March 2025

2024 Annual Hydrologic Conditions Report

Technical Report No. 2025-1

Managing, Protecting and Improving the Water Resources of the Delaware River Basin since 1961

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

ACKNOWLEDGEMENTS

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SUGGESTED CITATION

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LIST OF ACRONYMS/ABBREVIATIONS

ACIS	Applied Climate Information System
AHPS	Advanced Hydrologic Prediction Service
DRB	Delaware River Basin
DRBC	Delaware River Basin Commission
NCEP	National Center for Environmental Prediction
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
USGS	United States Geological Survey

DEFINITIONS

Action Stage – The stage which, when reached by a rising stream, represents the level where emergency managers prepare for possible significant hydrologic activity. The action taken varies for each gage location.

Crest – The peak river level during a flood at a specific location. Used synonymously with "flood peak."

Hydrologic Cycle - biogeochemical cycle that describes the movement of water through different reservoirs (oceans, lakes, rivers, groundwater, atmosphere) and its transformations (liquid, solid, gas).

Liquid Water Equivalent - The amount of water that results from melting any form of frozen precipitation (e.g., snow, sleet, or ice), including any liquid precipitation.

Major Flood – Extensive inundation of structures and roads occurs. Significant evacuation and/or transfer of property to higher elevations are necessary. Multiple Homes flooded, moved off foundations. Extreme erosion occurs.

Minor Flood – Minimal or no property damage, but possibly some public threat. Examples of conditions that would be considered minor flooding include water over banks and in yards; no building flooded, but some water may be under buildings built on stilts (elevated); water overtopping roads, but not very deep or fast flowing; inconvenience or nuisance flooding.

Moderate Flood – Some inundation of structures, evacuations of people and/or transfer of property to higher elevations (e.g., move cars, water rescues from flooded streets). During a moderate flood, water is deep enough over the road to make driving unsafe.

Reported flood locations: The flooding events summarized in this report are based on information provided by the Middle Atlantic River Forecast Center. The locations referenced are flood forecast and reporting locations from the Advanced Hydrologic Prediction Service website. Flooding may have occurred at other locations in the basin. The impacts of flash flooding are not detailed herein.

Stage – The level of the water above an arbitrary point in the river (commonly measured in feet)

Water Level – The surface level of a body of water

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HYDROLOGIC CONDITIONS IN 2024

The summarized components of the hydrologic cycle under observation include precipitation, streamflow, storage, groundwater and salt front location. During 2024, the Delaware Basin experienced a mix of wet and dry periods, with significant drier conditions beginning in the fall. Each of the four states declared either a drought watch or warning in some or all of their counties in the Delaware River Basin. The year ended with a large precipitation event in December, resulting in flooding in two upper basin tributaries. Groundwater levels were mostly normal in Delaware and New Jersey, while in drought watch in New York and Pennsylvania. Levels in these wells had slightly improved by December. The salt front was between RM 58 and RM 68 until mid-September, when low flows allowed the salt front to move upstream to RM 90, near the Philadelphia airport, on November 20, its most upstream location for the year. With higher flows resulting from rain in November and December, the salt front ended the year at RM 71.

1. PRECIPITATION

The precipitation for 2024 in the Delaware River Basin (DRB) was determined by available individual station reports, radar-based estimates and satellite information. Figure 1 shows a spatial representation of the total precipitation based on data from the Advanced Hydrologic Prediction Service (AHPS). Figure 2 shows the departures from normal precipitation in the Basin over the past year.

The highest amounts of precipitation in 2024 were observed in the upper Basin near the Catskill Mountains in New York and in Northeastern Pennsylvania, ranging from 55 to 65 inches. These areas received above normal precipitation for the year. Areas near Delaware Bay received precipitation amounts between 35 and 45 inches, slightly below normal precipitation for the year. Slightly below average precipitation also occurred in Schuylkill, Berks, Chester and Delaware Counties in Pennsylvania and in Southern New Jersey, with amounts also ranging from 35 to 45 inches. Except for the upper Basin, the rest of the Basin received below normal precipitation for the year. In some locations, there was a deficit of more than six inches (Figure 2). Reported values include the liquid water equivalent for snow[i].

Table **1** presents the annual, normal and maximum precipitation, based on data from 1990 to 2021, for ten stations located within or close to the Delaware River Basin. The departure from normal and the rank for each station based on the number of years of data is also presented. The highest amount of precipitation, 55.38 inches (5.16 inches above normal) was reported at Mount Pocono, Pa. Below-normal precipitation occurred at seven of the stations. Above normal precipitation occurred at two stations, Callicoon N.Y. and Mount Pocono, Pa. The lowest amount of precipitation, 35.30 inches (0.58 inches below normal), occurred in Millville, N.J. In Sussex, N.J. and Trenton, N.J., there was an annual shortfall of 4.7 and 8.23 inches, respectively. Portions of western Pennsylvania within the DRB received 10 inches less than the average precipitation for the year, based on ACIS station data. Most of the middle and lower Basin experienced below average precipitation (Figure 2).

The monthly precipitation at nine locations within the Basin is presented as bar charts in Figure 3, indicating the variation in monthly amounts throughout the year. The wetter months were January, March and August. High volume events in January, March and April caused tributary flooding in the lower Basin (Table B- 1, Table B-2, Table B-3, Table B-4, and Table B-5). The driest months were February, May, September and October. In October, Trenton, Philadelphia, Wilmington and Millville stations received no precipitation. Dry conditions throughout the Basin in the fall led to statewide drought watches issued in Delaware, Pennsylvania, New York and New Jersey. As of the end of the year, New Jersey, Berks County, Pa. and Schuylkill County, Pa. were in a drought warning. Figures and a table summarizing observed, normal and maximum precipitation amounts are presented by station in Appendix A.

Table 1. Total Annual Precipitation at select weather stations in the DRB. Note: Normal precipitation is based on a precipitation average between 1990-2021[1].

Station	Number of Years Reporting	2024 Precipitation Total (inches)	Normal Precipitation (inches)	Departure (inches)	Annual Rank (Lower = Wetter)	Max Annual Precipitation (inches)
Callicoon, NY	15	53.63	50.22	3.41	7	75.18 (2011)
Mount Pocono, PA	26	55.38	50.22	5.16	12	82.69 (2011)
Sussex, NJ[2]	25	41.41	48.73	-8.23	10	64.22 (2011)
Allentown, PA	85	42.06	42.11	-0.05	51	71.72 (2011)
Trenton, NJ	28	40.90	45.47	-4.57	23	62.96 (2018)
Reading, PA	28	41.69	41.74	-0.05	19	68.08 (2018)
Philadelphia, PA	84	39.40	39.44	-0.04	55	64.33 (2011)
Millville, NJ	76	35.85	35.88	-0.58	62	58.57 (1989)
Wilmington, DE	83	43.03	43.08	-0.05	37	61.37 (2018)

2. TOTAL SEASONAL SNOWFALL 2023 – 2024

Winter precipitation stored in the snowpack does not contribute to streamflow until it melts in the spring. Figure 4 shows snowfall in the DRB for the 2023-2024 winter season. The northern parts of the Basin received between 5-10 inches of snow, with some areas in the mountainous terrain receiving greater than 20 inches. The middle part of the Basin received between 5-10 inches of snow. The lower half of the Basin, below Trenton, received no snow last year. In Philadelphia, there

[1] Source: The Applied Climate Information System (ACIS).

[2] Note: For 2024, data from the Sussex Airport station was used for Sussex, NJ.

was no snow for over 700 days (approximately two years), which finally ended on January 16, 2024, with the first measurable snowfall since 2022.

3. STREAMFLOW

The daily time series and a bar chart with monthly average flows are presented in Figure 5 for four selected locations in the DRB: Montague and Trenton along the Delaware River, Bethlehem on the Lehigh River and Philadelphia on the Schuylkill River. High flows occurred in January, February and March due to two large precipitation events, and as early snowmelt reached the river as runoff. April and August experienced high flows because of several storm systems. Monthly flows were approximately 150 to 200 percent normal during January, February, March, April and August, except for the Delaware River at Philadelphia, with the monthly precipitation below normal in February. In the beginning of the year, the four stations either reported very high flows or very low flows.

Low flows occurred in May, June, July, September, October and November because of the absence of or little precipitation during those months. Drier conditions developed in May and continued until August due to below normal precipitation. During those months, flows were between 50-75 percent of the normal amount for the year. In the fall, dry conditions returned and continued to the end of the year. High flow events occurred in the middle of August, creating above normal flows, and in December, with much improved but still below normal average monthly flows. Along the mainstem, low flows occurred in May, June, July, September, October, November and December. The flow was particularly low in October and November (25-50%) after the lack of precipitation in the fall.

4. RESERVOIR STORAGE AND RELEASES

Reservoir releases are used to augment river flows for multiple purposes. Releases from Cannonsville, Pepacton and Neversink in the upper Basin are made to meet the Montague Flow Objective and maintain the tailwater fishery. Releases from Beltzville and Blue Marsh in the lower Basin are used to support the Trenton Flow Objective, which was established to maintain freshwater flows in the estuary. Low flows during the fall contributed to a need for releases from both upper and lower basin reservoirs to meet flow objectives.

4.1 UPPER BASIN

Three of the four largest reservoirs in the Basin, Cannonsville, Pepacton and Neversink, were constructed by New York City's water supply system. The combined storage of New York City reservoirs is important because it is used to determine drought status in the Basin and the associated drought management actions related to out-of-Basin diversions and flow objectives (Delaware River Basin Water Code, 18 CFR Part 410). Combined storage in the three New York City (NYC) reservoirs is presented as a daily time series in Figure 6. At the beginning of the year, the combined storage was approximately 270 BG, or 101.1 percent. Reservoir levels remained near 100 percent in January and from February until mid-May. For the month of January, the reservoirs spilled 15.8 BG, 22.5 BG between March 9 – 28, 29.4 BG between April 1 – 24 and 0.08 BG between May 1 – 8, for a total of 67.8 BG spilled in 2024. (Figure 7).

Reservoir levels began decreasing in May due to higher releases in preparation for the aqueduct repair project (Appendix C) along with below normal precipitation in May, June and July. During the summer months, the combined storage decreased until mid-August due to typically high summer diversion and higher-than-normal releases in preparation for the aqueduct repair project. Two heavy rain events, and associated reductions in diversions and releases, increased the storage by approximately 25 BG. The storage then began to decrease again due to the lack of rainfall, high diversions in preparation of the aqueduct closure and the need for release to meet the Montague Flow Objective. Although the aqueduct was closed on October 1st and diversions ceased, the storage continued to decrease, due to little to no rainfall in October and large releases made to meet the Montague Flow Objective. Based on predictions that below normal rainfall might continue, the aqueduct repair project was paused on November 18 to conserve storage in the NYC reservoirs. The minimum storage during the year was 133.3 BG (49.9 percent), which occurred on November 25, and was 23.3 BG above the drought watch curve. With some rainfall and the reduction in the conservation releases on December 1, storage began to increase. A large precipitation event in December raised the storage through the end of the year to 185.8 BG (69.5 percent), even though the aqueduct was reopened on December 14 and diversions were resumed.

Releases from the three NYC Delaware River Basin (DRB) reservoirs were in accordance with the 2017 Flexible Flow Management Program (FFMP). The Delaware River Master directed releases to meet the Montague Flow Objective during the fall months. The total volume of water released for Montague in the fall was approximately 48.3 BG, which was released intermittently between September and mid-November. Releases were also made for five days in June, for six days in July and for one day in August. The total volume of water released during this period is 8.6 BG. Thermal mitigation releases were made for seven days in June, seven days in July and two days in August, when water temperatures were in danger of exceeding 25 degrees Celsius at Lordville, N.Y. The amount of water used for thermal releases was 1.03 BG (1590 cfs-days). Three rapid flow change mitigation releases were made between November 20 - 22, using 142 million gallons (219 cfs-days). Total releases of 1.87 BG were also made from a bank of water reserved in the New York City reservoirs to support the Trenton Equivalent Flow Objective (TEFO bank).

4.2 LOWER BASIN

The DRBC pays for water supply storage in Beltzville Reservoir (located on the Pohopoco Creek, a tributary of the Lehigh River) and Blue Marsh Reservoir (located on the Tulpehocken Creek, a tributary of the Schuylkill River) for use to augment flows in the Delaware River in support of the Trenton Equivalent Flow Objective (TEFO). At Beltzville Reservoir, until late October, the storage was maintained at the normal pool except for short periods after several high rainfall events (Figure 8). As a result of the large mid-January storm, almost 2 BG of storage was added to the pool. A lack of precipitation and releases needed for TEFO led to a decrease in storage beginning at the end of October. Releases for TEFO were made intermittently on 21 days between October 26 and November 17. In total, 3.03 BG of water was used. At the end of the year, the usable storage in Beltzville Reservoir was 12 BG (87 percent).

Blue Marsh reservoir follows a seasonal rule curve from April 1 through mid-October to create a recreation pool for boating and swimming. The use of a seasonal rule curve provides additional flood control space for spring runoff. At the beginning of the year, the reservoir was slightly above the normal pool. The storage increased by 2.0 BG after the mid-January storm (3.3 inches of precipitation), and the reservoir elevation exceeded the recreation pool level for two days. The storage was near or above the normal winter or recreation pool level, except for higher pool levels caused by larger storm events. Of note is the sharp decrease then increase in storage in August. The recreation pool was released in anticipation of a large rainfall event. The storage did not return to the recreation pool level due to low inflows in September and October and the normal white-water releases. After the “mega release” in October, the storage was at or near winter pool. However, at year’s end, it was one foot above the winter pool due to a large storm event (1.5 inches of precipitation). The change in storage throughout the year at Beltzville is shown in Figure 9.

Merrill Creek Reservoir, located in Phillipsburg, N.J., was constructed by thermoelectric power utilities for the replacement of their consumptive use during periods when the DRBC drought management plan is in effect. Releases from the Merrill Creek during drought conditions allow the power generators to continue to withdraw water up to their full allocation to produce power during drought conditions. The drought management plan was not in effect during 2024, and no releases were required for consumptive replacement from Merrill Creek reservoir.

5. GROUNDWATER

Groundwater conditions are characterized by thirteen representative wells in the Basin states. The individual wells were selected based on their geographic locations and availability of data. The range of conditions (normal, drought watch, drought warning and drought), defined by the USGS or state, represents well levels based on their respective period of record for comparison to observed values for the same day in previous years.[3] At the start of the year, groundwater levels in all but two wells were in the normal range. Levels in all the wells increased to within or above the normal range until June, when water demands begin to increase due to pumping from aquifers. In all wells except those in Southwest N.J., levels increased as the result of high rainfall in August but then began to decrease again due to low or no precipitation. At the end of the year, only three wells had returned to their respective normal ranges. A detailed description of the groundwater conditions for each state, based on its indicator well(s), is summarized below.

5.1 NEW YORK

The USGS groundwater well at Woodbourne, New York, is used to represent the groundwater levels in the upper Basin (Figure 10). Groundwater levels increased above the normal range in response to storms in January. The peak levels occurred in mid-January after another large storm event. Other small peaks occurred in February, March and May after rain events. During late February, groundwater levels decreased and were below normal. Groundwater levels began a decline for the year beginning in mid-April, which continued for the rest of the year. During this time, groundwater levels remained near the normal range but were below from June through August and again from October through December. By the end of the year, levels began to rebound with more precipitation but remained below normal.

