2016 Hydrologic Conditions in the Delaware River Basin

Low flows in the Delaware River at the Washington Crossing Bridge
October 18, 2016

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
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Prepared by Water Resource Operations Staff
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Hydrologic Conditions in the Delaware River Basin
Annual Report 2016

Hydrologic Highlights

Precipitation during January was generally normal to below normal. February's weather pattern was wetter, which benefitted portions of New Jersey still under a drought watch declared in September 2015. The drought watch, issued for the Northeast, Central and Coastal North regions of the state (including small sections of basin counties Morris, Hunterdon, Mercer, Monmouth and Ocean), was the result of below-normal precipitation and stressed water supply reservoirs during the summer 2015. Areas under the watch received above-normal precipitation during February prompting a return to normal status by March 1.

A two-day storm event during February 23-24 produced 1.5" – 3.0" of widespread rainfall. The combination of rain and above-normal streamflow from precipitation and snowmelt earlier in the month produced tributary flooding in the Lower Basin. Along the Schuylkill River, minor flooding occurred at Norristown, Pa. Flooding also occurred at several locations along the Brandywine River, including Chadds Ford, Pa. and Wilmington, Del. In the Upper Basin, the West Branch Delaware River at Walton, N.Y. experienced minor flooding. Although no flooding occurred along the main stem of the Delaware River, the river rose more than 1.5' above action stage at Riegelsville, N.J.

Dry conditions returned in March and lingered into the summer. By the end of June, six-month precipitation departures averaged approximately 2.25" below normal.[1] Persistent precipitation shortages, low streamflow and declining reservoir and groundwater levels prompted state officials to issue drought declarations in the Delaware River Basin (DRB). On July 15, the New York State Department of Environmental Conservation issued a drought watch for the entire state of New York, including the eight counties located totally or partially in the DRB. This was the first time New York had been under a drought declaration since 2002.

In New Jersey, precipitation deficits during the spring and summer eroded hydrologic gains made earlier in the year. Reservoirs in the northern part of the state were once again showing signs of stress and on July 25 the New Jersey Department of Environmental Protection (NJDEP) issued a water supply drought watch for much of northern New Jersey. The following DRB counties were included in New Jersey's drought watch—Sussex, Warren, Hunterdon, Mercer and Morris.

Low streamflows and declining groundwater levels prompted the Pennsylvania Department of Environmental Protection (PADEP) to issue a drought watch for Berks, Carbon, Lehigh, Northampton, Schuylkill and Lebanon counties on August 2. The drought watch was expanded on September 6 to include Chester, Delaware and Philadelphia counties.

Dry conditions persisted into autumn. New Jersey and Pennsylvania continued to upgrade and expand their respective drought declarations while New York remained under a statewide drought watch. On October 5, the NJDEP expanded the drought watch to include Burlington, Camden, Gloucester, Monmouth, Ocean and

[1] This information is based on precipitation data from the National Weather Service Middle Atlantic River Forecast Center (NWS MARFC) for 38 of the 42 counties located either partially or completely in the Delaware River Basin. Data for four counties is not available. The NWS uses several precipitation gages in each county to calculate the average precipitation for each county. 90-day and 180-day precipitation departures are calculated by DRBC staff using the NWS MARFC data.

Salem counties. Only a few weeks later, the drought status in New Jersey was upgraded to drought warning in Hunterdon, Mercer, Monmouth, Morris, Ocean, Sussex and Warren counties on October 21.

On November 3, PADEP upgraded drought status to drought warning in Carbon, Lehigh, Monroe and Northampton counties and expanded the drought watch to include Bucks, Luzerne, Lackawanna, Lancaster, Montgomery, Pike and Wayne counties. All of Pennsylvania's basin counties were in either a drought watch or warning.

By November only six counties in the basin were not under a state-declared drought: Atlantic, Cumberland and Cape May counties in New Jersey and New Castle, Kent and Sussex counties in Delaware. As the drought peaked in late November, the U.S. Drought Monitor[2] reported nearly all the DRB, except for Delaware and far southern New Jersey, under moderate to severe drought.

Precipitation deficits yielded below-normal streamflow throughout the DRB. Releases to meet minimum flow objectives on the Delaware River at Montague, N.J. and Trenton, N.J. were required from the New York City (NYC) Delaware reservoirs in the Upper Basin as well as from Blue Marsh and Beltzville reservoirs in the Lower Basin. Despite the reservoir releases, the 250 parts-per-million (ppm) isochlor (salt front) reached Delaware River Mile 90 in November. This location is 20 river miles upstream of the normal location for November.

On November 9, the commission held a hearing to accept public input about the drought issues impacting the basin. DRBC held a special meeting on November 23 where it unanimously approved the issuance of a drought management special permit for coordinated operation of regional reservoirs, out-of-basin diversions and Delaware River flow objectives. The special permit deemed the entire basin under a drought watch. Out-of-basin diversions to the City of New York were reduced and Merrill Creek Reservoir was required to make releases to replace evaporative losses caused by power generation. The Delaware River flow objectives at Montague and Trenton were also reduced.

