFICATION

> From time to time, the Decree Parties and the DRBC may agree that emergencies, maintenance and repair operations, short-term needs, or unanticipated effects of the FFMP may require temporary suspension or modification of one or more of the provisions herein. In considering such temporary suspensions or modifications, the Decree Parties and the DRBC may estimate probabilities and risks associated with such temporary suspensions or modifications. Any resultant action taken, other than modifications to the releases as provided below, shall require the unanimous approval of the Decree Parties.

Upon agreement the City would immediately begin ramping releases up to the L1-a rate, 190 cfs. FFMP downstream flow conditions as described in Section 7*vi* and Table 5 will be closely monitored at all times and releases reduced if required. The higher release rates will continue as necessary as determined by the City or a return to normal program releases is requested by a Decree Party member.

_____
City of New York Date

_____
State of New York Date

_____
State of Delaware Date

_____
State of New Jersey Date

_____
Commonwealth of Pennsylvania Date

For more information about this report, contact:

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Office of the Delaware River Master
U.S. Geological Survey
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Or visit our website at:
https://webapps.usgs.gov/odrm/

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