5.2 PENNSYLVANIA

Water levels at the wells for the first half of the year were above normal conditions because of average precipitation during previous months and adequate snowpack (Figure 11). Small declines were offset by precipitation events early in the year. The lack of precipitation did not become evident until May, when well levels began to decline. At this point, well levels dipped into the normal range where they remained until fall. By the fall, a serious lack of rainfall caused many of the levels to fall

[3] For the well in Woodbourne, NY, and the wells in New Castle County, DE, only the normal range is defined.

into drought watch stage where they remained through the end of the year. In some PA locations such as Bucks, Delaware, Lebanon, Monroe and Schuylkill counties, well levels dropped into drought emergency due to a serious lack of rainfall in the fall. These wells showed a slight recovery with the precipitation in December, but remained in drought warning. Except for Wayne County, the other wells ended the year in a drought watch or drought warning.

5.3 NEW JERSEY

Two USGS county observation wells represent groundwater conditions in New Jersey: Burlington and Cumberland counties, New Jersey. Both wells began the year in a drought emergency status. Cumberland County well recovered to normal levels by mid-January after several large precipitation events and remained above normal through the end of year. While the area experienced little rainfall in the summer and fall, groundwater levels remained steady and only showed a slight decline. The water levels in Burlington County recovered to normal conditions by February after several precipitation events. The well reached its highest level for the year in May, before declining for the rest of the year due to the lack of rainfall. In mid-September, the well levels fell into drought watch and remained in watch through the end of the year. By the end of the year, the water level in the Cumberland County well was Normal, and the water level in the Burlington County well was in Drought Watch Status (Figure 12).

5.4 DELAWARE

Groundwater levels in Delaware are determined by wells maintained by the Delaware Geological Survey (DGS) in New Castle County. Well levels generally remained in the normal range throughout the year and above the median. The first four months of the year had increases in groundwater levels. By mid-April, the well levels began to decline, which continued through the end of the year. Well levels were within the normal range at the end of the year (Figure 13).

6. SALT FRONT

The salt front is defined as the seven-day average of 250 parts-per-million isochlor. The salt front is used by DRBC as an indicator of salinity intrusion in the Delaware Estuary for reservoir operations. In dry and drought conditions, reservoir releases are made to meet the Trenton Flow Objective, which was established for salinity repulsion in 1983 (Delaware River Basin Water Code). The location of the salt front moves downstream or upstream along the main stem Delaware River as streamflow increases or decreases, respectively. The long-term median monthly locations range from river mile 67 (RM 67) in April (two miles downstream of the Delaware Memorial Bridge) to RM 76 in September (two miles downstream of the Pennsylvania-Delaware State boundary).

In January 2024, the salt front was at RM 58.4 (near the C&D confluence to the Delaware). The salt front oscillated between below RM 55 and RM 68 for the next four months. Beginning in April, the Reedy Island gauge, used to calculate the salt front, was lost due to a storm event, and no data was available until a new gauge was established in late May. On June 6, the salt front was near RM 68 and remained in the normal range of RM 68 to RM 76 until mid-September. Beginning in September, dry conditions developed, and streamflow decreased. With lower flows, the salt front began to move upstream and reached its peak location on November 21 at RM 89.7 (near the Philadelphia International Airport). When flows increased due to more regularly occurring rainfall events, the salt front moved downstream, ending the year at RM 71. The salt front location throughout the year is shown in Figure 14.

7. HYDROLOGIC EVENTS

7.1 DROUGHT

Due to dry conditions, decreasing groundwater levels and other indicators, the October 3, 2024, U.S. Drought Monitor classified northern Del. and southeastern Pa. as experiencing moderate drought conditions, and the remainder of the Basin as abnormally dry. On October 17[4], N.J. declared a statewide drought watch, which was updated to a statewide drought warning on November 13[5]. Delaware issued a statewide drought watch on October 25[6]. New York issued a drought watch for regions II and IIA, which includes six counties in the DRB. By November 18, regions II and IIA were upgraded to drought warning, and the rest of the state was placed under a drought watch. On November 1[7], Pennsylvania issued a drought watch for 33 counties, including 13 in the DRB, and a drought warning for two counties, both in the DRB. Figure 15 shows the

[4] NJDEP Press release: https://dep.nj.gov/newsrel/24_0048/
[5] NJDEP Press release: https://dep.nj.gov/newsrel/24_0054/
[6] DEDNREC Press release: https://news.delaware.gov/2024/10/25/governor-carney-declares-statewide-drought-watch/
[7] PADEP 11/1/2024 Press release: https://www.dep.pa.gov/Business/Water/PlanningConservation/Drought/pages/default.aspx

drought status map for all counties in the Basin, based on indicators defined by each of the Basin states. Conditions improved as the Basin received more regular precipitation. As a result, New York State reverted to drought watch on December 16[8]. The other Basin states remained in either drought watch or drought warning. Implementation of DRBC's drought management plan was not needed because the combined storage in the NYC reservoirs did not decrease to the drought watch level. However, due to mixed signals in weather forecasts and outlooks and the low combined storage, Resolution 2024-07 (Appendix D) was passed to allow for immediate implementation of drought operations if the combined storage met the criteria for a drought watch, which did not occur before the end of the year.

7.2 FLOODING

Several high-volume precipitation events occurred in 2024, resulting in minor and moderate flooding along tributaries in the Basin. In particular, the Neshaminy Creek at Langhorne saw minor flooding and moderate flooding during the January 9 – January 18, March 23 – March 26 and April 2 – April 6 events (Table B- 1, Table B-3 and Table B-4). During the January 9 – 18 event, the following tributaries experienced minor flooding: North Branch Rancocas, Assunpink Creek, Schuylkill River and Brandywine Creek. Moderate flooding occurred along the Brandywine Creek at Chadds Ford, Perkiomen Creek at Graterford, and Neshaminy Creek at Langhorne (Table B- 1,Table B-2 and Table B-3). The March 9 – 14 event led to minor flooding at the West Branch Delaware at Walton (Table B-2). From March 23 – 26, the following tributaries experienced minor flooding: Assunpink, North Branch Rancocas, Brandywine, Neshaminy and Schuylkill River (Table B-3). On April 2 – April 6, four tributaries experienced moderate flooding: North Branch Rancocas, Brandywine, Neshaminy and Schuylkill River (Table B-4). During the Aug 9 – Aug 14 event, five tributaries experienced minor flooding: East Branch Delaware at Fishs Eddy, East Branch at Harvard, West Branch Delaware at Walton, Beaver Kill at Cooks Falls and Brandywine Creek at Chadds Ford (Table B-5). The December 11 – 12 event had two tributaries with minor flooding: Beaver Kill at Cooks Falls and the West Branch Delaware at Walton (Table B-6).

[8] NYDEC 12/16/2024 Press release: https://dec.ny.gov/news/press-releases/2024/12/dec-issues-update-on-statewide-drought-conditions

8. SUMMARY

The hydrologic conditions in the Delaware River Basin for 2024 were characterized by a wet period early in the year, with 3 large precipitation events, and a dry period beginning in the fall and lasting until the end of the year. Flows were above normal during the late winter and early spring due to a few snow and rain events. During the fall, all Basin states issued drought declarations of different levels for some or all their counties in the Basin.

Flooding events in the lower Basin occurred after the January, March and April storms. Reservoir releases were made from upper basin reservoirs for thermal mitigation in June, July and August due to dry conditions, low flow and warmer temperatures. Flows were below normal in the fall due to a lack of precipitation, and reservoir releases were made from the New York City Delaware Basin Reservoirs for the Montague Flow Objective and from the Lower Basin Reservoirs and the TEFO bank for the Trenton Flow Objective. Concerns about low combined storage and the potential continuation of dry conditions led to the suspension of the Delaware Aqueduct Repair project. With precipitation returning in November and a significant rainfall event in December, hydrologic conditions began to improve. A few upper Basin tributaries experienced flooding due to heavy precipitation and associated runoff after the December storms. Groundwater levels fluctuated throughout the year in all four Basin states. The maximum location of the salt front was RM 89.7 on November 21st. Conditions improved by the end of the calendar year but remained abnormally dry.

FIGURES

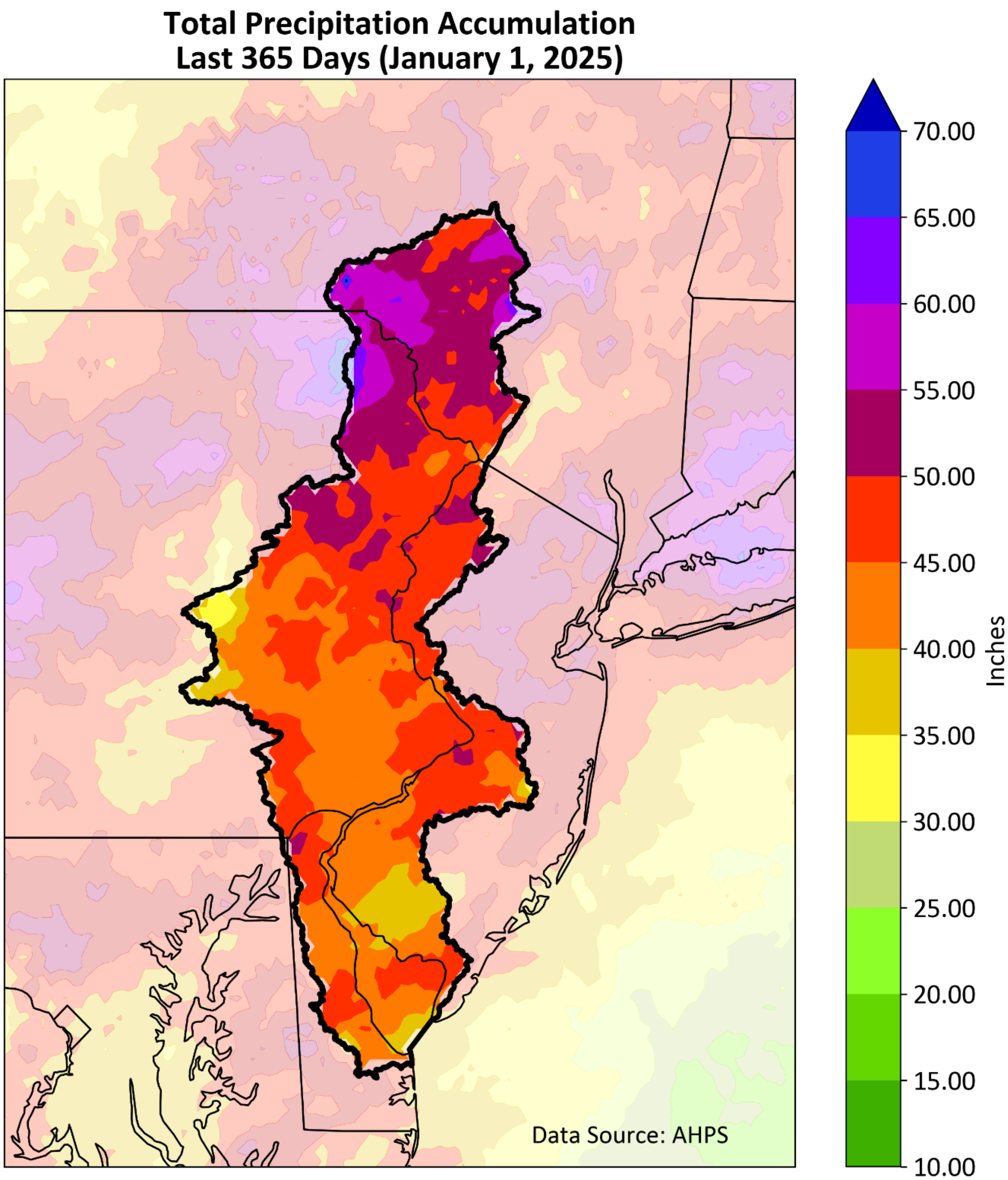


Figure 1: Annual Precipitation in 2024.

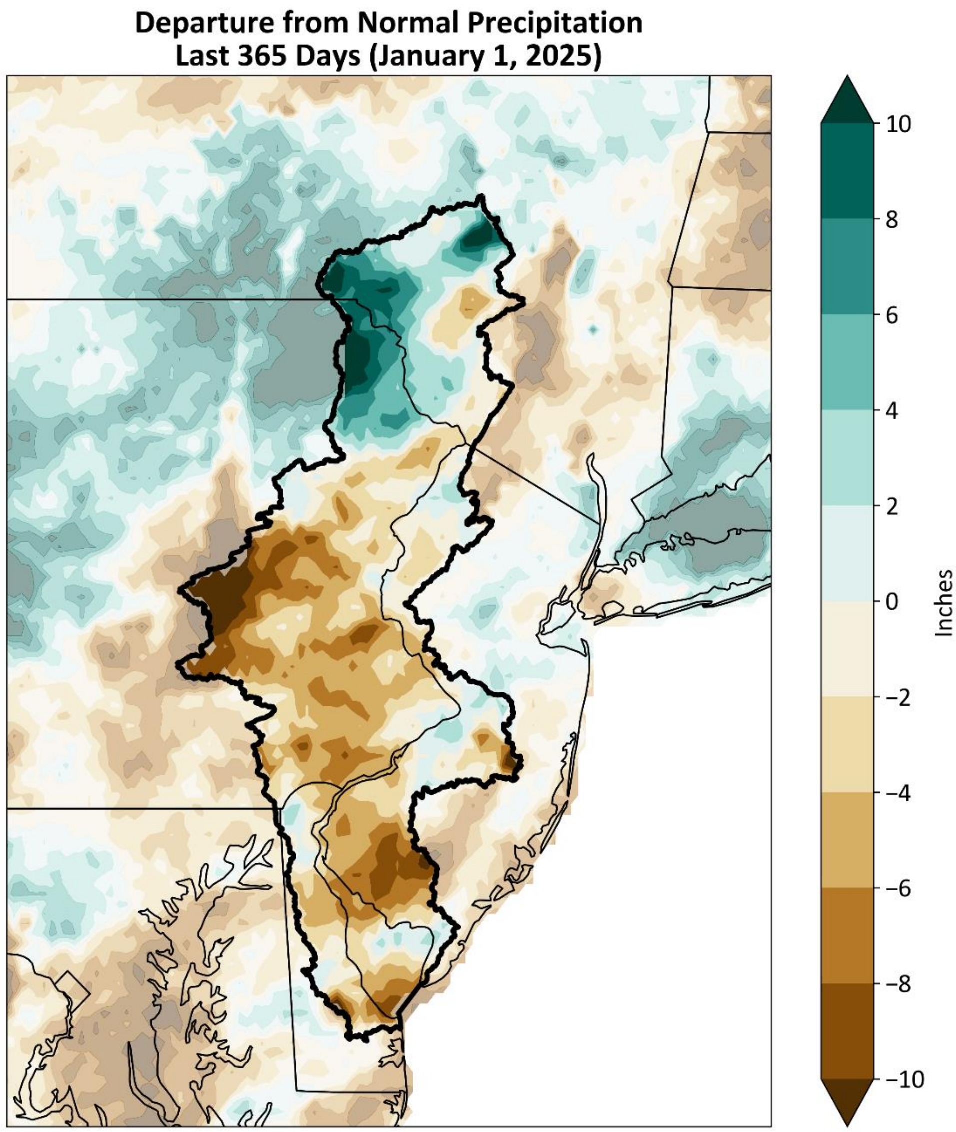


Figure 2: Departure from normal precipitation in the last 365 days.