Precipitation in late November and early December increased groundwater levels and streamflows. The higher flows on the Delaware River reduced the need for releases and storage in the Upper and Lower Basin reservoirs began to recover. By the end of 2016, Blue Marsh Reservoir regained normal storage and Beltzville Reservoir increased to above its drought warning level. In the NYC Delaware Reservoirs, combined storage increased during December, but not enough to terminate the basinwide drought watch, which continued into the new year. For additional details regarding drought actions during 2016, please refer to the *2016 Chronology of Drought in the Delaware River Basin* section at the end of the report.

Precipitation

Most of the DRB counties experienced below-normal precipitation during 2016[3]. Only four of the 38 reported counties, all located in the southern portion of the basin, recorded above-normal precipitation during the year. Annual precipitation totals ranged from 34.9 inches in Broome County, N.Y. to 52.2 inches in Sussex

[2] The U.S. Drought Monitor is a weekly map prepared by the United States Department of Agriculture, the National Oceanic and Atmospheric Administration and the National Drought Mitigation Center at the University of Nebraska-Lincoln.

[3] This information is based on precipitation data from the National Weather Service Middle Atlantic River Forecast Center (NWS MARFC) for 38 of the 42 counties located either partially or completely in the Delaware River Basin. Data for four counties is not available. The NWS uses several precipitation gages in each county to calculate the average precipitation for each county. Annual precipitation departures are calculated by DRBC staff using the NWS MARFC data.

County, Del. Departures from the annual normal precipitation ranged from 12.1 inches below normal in Monroe County, Pa. to 7.2 inches above normal in Sussex County, Del. Figure 1 presents the annual precipitation by county in the DRB.

The precipitation amounts at Montague, N.J., Trenton, N.J. and Wilmington, Del. are used to represent the regional precipitation throughout the DRB[4]. The average observed precipitation above Montague in 2016 was 38.09 inches, or 7.20 inches below normal. Similarly, observed precipitation above Trenton was 39.20 inches, or 8.80 inches below normal. Precipitation at Wilmington was 40.78 inches, or 2.30 inches below normal. Table 1 presents normal and observed monthly precipitation totals at selected locations in the DRB for 2016.

Streamflow

Observed monthly mean streamflows along the main stem of the Delaware River and its two largest tributaries, the Lehigh and Schuylkill rivers, were normal to above normal during January and February 2016. The highest monthly average streamflows of the year at these locations occurred in February due to several storm events that produced heavy rain and melting snow. The streamflow at Montague and Trenton was 167 and 185 percent of the normal flow, respectively. Flows were similarly high along the tributaries. The Lehigh River at Lehighton, Pa. and Bethlehem, Pa. were 213 percent and 188 percent of normal, respectively. The Schuylkill River at Pottstown, Pa. and Philadelphia, Pa. averaged 246 percent and 219 percent of normal, respectively.

Except for August when streamflows were normal to above normal, average monthly flows were generally below normal for the remainder of 2016. The lowest monthly average flows of the year occurred during November. The streamflows at Montague and Trenton were 44 and 31 percent of normal flow, respectively. Flows were similarly low along the tributaries. The Lehigh River at Lehighton and Bethlehem were 20 percent and 26 percent of normal, respectively. The Schuylkill River at Pottstown and Philadelphia averaged 28 percent and 20 percent, respectively.

Table 2 presents observed monthly mean streamflow at selected stations for 2016. Figure 2 and Figure 3 present annual hydrographs for 2016 at Montague and Trenton, respectively. Changes to the minimum flow objectives during 2016 are noted on the graphics. During the basinwide drought watch declared by DRBC on November 23, the minimum flow objective at Montague was lowered from 1,750 cubic feet per second (cfs) to 1,650 cfs. Likewise, the minimum flow objective at Trenton was lowered from 3,000 cfs to 2,700 cfs. These reductions remained in effect through the end of the year.

Reservoir Storage and Releases

Lower Basin

DRBC released nearly nine billion gallons (BG) from Beltzville and Blue Marsh reservoirs during 2016 to meet the minimum flow objective for the Delaware River at Trenton and to repel salinity in the Delaware Estuary. Over half of the releases occurred from early September through late November, when DRBC directed 5.18 BG from Beltzville and 3.60 BG from Blue Marsh. DRBC's directed releases reduced storage in both reservoirs and a lower basin drought warning seemed increasingly likely. Beltzville's storage declined below its drought warning elevation of 615' in October, but Blue Marsh's storage remained above its drought warning elevation

[4] Selected precipitation data were provided by the National Weather Service and the Delaware River Master's Office. Annual precipitation departures are calculated by DRBC staff using the data provided for 2016. Normal data is based on historical records for the period 1981-2010.

of 283' by late November. A Lower Basin drought warning would have gone into effect if storage in both reservoirs fell below their respective drought warning elevations; however, before this could occur, DRBC declared a basinwide drought watch on November 23 based on combined storage in the three NYC Delaware reservoirs.