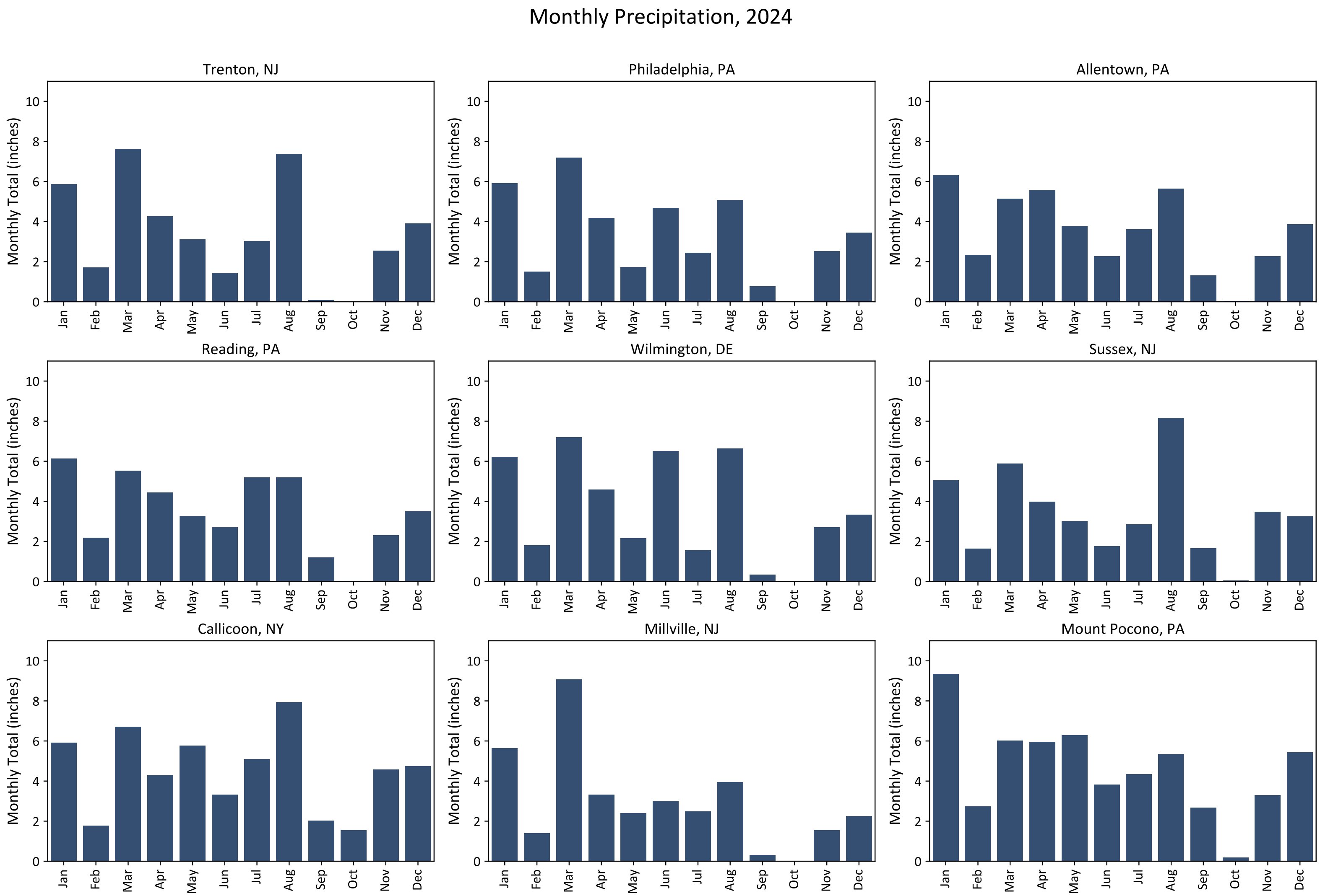


Figure 3: Monthly Precipitation at Nine Regional Weather Stations. Note: Data for Sussex, N.J. was taken from the Sussex Airport station as the old station was discontinued.

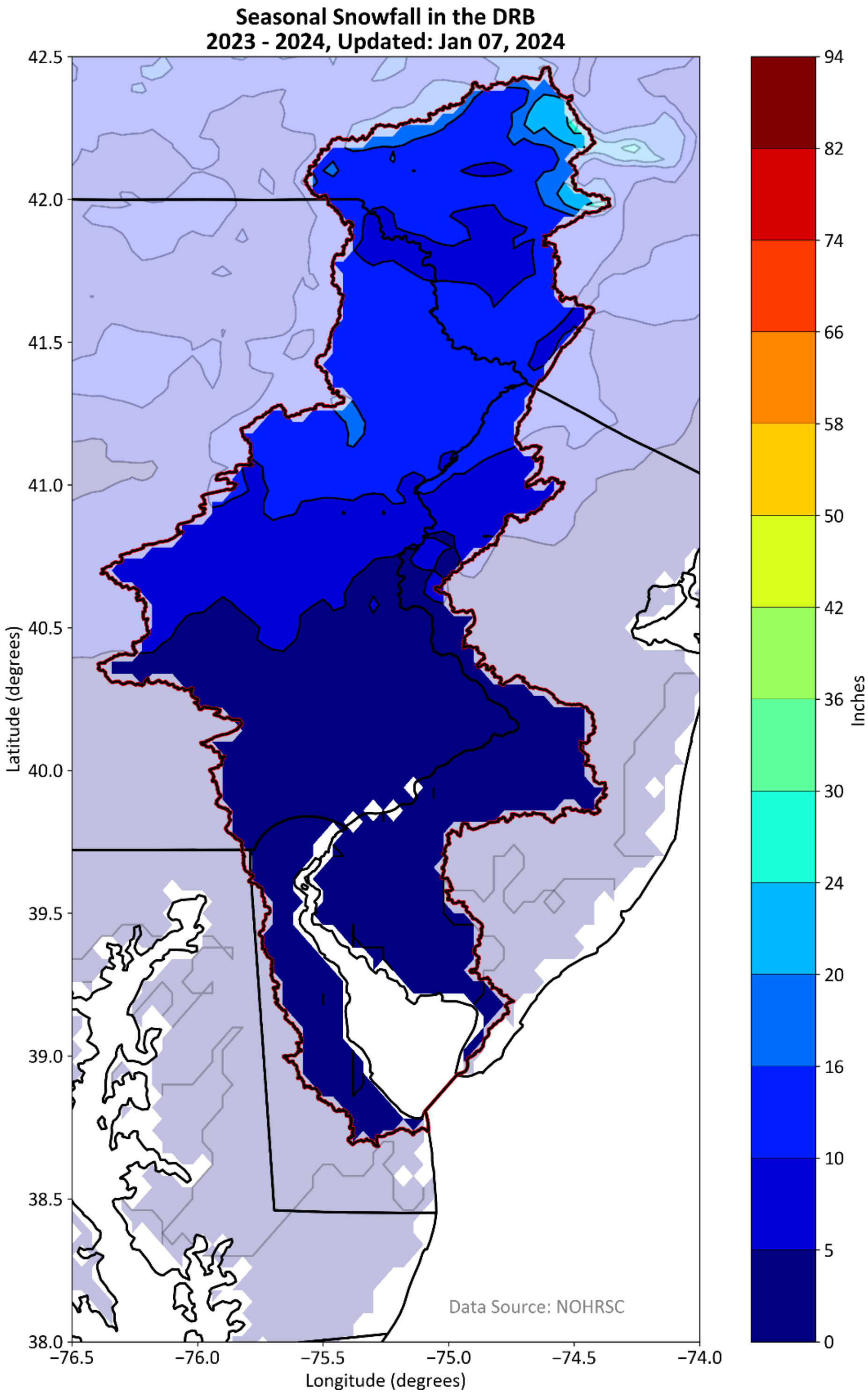


Figure 4:Total Snowfall for the Winter 2023-2024.

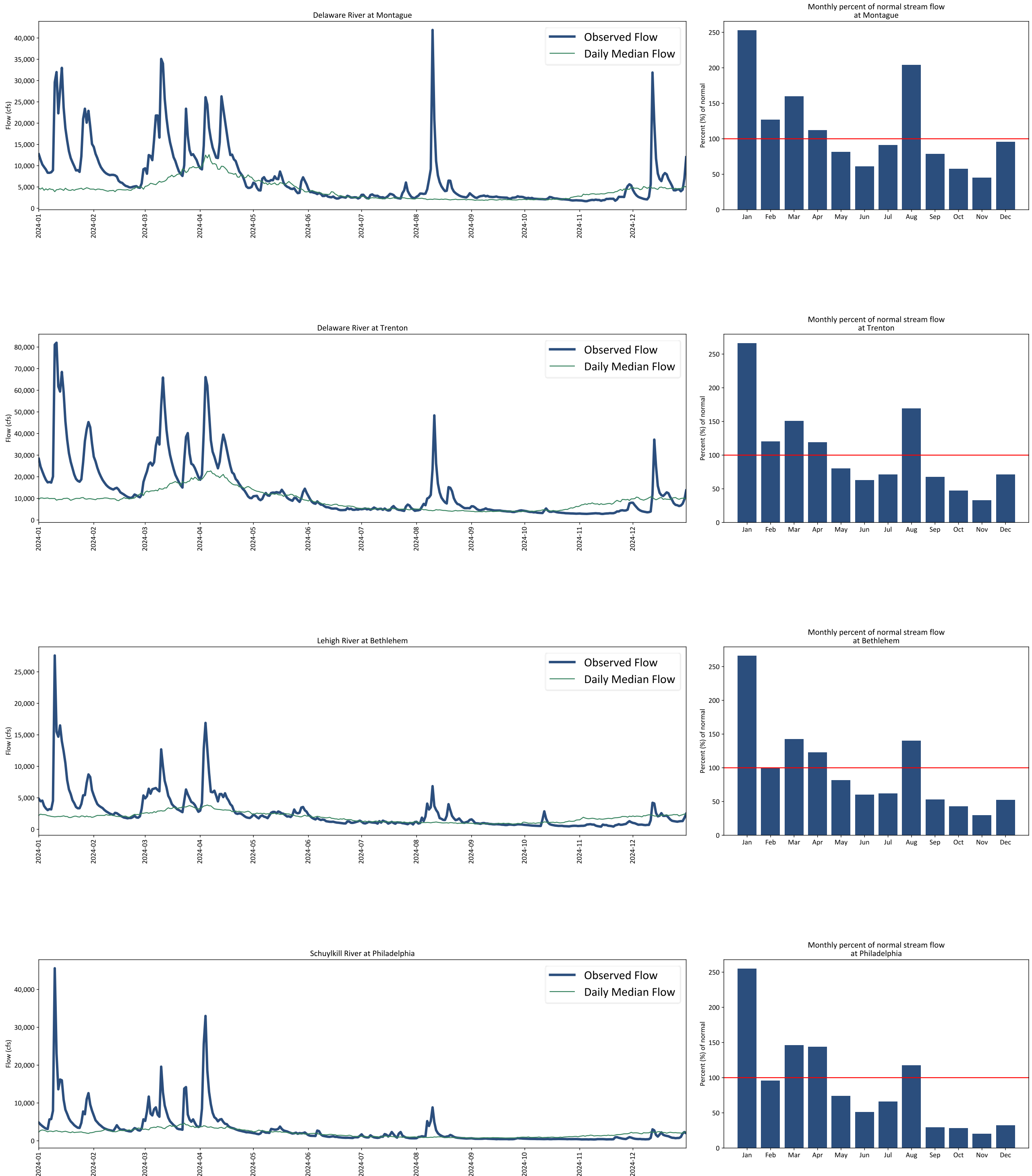


Figure 5: Streamflow and Percent of Normal Streamflow at Four Representative Locations.

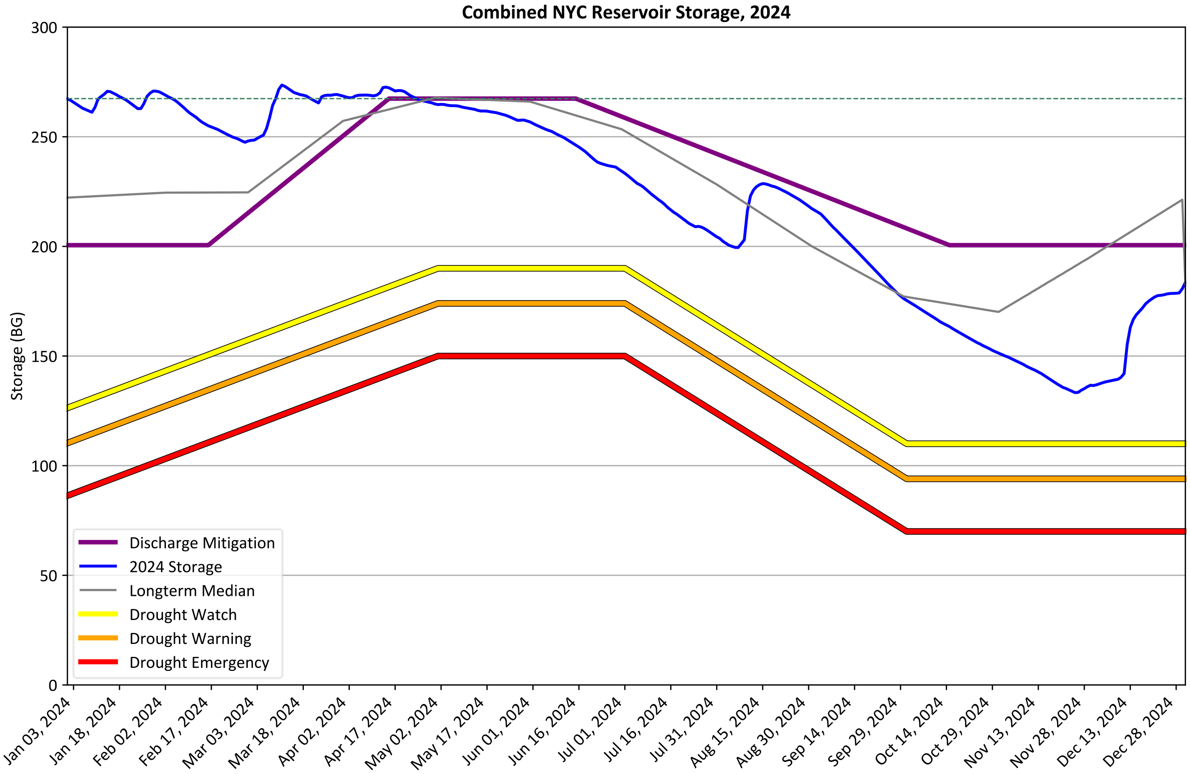


Figure 6: Combined New York City Reservoir Storage for Delaware River Basin Reservoirs (Cannonsville, Pepacton and Neversink).

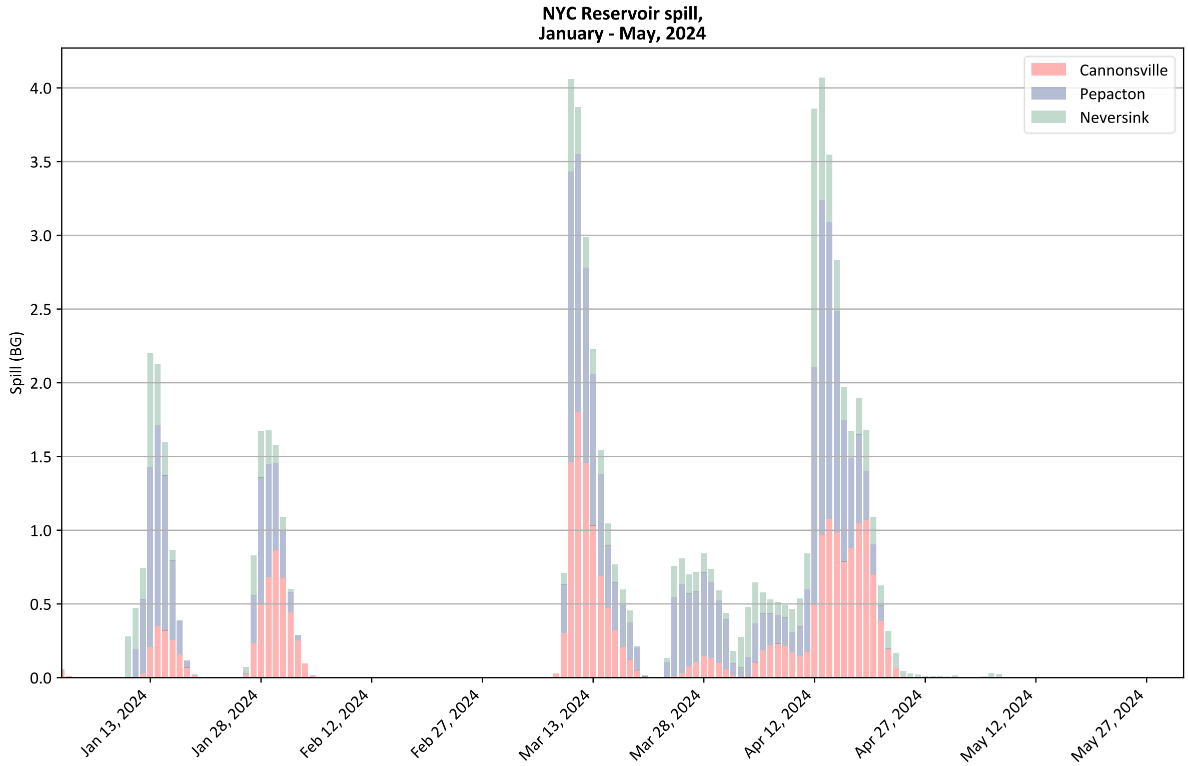


Figure 7: NYC Reservoir Spills (January - May 2024). Note: The total amount spilled over the period was approximately 67.8 BG.

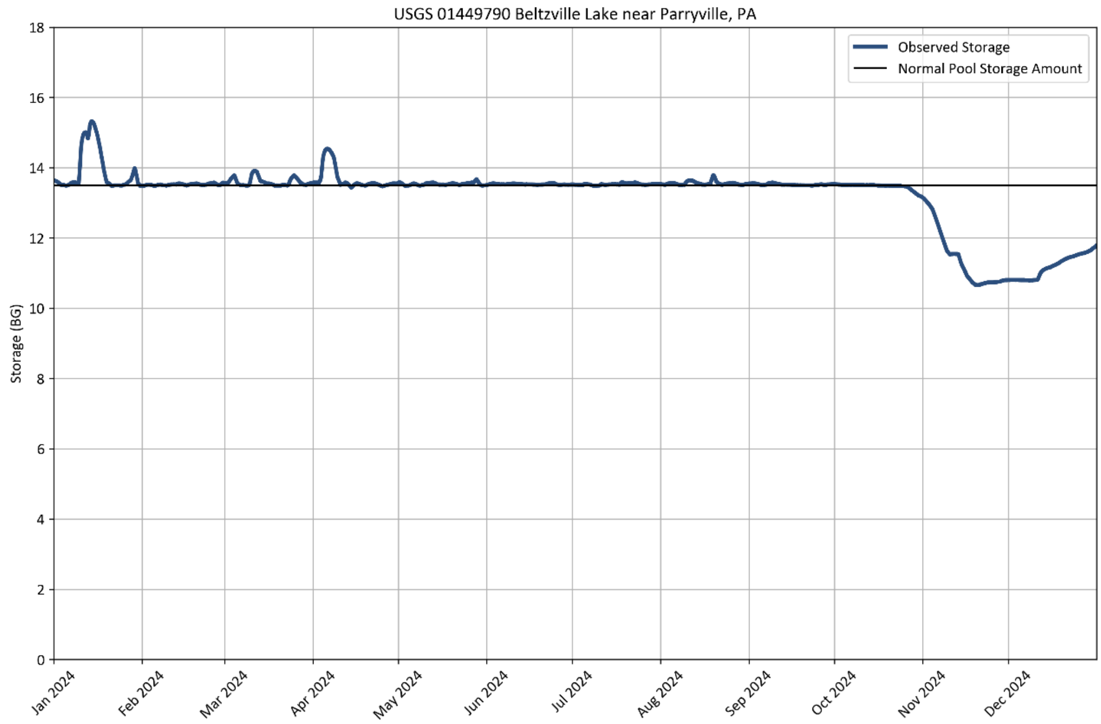


Figure 8: 2024 Beltzville Reservoir Storage.

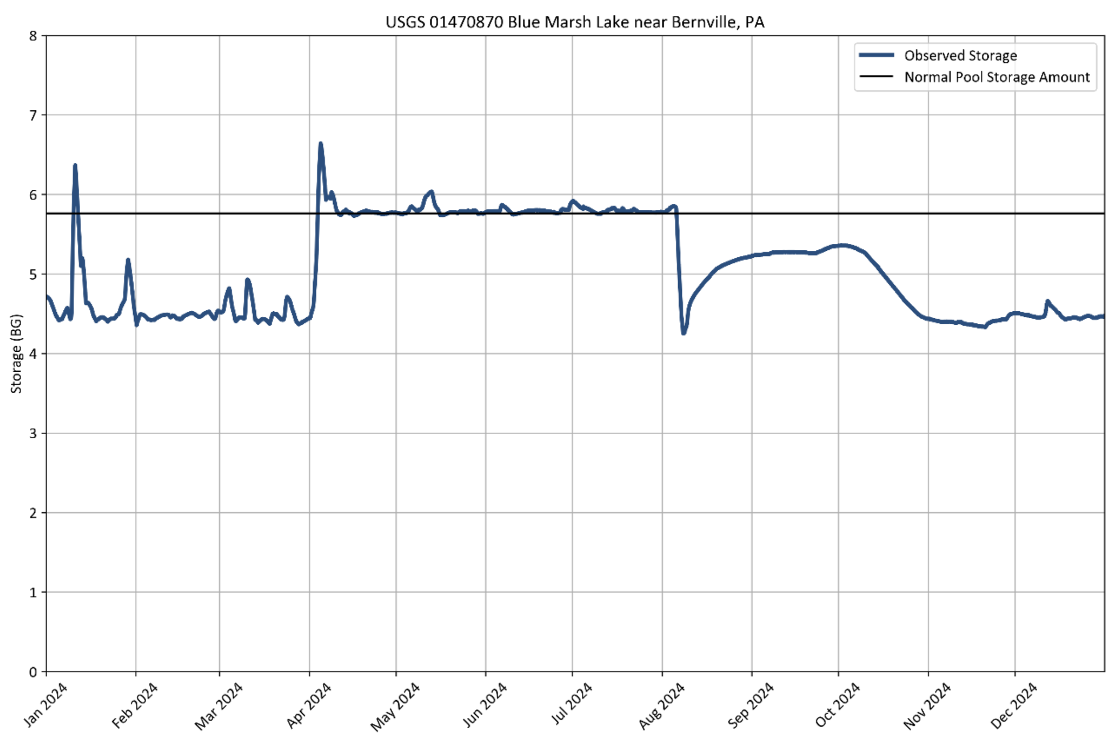


Figure 9: 2024 Blue Marsh Reservoir Storage.

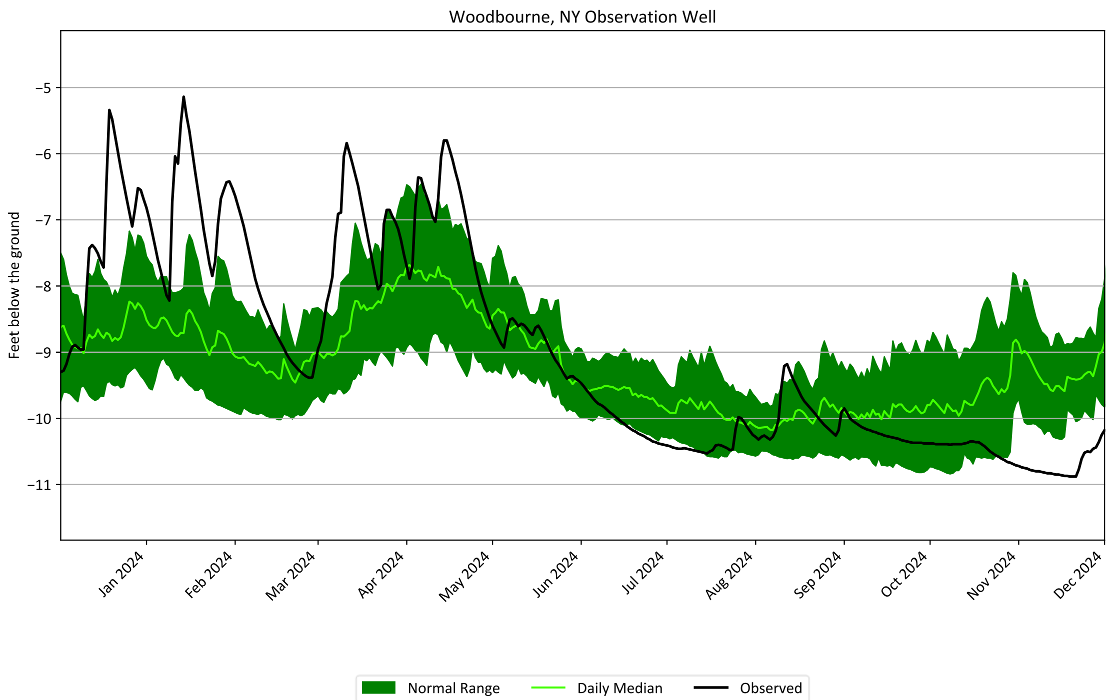


Figure 10: Groundwater Levels, Woodbourne, New York.

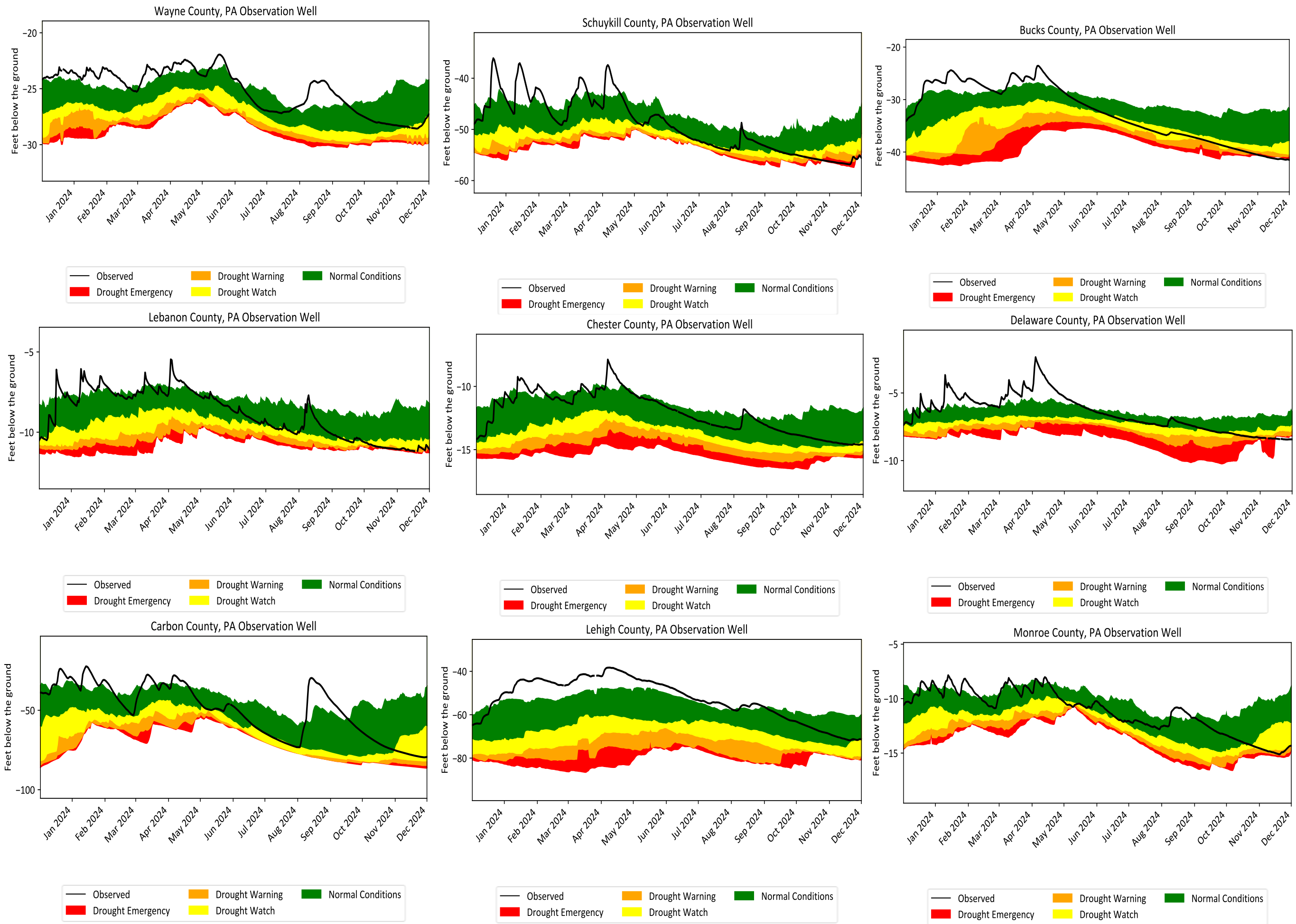


Figure 11: Groundwater Levels at Pennsylvania sites.

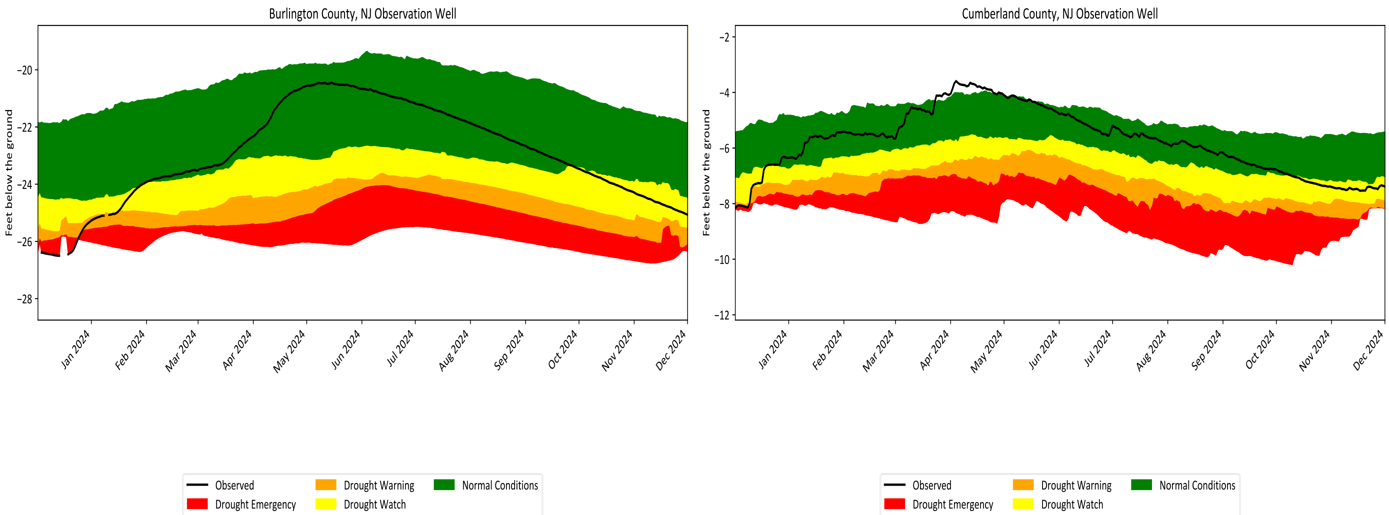


Figure 12: 2024 Groundwater levels at New Jersey sites.

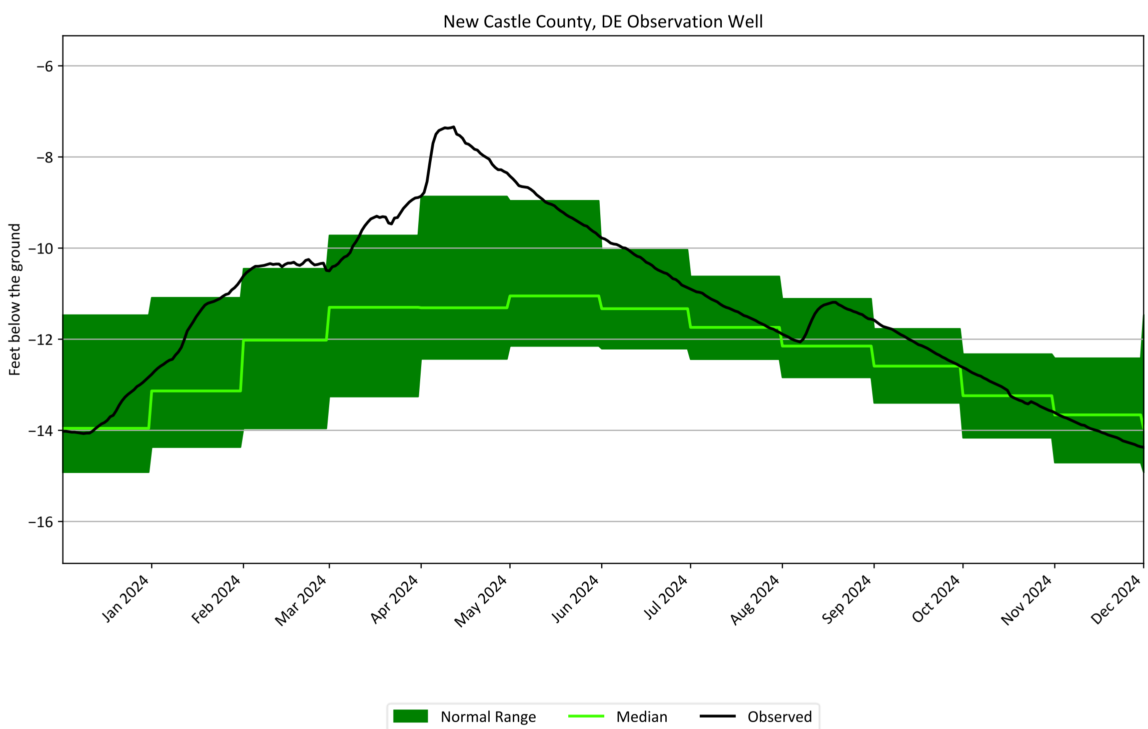


Figure 13: Groundwater levels at New Castle County, Delaware site.

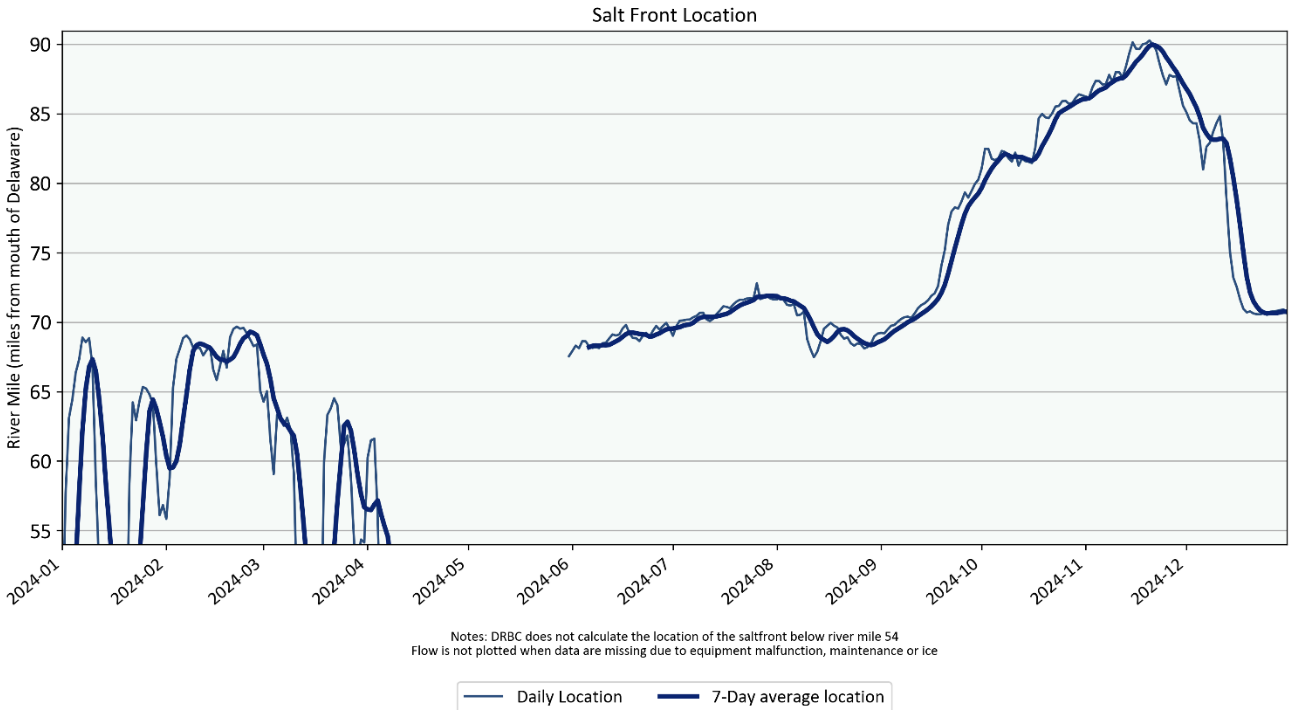


Figure 14: Salt front location in 2024.

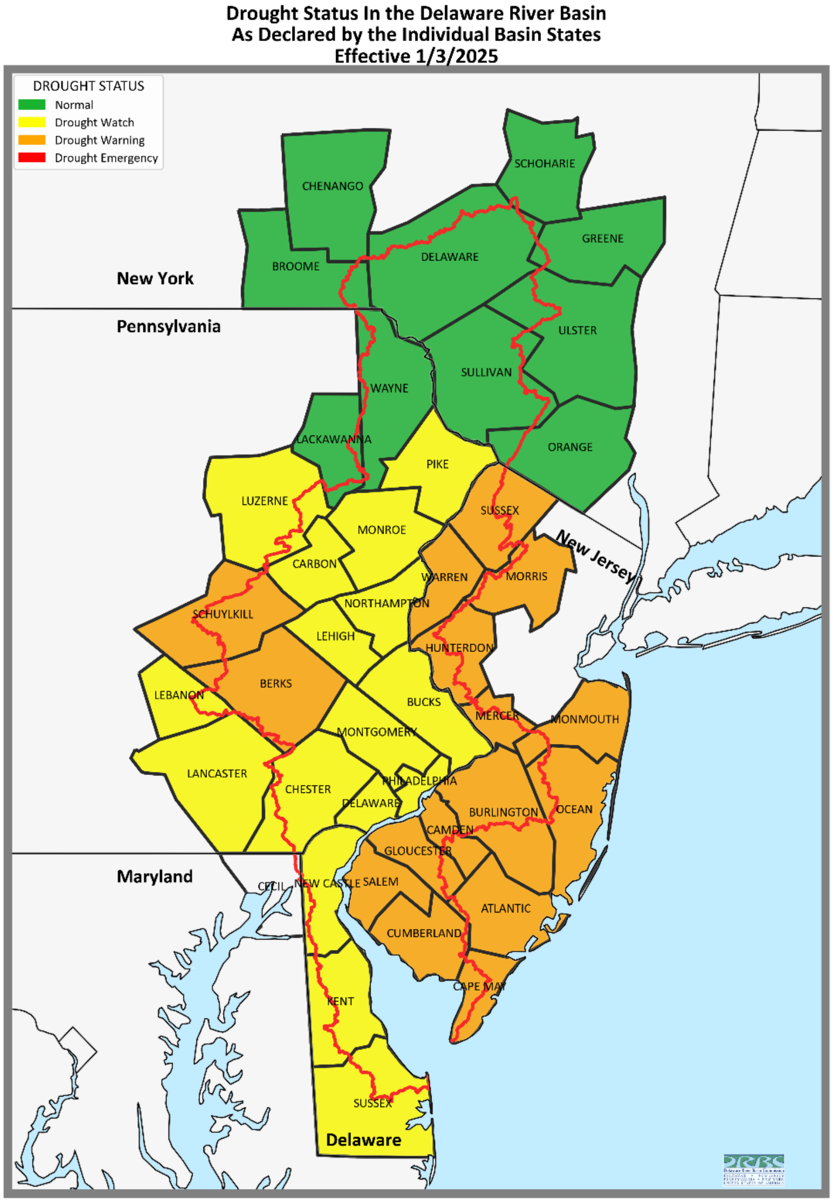
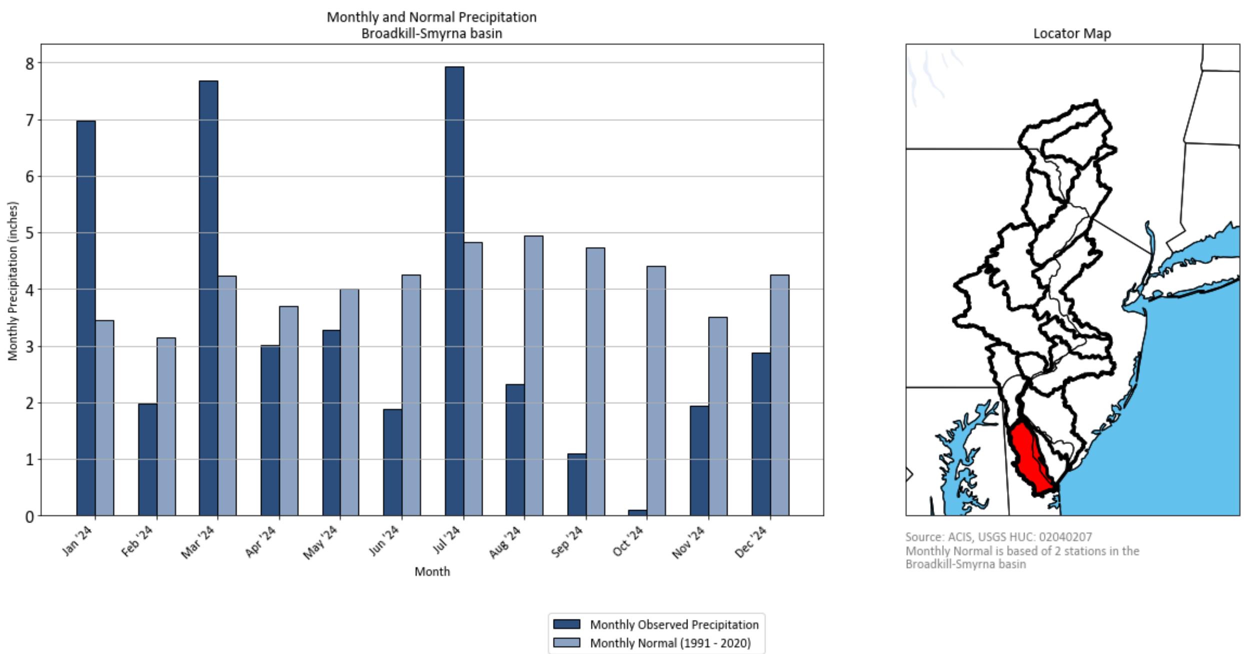


Figure 15: Drought status in the Delaware River Basin. This is a map of all counties partly or completely contained within the DRB, colored based on drought status as declared by individual Basin states. On this map, the red line represents the boundary of the Basin.

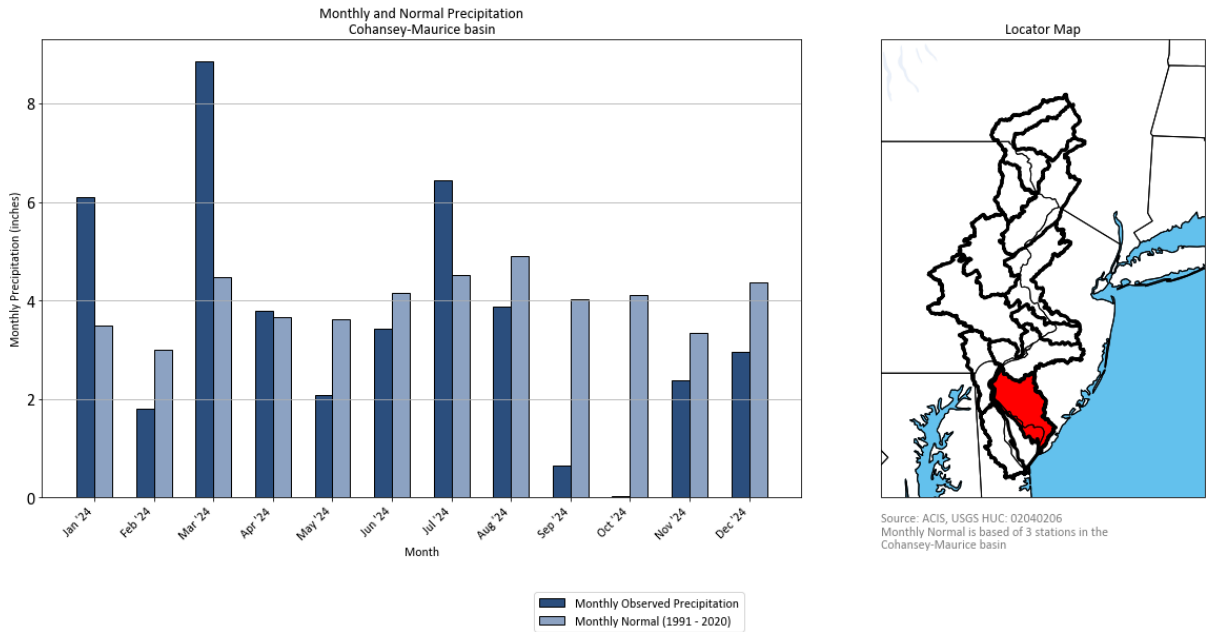
9. APPENDIXES

APPENDIX A: MONTHLY PRECIPITATION COMPARED TO NORMAL

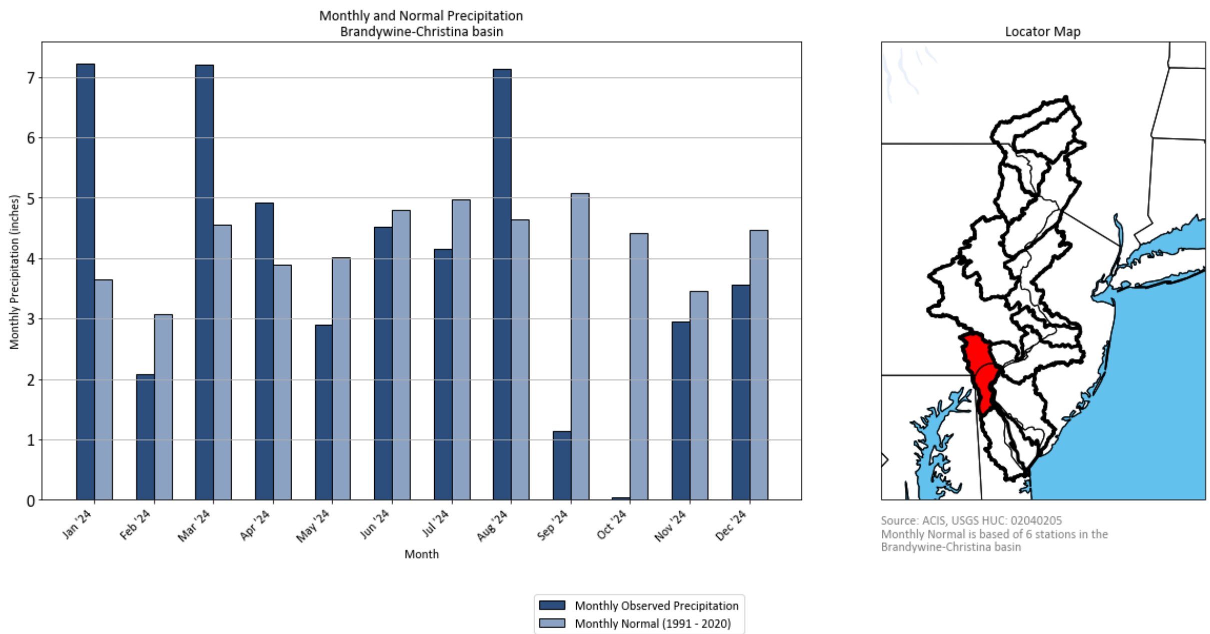
The following Figures present a comparison of observed monthly precipitation to normal monthly precipitation in twelve hydrologic regions across the DRB, as defined by the Hydrologic Unit Code system (HUC) at the eight-digit scale. The Applied Climate Information System (ACIS) is a service provided by the Northeast Regional Climate Center (NRCC), which compiles daily meteorological records from across the United States. The monthly total and normal are calculated using the daily average of precipitation stations within each HUC. In the Figures below, the observed precipitation for the year is depicted by dark blue bars, while the grey bars represent the normal precipitation using the 30-year period from 1991 to 2020, in accordance with NOAA's current definition of normal precipitation. A locator map accompanies each Figure.



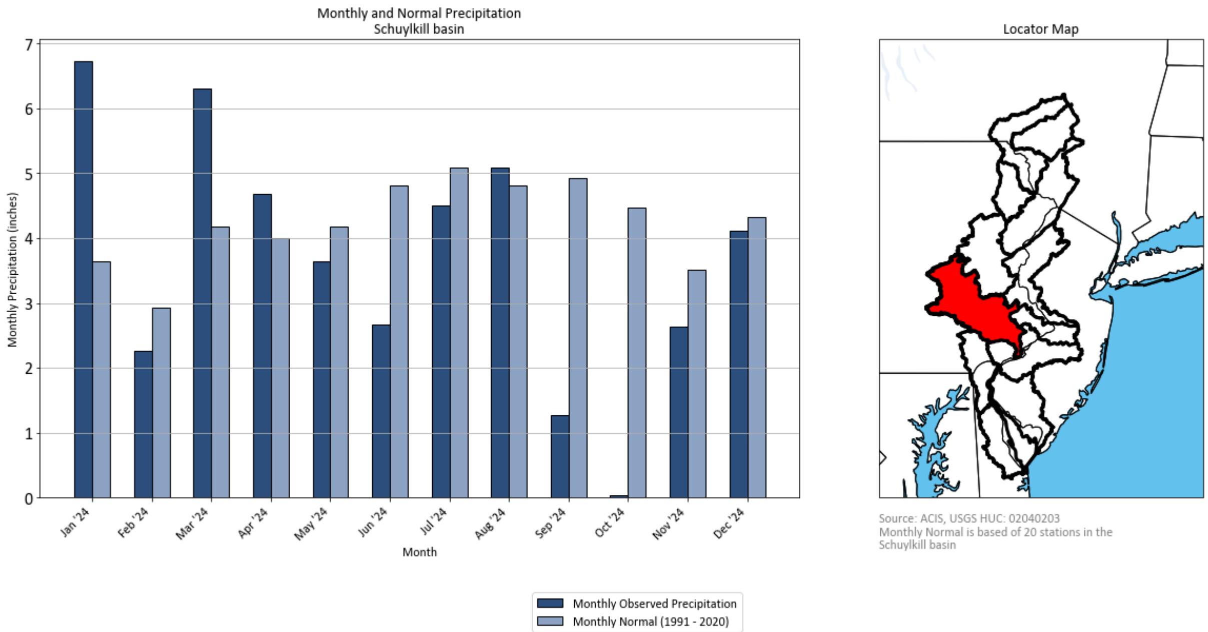
Appendix Figure A: Monthly and normal precipitation in the Broadkill-Smyrna Basin.



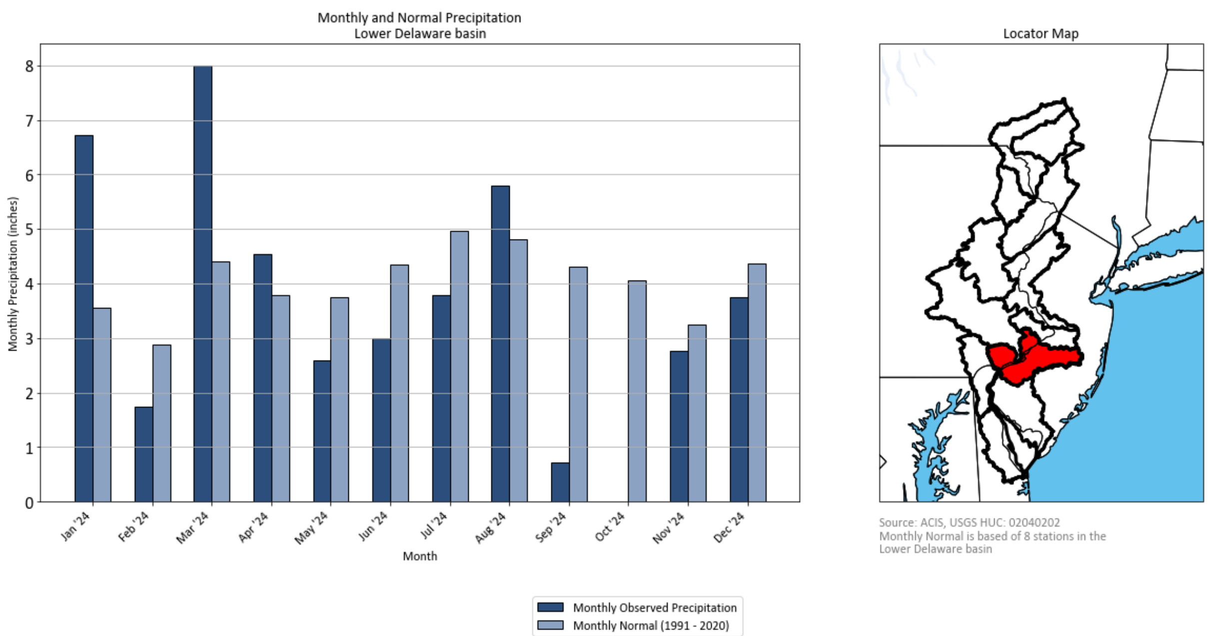
Appendix Figure B: Monthly and normal precipitation in the Cohansey-Maurice Basin.



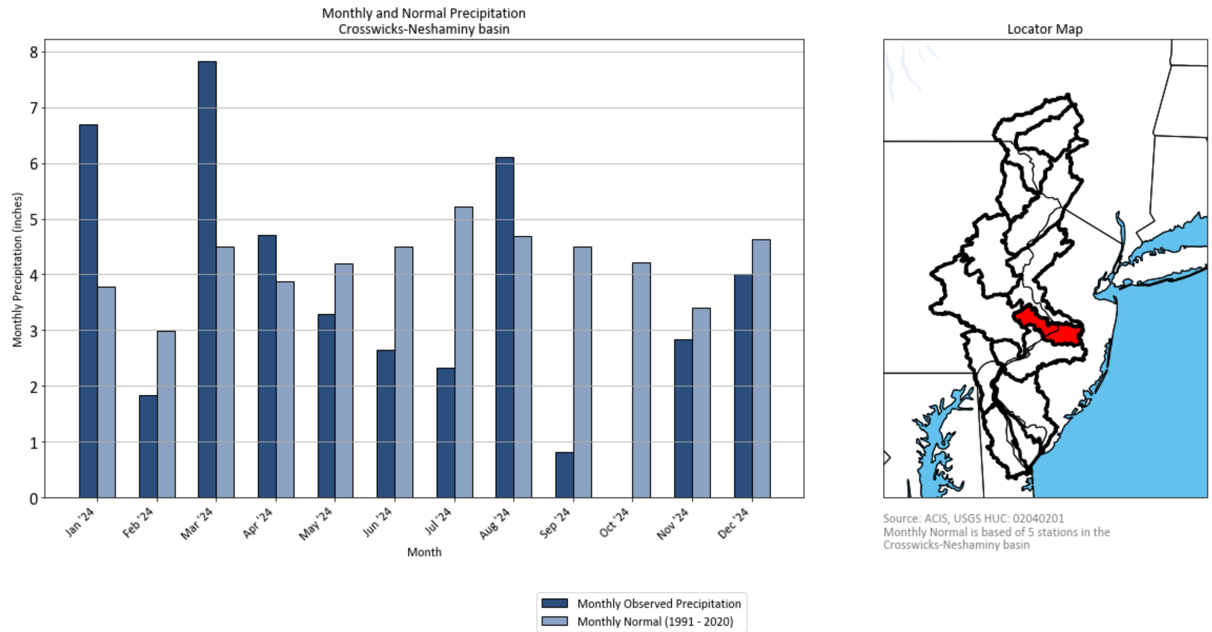
Appendix Figure C: Monthly and normal precipitation in the Brandywine-Christina Basin.



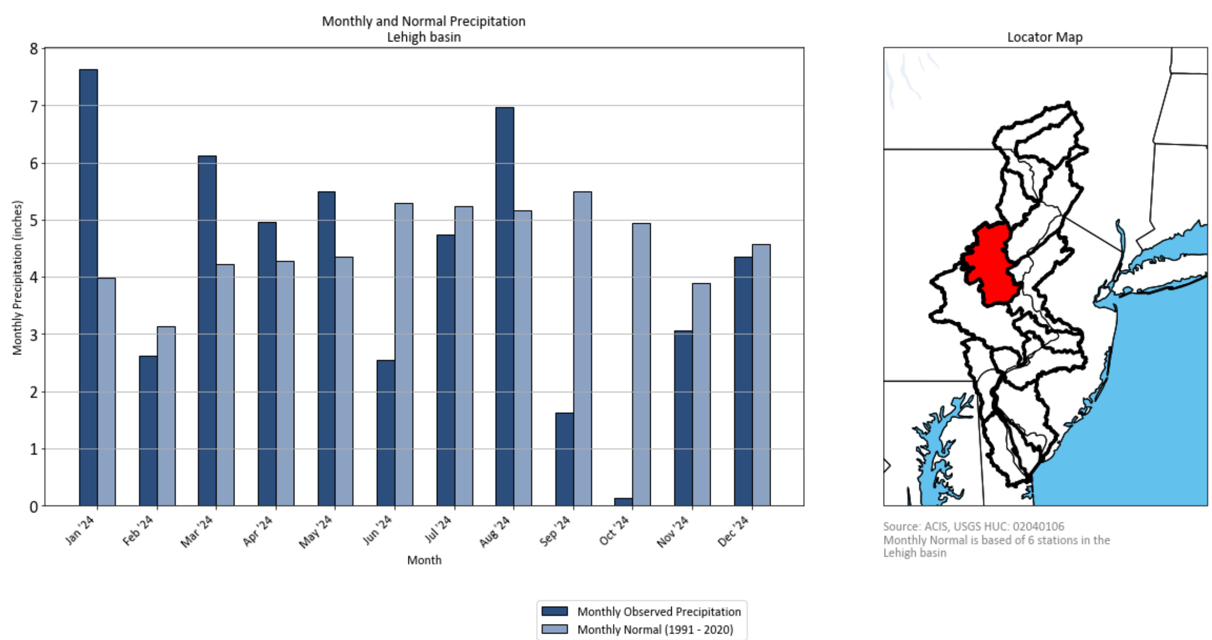
Appendix Figure D: Monthly and normal precipitation in the Schuylkill Basin.



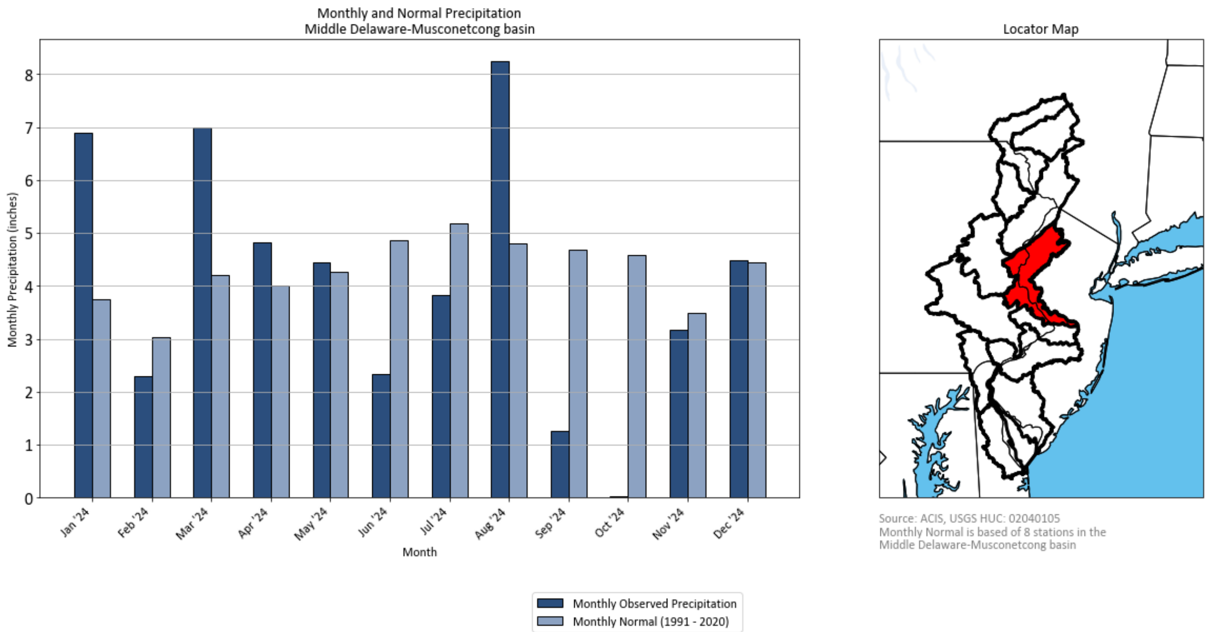
Appendix Figure E: Monthly and normal precipitation in the Lower Delaware Basin.



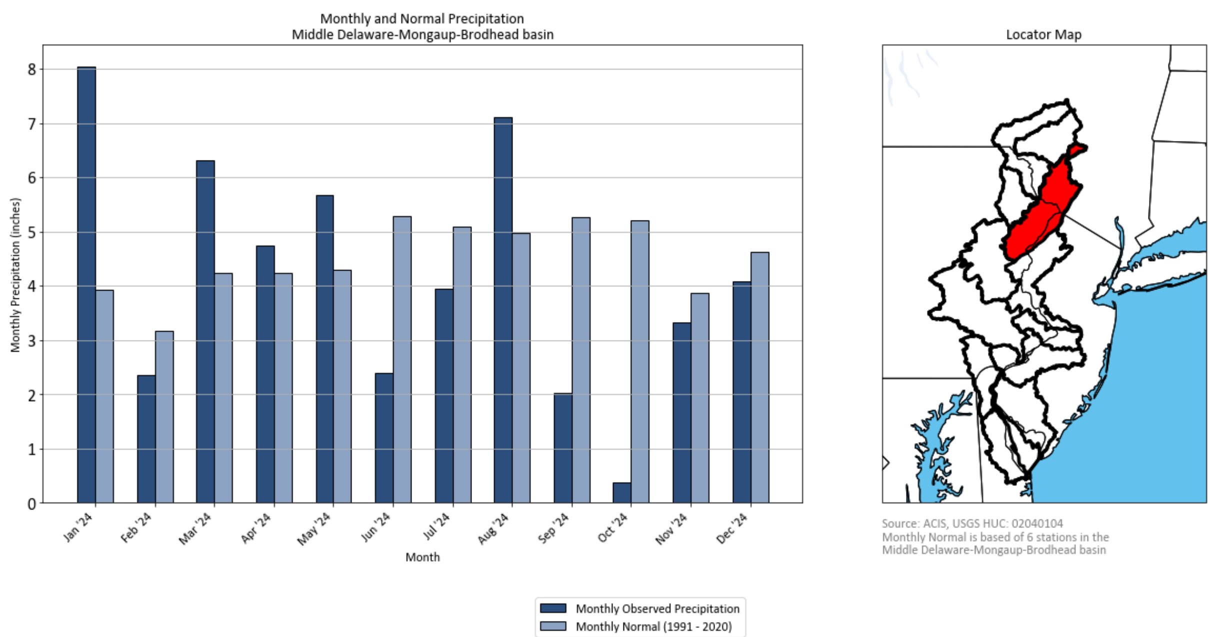
Appendix Figure F: Monthly and normal precipitation in the Crosswicks-Neshaminy Basin.



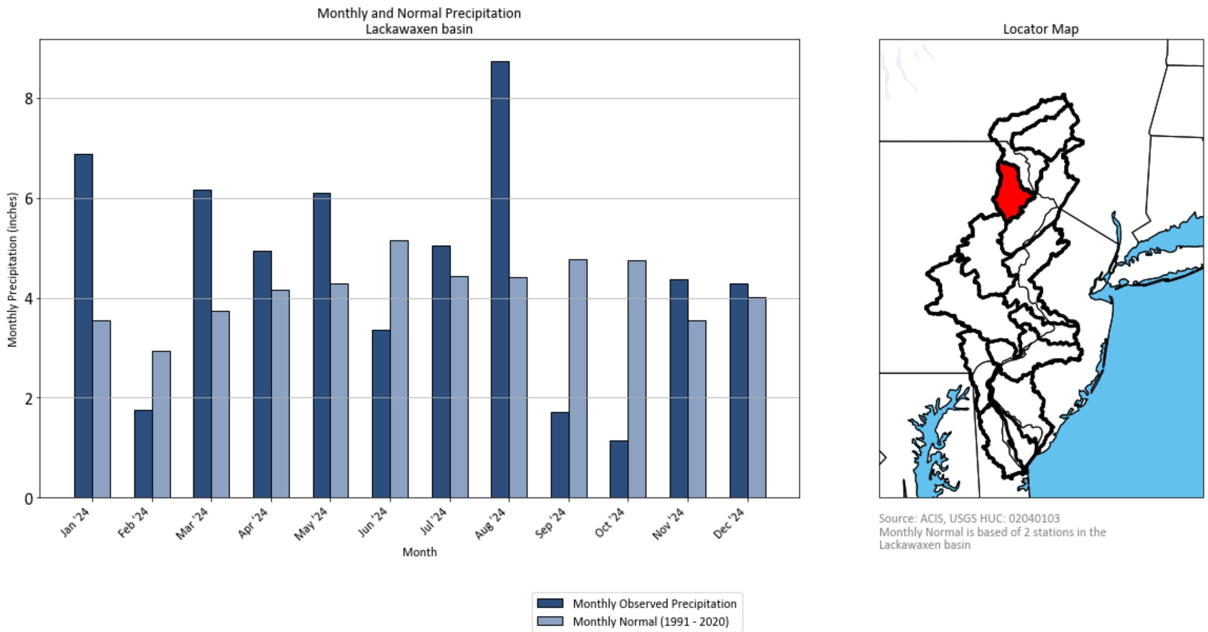
Appendix Figure G: Monthly and normal precipitation in the Lehigh Basin.



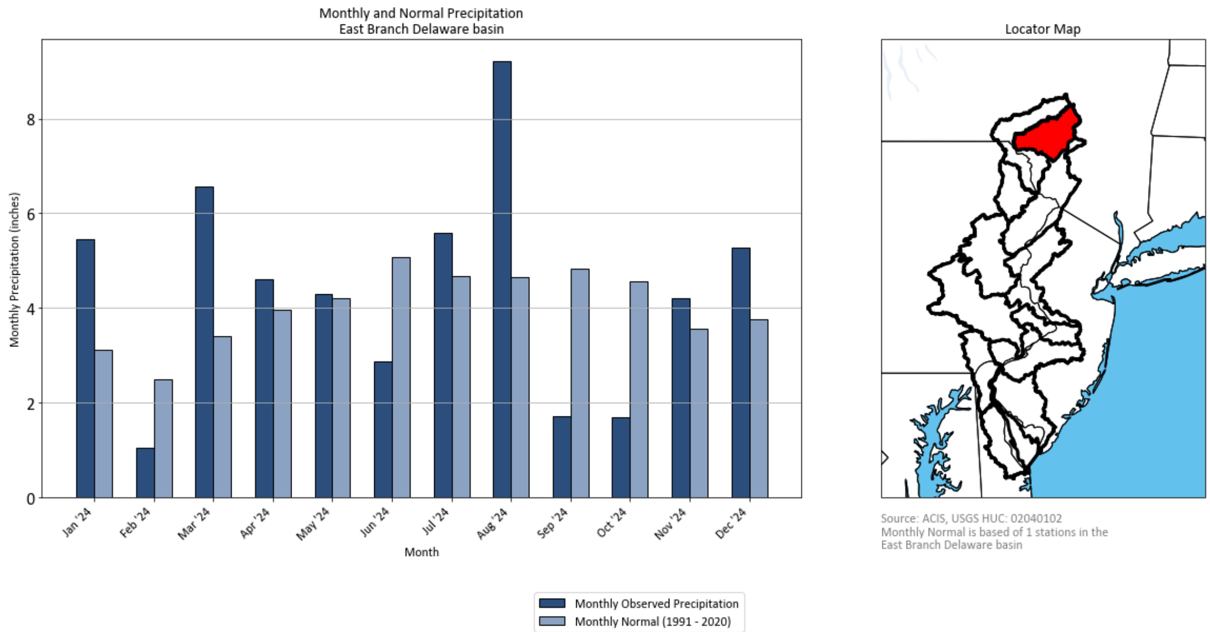
Appendix Figure H: Monthly and normal precipitation in the Middle Delaware-Musconetcong Basin.



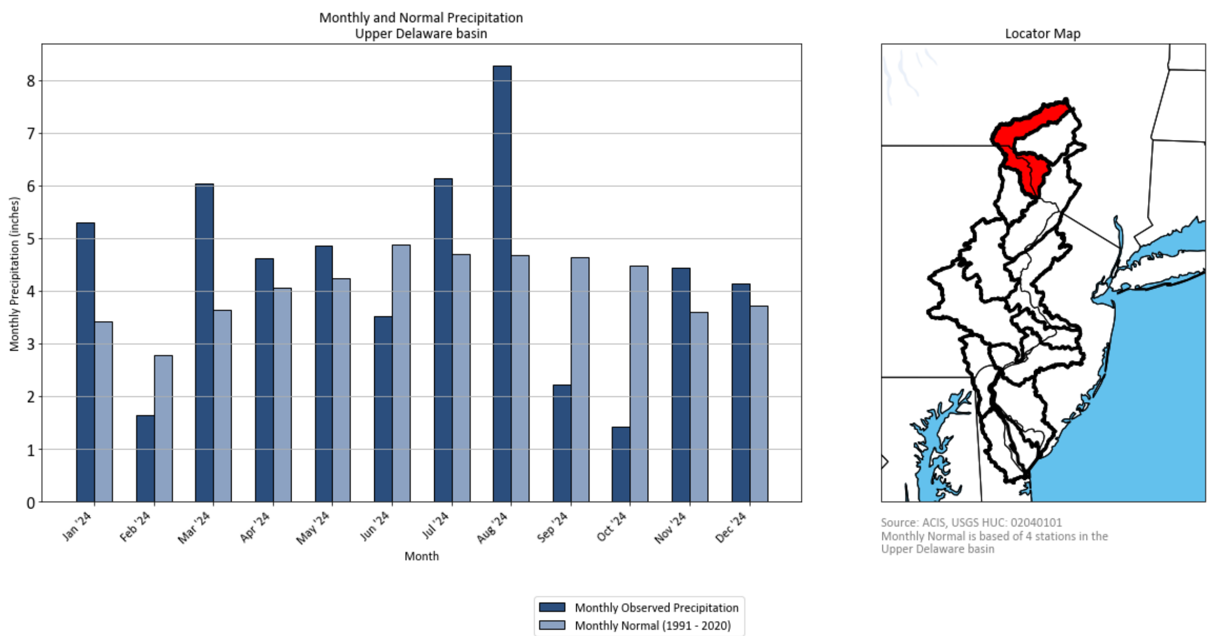
Appendix Figure I: Monthly and normal precipitation in the Middle-Delaware-Mongaup-Brodhead Basin.



Appendix Figure J: Monthly and normal precipitation in the Lackawaxen Basin.



Appendix Figure K: Monthly and normal precipitation in the East Branch Delaware Basin.



Appendix Figure L: Monthly and normal precipitation in the Upper Delaware Basin.

Table A: **Monthly Precipitation Totals for 2024, Mean Monthly, and Maximum values (Source: ACIS).** Note: Normal precipitation is based on a precipitation average between 1990-2021[9].

Location		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Callicoon, NY	2024 Obs.	5.91	1.76	6.70	4.30	5.75	3.32	5.09	7.94	2.03	1.54	4.57	4.72
	Mean	3.26	2.90	3.66	4.13	4.39	5.14	4.84	5.11	4.77	4.54	3.54	3.94
	Max	6.14 (2019)	5.08 (2018)	5.78 (2011)	8.57 (2019)	8.72 (2012)	8.62 (2011)	10.07 (2021)	12.47 (2011)	10.6 (2011)	7.8 (2010)	8.18 (2018)	6.27 (2023)
Mt.Pocono, PA	2024 Obs.	9.33	2.73	6.02	5.95	6.29	3.82	4.34	5.34	2.66	0.18	3.29	5.43
	Mean	2.98	2.45	3.83	4.24	4.06	4.69	4.73	4.64	5.59	5.15	4.08	3.78
	Max	7.16 (2005)	7.24 (2008)	9.75 (2011)	9.24 (2011)	7.27 (2019)	12.05 (2006)	10.85 (2018)	12.69 (2011)	12.93 (2011)	12.71 (2005)	8.53 (2018)	9.07 (2023)
Sussex Airport, NJ	2024 Obs.	5.07	1.64	5.88	3.98	3.01	1.77	2.86	8.16	1.66	0.05	3.47	2.95
	Mean	2.63	2.16	3.20	3.43	3.73	3.68	4.06	3.93	3.83	4.23	2.97	3.10

[9] Note: T denotes trace rainfall for that month.

Location		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Max	10.17 (1979)	7.93 (2008)	8.85 (2010)	10.00 (1983)	10.58 (1984)	11.18 (1972)	12.77 (1945)	17.3 (1955)	14.51 (2011)	14.58 (2005)	10.2 (1972)	8.48 (1972)
Allentown, PA	2024 Obs.	6.32	2.33	5.14	5.56	3.77	2.27	3.60	5.63	1.30	0.02	2.26	3.86
	Mean	3.30	2.77	3.63	3.67	3.65	4.40	5.30	4.56	4.84	4.14	3.24	3.86
	Max	8.42 (1979)	7.62 (2008)	7.21 (1953)	10.09 (1952)	10.62 (1984)	9.13 (2006)	10.42 (1969)	13.47 (2011)	12.99 (2011)	13.16 (2005)	9.73 (2018)	8.62 (2023)
Trenton, NJ	2024 Obs.	5.87	1.71	7.62	4.25	3.10	1.44	3.02	7.37	0.08	T	2.53	3.91
	Mean	3.29	2.65	4.00	3.63	3.99	4.35	4.42	4.22	4.05	3.79	3.20	4.04
	Max	6.59 (1999)	5.75 (2018)	8.34 (2018)	9.95 (2007)	7.57 (2019)	10.14 (2013)	9.87 (1945)	15.69 (2011)	11.22 (1999)	11.21 (2005)	8.85 (2018)	7.53 (2023)
Reading, PA	2024 Obs.	6.14	2.18	5.52	4.44	3.27	2.73	5.19	5.19	1.19	0.03	2.31	3.50
	Mean	2.97	2.61	3.53	3.35	3.51	4.77	4.77	4.49	4.88	3.80	3.02	3.51
	Max	6.10 (1949)	6.88 (2008)	6.53 (2000)	6.47 (2014)	9.72 (2019)	9.05 (2006)	11.37 (2004)	14.81 (2018)	12.35 (1999)	10.53 (2005)	8.15 (2018)	7.70 (2023)
Phila., PA	2024 Obs.	5.91	1.49	7.19	4.16	1.72	4.68	2.44	5.07	0.77	T	2.52	3.45

Location		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
	Mean	3.13	2.75	3.96	3.47	3.34	4.04	4.38	4.29	4.40	3.47	2.91	3.97
	Max	8.86 (1978)	6.44 (1979)	7.33 (2010)	9.05 (2007)	7.40 (1948)	10.56 (2013)	13.24 (2013)	19.31 (2011)	13.07 (1999)	8.68 (2005)	9.06 (1972)	8.86 (2009)
Millville, NJ	2024 Obs.	5.63	1.39	9.06	3.32	2.40	2.99	2.48	3.95	0.30	T	1.53	2.25
	Mean	3.13	2.63	4.09	3.53	3.12	3.91	4.26	4.61	3.15	3.82	3.17	3.95
	Max	7.93 (1999)	7.64 (1971)	10.13 (1994)	8.70 (2023)	8.60 (1948)	12.74 (2015)	12.9 (1969)	12.74 (2011)	7.66 (1966)	7.63 (2005)	8.60 (1972)	9.30 (1969)
Wilmington, DE	2024 Obs.	6.22	1.80	7.20	4.58	2.17	6.50	1.56	6.63	0.33	T	2.70	3.34
	Mean	3.23	2.83	4.16	3.51	3.57	4.67	4.41	3.98	4.38	3.68	3.06	3.85
	Max	8.41 (1978)	7.02 (1979)	9.17 (2000)	8.55 (2007)	7.38 (1983)	13.66 (2013)	12.63 (1989)	14.7 (2011)	12.68 (1999)	8.01 (1995)	8.69 (2018)	8.58 (2009)

APPENDIX B: FLOODING EVENTS

Table B- 1: NWS Forecast Locations with Levels at Action or Minor Flood Stage (Jan 9 – Jan 18)

NWS Flood Forecast Location	Type	Peak	Stage
North Branch Rancocas Creek at Pemberton	Stream	2.56 ft	Minor
Assunpink Creek at Trenton	Stream	8.74 ft	Minor
Schuylkill River at Berne	Stream	12.57 ft	Minor
Brandywine Creek at Chadds Ford	Stream	12.84 ft	Moderate
Perkiomen Creek at Graterford	Stream	13.57 ft	Moderate
Neshaminy Creek at Langhorne	Stream	13.91 ft	Moderate
Schuylkill River at Norristown	Stream	16.29 ft	Minor
Schuylkill River at Philadelphia	Stream	9.82 ft	Minor
Schuylkill River at Philadelphia 30th St	Stream	9.76 ft	Minor
Schuylkill River at Pottstown	Stream	13.65 ft	Minor
Brandywine Creek at Wilmington	Stream	17.39 ft	Minor

Table B-2: NWS forecast locations with Levels at Action or Minor Flood Stage (March 9 – March 14)

NWS Flood Forecast Location	Type	Peak	Stage
West Branch Delaware at Walton	Stream	10.05 ft	Minor

Table B-3: NWS forecast locations with Levels at Action or Minor Flood Stage (March 23 – 26)

NWS Flood Forecast Location	Type	Peak	Stage
Assunpink Creek at Trenton	Stream	9.48 ft	Minor
North Branch Rancocas Creek at Pemberton	Stream	2.59 ft	Minor
Brandywine Creek at Chadds Ford	Stream	9.49 ft	Minor
Neshaminy Creek at Langhorne	Stream	11.91 ft	Minor
Schuylkill River at Norristown	Stream	13.05 ft	Minor

Table B-4: NWS Forecast Locations with Levels at Action or Minor Flood Stage (April 2 – April 8)

NWS Flood Forecast Location	Type	Peak	Stage
North Branch Rancocas Creek at Pemberton	Stream	2.74 ft	Minor
Brandywine Creek at Chadds Ford	Stream	10.12 ft	Minor
Neshaminy Creek at Langhorne	Stream	9.17 ft	Minor
Schuylkill River at Norristown	Stream	13.94 ft	Minor

Table B-5: NWS Forecast Locations with Levels at Action or Minor Flood Stage (Aug 9 – Aug 14)

NWS Flood Forecast Location	Type	Peak	Stage
East Branch Delaware at Fishs Eddy	Stream	14.47 ft	Minor
East Branch Delaware at Harvard	Stream	11.41 ft	Minor
West Branch Delaware at Walton	Stream	11.71 ft	Minor
Beaver Kill at Cooks Falls	Stream	10.32 ft	Minor
Brandywine Creek at Chadds Ford	Stream	9.64 ft	Minor

Table B-6: NWS Forecast Locations with Levels at Action or Minor Flood Stage (Dec 11 – Dec 12)

NWS Flood Forecast Location	Type	Peak	Stage
Beaver Kill at Cooks Falls	Stream	11.09 ft	Minor
West Branch Delaware at Walton	Stream	11.66 ft	Minor

APPENDIX C: NYC DELAWARE AQUADUCT SHUTDOWN

The Delaware Aqueduct is the longest tunnel in the world and NYC and provides approximately 500 MG of water per day to NYC and eight counties along the aqueduct north of the city. In 1992, leaks were discovered in the aqueduct near Newburgh and Wawarsing, N.Y. The leaks are caused by faulty limestone and cracks in the pipe, and the amount of water lost is estimated to be a combined 30 million gallons per day. NYC is undertaking a $1.1 million project to repair the leaks by grouting in Wawarsing and building a bypass tunnel to replace the leaking section in Newburgh. The replaced section will be decommissioned and left in place.

The aqueduct must remain closed for approximately nine months to grout the pipe and connect the bypass. Predecessor projects are required to ensure that NYC can meet its demand from the rest of its system during that period. In addition, constant pumping will be required to remove groundwater infiltration. The shutdown of the aqueduct was originally scheduled for 2022 but was postponed in both 2022 and 2023 due to difficulties encountered with a few of the predecessor projects.

While the aqueduct is closed for the project, the reservoirs will operate in accordance with the FFMP. The only difference from normal operation during the project is when water is diverted from the reservoirs. The Delaware system will be used heavily from June – September to maintain the storage in the remainder of their water supply system. Then no water will be withdrawn during the six to nine-month period while the aqueduct is closed. The potential impacts in the Delaware Basin were evaluated in a full environmental impact review, conducted for the project.

During the shutdown, beginning in October and lasting six to nine months, no water will be diverted from the reservoirs because the only way water leaves the reservoirs is through the release works or over the spillway. Reservoir storage will most likely be at its lowest levels in late September or early October because NYC intends to take more than normal amounts of water during the pre-shutdown period. The reservoirs are likely to refill sooner, mid-winter, because no water will be diverted from the reservoirs during the shutdown.

The project was ultimately suspended in November 2024, because of dry conditions impacting water supply in NYC reservoirs. The aqueduct was reopened on December 18.

APPENDIX D: DRBC RESOLUTION NO. 2024-07

A RESOLUTION pursuant to section 10.4 of the Delaware River Basin Compact to preserve and protect water supplies in the Delaware River Basin during persistent dry conditions by providing for coordinated actions to manage out-of-basin diversions, Delaware River flow objectives, regional reservoir operations, and consumptive uses by electric generating and cogenerating facilities.

WHEREAS, the states of New Jersey, New York, and Delaware and the Commonwealth of Pennsylvania have issued drought watches and warnings covering a significant area of the Delaware River Basin and have taken steps to manage water availability, including calls for water conservation by all users; and

WHEREAS, the New York City Department of Environmental Protection on November 18, 2024, elevated its previously declared drought watch to drought warning and paused the final phase of the City's Delaware Aqueduct Repair Project, restoring the City's access to water impounded in the City's Delaware River Basin reservoirs; and

WHEREAS, multiple hydrologic and drought indicators and trends, including reservoir storage volumes, precipitation, streamflows, the location of the salt front in the Delaware River Estuary, and national drought monitors all indicate stressed conditions that have led to regional and localized drought and could adversely affect water supplies and the attainment of DRBC flow management objectives; and

WHEREAS, the Delaware River Basin's drought management plans, adopted with the unanimous consent of the Decree Parties pursuant to Section 3.3(a) of the Compact, are set forth in and have been codified in the Delaware River Basin Water Code ("Water Code"); and WHEREAS, the Basin's drought management plans complement the states' drought response measures by providing for the conservation of regional reservoir storage through phased reductions in diversions, reservoir releases and flow objectives for purposes of water supply and flow augmentation in the Delaware River and salinity control in the Delaware River Estuary; and

WHEREAS, the Water Code defines "Basinwide" and "Lower Basin" drought conditions and provides for the implementation of corresponding drought management actions, while simultaneously encouraging the Commission and Decree Parties by unanimous agreement to modify and adjust applicable plans, as necessary and appropriate, to reflect observed conditions and needs; and

WHEREAS, by Resolution No. 2018-5, the Commission in 2018 clarified and re-stated the Commission's policy for the replacement of water consumptively used by electric generating or cogenerating facilities during "critical hydrologic conditions"; and

WHEREAS, in anticipation of the need to consider a declaration under section 10.4 of the Delaware River Basin Compact, the Commission on November 19, 2024, held a public hearing to accept input on the persistent dry conditions throughout the basin and how to address them; and

WHEREAS, section 10.4 of the Compact provides that "[i]n the event of a drought or other condition which may cause an actual and immediate shortage of available water supply within the basin, or within any part thereof, the commission may, after public hearing, determine and delineate the area of such shortage and declare a water supply emergency therein," and further provides that "[f]or the duration of such emergency… no person, firm, corporation or other public or private entity shall divert or withdraw water for any purpose, in excess of such quantities as the commission may prescribe by general regulation or authorize by special permit"; and

WHEREAS, the Compact and Water Code empower the Commissioners and Decree Party representatives to jointly select and implement operations plans designed to meet existing conditions; now therefore, BE IT RESOLVED by the Delaware River Basin Commission:

1. **Declaration Under Section 10.4 of the Compact.** To address overall dry conditions throughout the basin, the Commission is taking the procedural step of declaring a "water supply emergency" pursuant to section 10.4 of the Delaware River Basin Compact for the entire Delaware River Basin. This action is not a declaration of a "drought emergency" by DRBC or any other jurisdiction, but it allows the Commission to implement a coordinated response to conserve water in regional reservoirs and protect water users. Future conditions will determine if and when there may be a need to declare a "drought emergency" as a result of declining reservoir storage.

2. **Allowable Water Uses.** Except as otherwise provided by this Resolution or in accordance with a Conservation Order issued by the Commission or the Executive Director hereafter, any person, firm, corporation, or public or private entity heretofore entitled to divert or withdraw water may continue to do so within such limits as are otherwise now imposed by law.

3. **Drought Management Special Permit No. 2024-01 for Major Diversions, Releases and Flow Objectives.** Pursuant to section 10.4 of the Compact, a special permit consisting of this paragraph 3 and sub-paragraphs 3.a through 3.g. below is hereby approved, to provide for coordinated operation of regional reservoirs and diversions, and in particular, to conserve regional reservoir storage.

   a. **Decree Party Consent**. Because the diversions, releases and flow objectives established hereby affect the diversions, compensating releases, rights, conditions, obligations, and provisions for administration thereof as provided in the United States Supreme Court decree in New Jersey v. New York, 347 U.S. 995 (1954) ("Decree"), in accordance with section 3.3 of the Compact, the parties to the Decree have signified their consent hereto by the signatures of their authorized representatives on an attached page.

   b. **Drought Stages**. For purposes of this special permit, basinwide drought stages consisting of "drought watch," "drought warning" and "drought" shall be determined on the basis of combined storage in the Cannonsville, Pepacton, and Neversink Reservoirs, as set forth in Figure 1 below ("Figure 1").

   c. **Term of Special Permit.** Implementation of the conditions of this special permit shall begin immediately, and unless the Commission with the unanimous consent of the Decree Parties provides otherwise, shall terminate upon: the date of the Commission's first quarterly business meeting in 2025, currently scheduled for Wednesday, March 12, 2025; or the date when the combined storage in the New York City Delaware Basin reservoirs (including the projected water runoff equivalent of actual snow and ice within the watersheds tributary to the reservoirs) reaches a level 15 billion gallons above the drought watch line, as defined in Figure 1, and remains above that level for five consecutive days.

d. **Out-of-Basin Diversions and Delaware River Flow Objectives.** The schedule of diversions and flow objectives during a Basinwide drought will be in accordance with the drought stages depicted in Figure 1 and the corresponding rates set forth in Tables 1 and 2 below. The difference between the amount of water diverted from the basin by New Jersey under Table 1 below and the diversion values expressed in Section 2.5.3 of the Water Code will be drawn from banks of water established by the Decree Parties. No offsetting or accounting for offsetting is required for New Jersey's increased diversions on any day when DRBC determines that releases from lower basin reservoirs are not required to meet the Trenton flow objective. The bank referred to by the Decree Parties as the New Jersey Diversion Offset Bank is 1.49 BG (2,300 cfs-days) for this special permit. The bank referred to by the Decree Parties as the NJ Diversion Amelioration Bank is 1.65 BG (2,545 cfs-days) for this special permit.

e. **Drought Stages Automatic.** The schedule of diversions, releases and streamflow objectives for Basinwide drought operations shall go into effect automatically if and when the combined storage in the New York City Delaware Basin Reservoirs declines below any of the drought stage lines, defined in Figure 1, and remains below that line for five consecutive days.

f. **Other**. Except as set forth in paragraphs 3.b. through 3.e. above, operation of lower basin reservoirs shall be in accordance with sections 2.5.1 through 2.5.6 of the Water Code, except that throughout those sections, references to "Figure 1" shall be deemed to be references to Figure 1 below; and references to "drought warning" shall be deemed to encompass both "drought watch" and "drought warning" as defined by Figure 1 below.

g. **Ongoing Consultation, Coordination and the Potential for Modification.** Consultation among the Commissioners, Decree Parties and Delaware River Master will continue throughout the duration of the current drought event. On the basis of these ongoing consultations and with the unanimous consent of the Decree Parties, the operations prescribed herein may be modified or terminated.

4. **Consumptive Use Management.** The Commission's policy for the replacement of water consumptively used by electric generating or cogenerating facilities during critical hydrologic conditions is set forth in Resolution No. 2018-5. Unless otherwise directed by the Commission, a "critical hydrologic condition" will exist whenever the Trenton Effective Flow Objective is less than 3,000 cfs.
5. **Signatory State Actions**. The signatory states shall be responsible for the declaration of county or statewide drought stages in their respective jurisdictions as they deem necessary and shall be responsible for the implementation and enforcement of associated water use restrictions in these areas.
6. **Interference and Impairment**. For the duration of this water supply emergency, in any instance in which the Executive Director determines that a withdrawal (or withdrawals) of groundwater not regulated by DRBC or the host state may be impairing a publicly or privately owned groundwater source vital to human health or sanitation, the Executive Director may, following consultation with host state representatives, require the operator of the allegedly responsible withdrawal(s) on an expedited basis to furnish reasonably available data or to provide new data, or both, to ascertain the degree of impact on the uses allegedly experiencing impairment. If the Executive Director determines on the basis of existing or new data that the unregulated withdrawal is interfering, the Executive Director may place limits on the amount and rate of the groundwater withdrawals causing the impairment or require the operator to cease all such withdrawals until the Commission ends the water supply emergency declared today.
7. **Maximum Water Use Efficiency Encouraged**. All residents, businesses and users of the basin are encouraged to maximize water efficiency to preserve and protect the basin's water supplies as provided for in section 2.1.4 of the Water Code.

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[i] https://forecast.weather.gov/glossary.php?word=water%20equivalent