Precipitation during late November and December raised storage in Blue Marsh Reservoir and the normal winter pool elevation of 285' was attained by the end of the year. Similarly, Beltzville storage increased to above the drought warning elevation, but storage was still far below the normal elevation of 628' at the end of 2016. Figure 4 and Figure 5 present 2016 reservoir elevations for Beltzville and Blue Marsh, respectively.

Releases were also required from Merrill Creek Reservoir during 2016. Storage in this reservoir, located near Phillipsburg, N.J., is used to replace evaporative losses caused by power generation when the basin is under DRBC-declared drought operations and the equivalent average daily flow target for the Delaware River at Trenton is below 3,000 cfs. Merrill Creek released a total of 64.9 million gallons during November 28-29. Sufficient precipitation during the remainder of the year increased the streamflow at Trenton so additional releases from this reservoir were no longer required through the end of 2016.

Upper Basin

The three New York City (NYC) Delaware reservoirs -- Cannonsville, Pepacton and Neversink -- are operated under the Flexible Flow Management Program (FFMP)[5]. On January 1, 2016, combined storage in these three Upper Basin reservoirs was 214.6 BG, which is 79.2 percent of their usable capacity and 11 BG below the long-term median usable storage for that date. Increased precipitation and snowmelt during February raised storage above the long-term median and the reservoirs refilled on May 11, which was slightly later than the normal refill date of May 1.

Reservoir storage sharply declined throughout the summer and autumn months. On November 23, combined storage in the three reservoirs decreased below the drought watch operation curve prompting DRBC to issue Resolution No. 2016-7 placing the entire basin in a drought watch stage. Combined storage reached the year's lowest level of 106.406 BG, or 39.3 percent of capacity, on November 28.

Precipitation during the last two days of November and into early December increased combined storage above the drought watch threshold, but not enough to end the basinwide drought watch. As of December 31, the combined storage in Cannonsville, Pepacton and Neversink reservoirs was 135.7 BG, which is 50.1 percent of their usable capacity, 89 BG below the long-term median and 9.8 BG above drought watch curve. Storage needed to be at least 15 BG above the drought watch curve for five consecutive days to automatically end the basinwide drought watch. Figure 6 presents NYC reservoir storage levels for 2016.

The Delaware River Master directed approximately 61.5 BG[6] of water from the NYC reservoirs from June through November 2016 to meet the minimum flow objective for the Delaware River at Montague. Much of these releases were made during the driest periods from September through November. In comparison, the River Master directed releases totaling 39 BG in 2015 and 101 BG during the drought year 2001.

[5] Beginning in October 2007, the NYC reservoirs were operated in accordance with the FFMP, a temporary operations plan unanimously approved by the parties to the 1954 U.S. Supreme Court Decree (four basin states and NYC).
[6] Directed release information supplied by the Office of the Delaware River Master.

Additionally, releases were directed by the DRBC from the Interim Excess Release Quantity (IERQ) bank of water in the NYC Delaware Reservoirs. The IERQ consists of 6.09 BG of water that is available for DRBC to release for the purpose of meeting the minimum flow objective at Trenton. DRBC began requesting releases from the IERQ on September 4. This bank of water was depleted on November 16 and would not be available again until June 15, 2017.

Groundwater

New York

Groundwater levels in the Sullivan County well were generally within the normal[7] (25th to 75th percentile) to above-normal range until late summer. A decrease below the normal range was observed during the driest periods from September through December. Increased precipitation during December improved conditions, but the groundwater level remained below the normal range at the end of the year. Figure 7 presents the historical groundwater levels as the 25th and 75th percentile values, the median of the daily mean, and the observed daily mean in 2016 for this U.S. Geological Survey (USGS) well.

Pennsylvania

Groundwater levels in five selected USGS county observation wells were used to represent Pennsylvania's groundwater conditions during 2016. The individual wells were selected according to their geographic locations in the Pennsylvania portion of the DRB: Wayne County WN 64 (northern), Schuylkill County SC 296 (western), Lehigh County LE 644 (central), Bucks County BK 1020 (eastern) and Chester County CH 10 (southern).

In the northern region of the basin, water levels in the Wayne County and Schuylkill County observation wells were generally within the normal range (25th to 75th percentile) for the first half of the year, although both wells declined to below normal during the drier periods of April and May. By late May, these wells were trending downward and by November water levels were below the normal range in both wells. Increased precipitation during December caused the Wayne County well's water level to markedly increase to within the normal range by the end of the year. Similarly, the water level in the Schuylkill County well also improved during December, but remained below the normal range.

Water levels in the Lehigh County and Bucks County observation wells in the central portion of the basin began the year within the normal range (25thto 75th percentile). The Lehigh County well declined to below normal by April and continued to decline through November. The Bucks County well maintained a water level within the normal range until mid-September when the level dropped to below normal. Water levels in both wells improved in December, but still ended the year below the normal range.

On the southwest edge of the basin, the Chester County observation well began the year with a water level within the normal range (25th to 75th percentile). By February the water levels were trending downward and by June had declined to below normal. The water level experienced an uptick in December after increased precipitation, but remained below the normal range until the end of 2016.

[7] The normal water level range for the USGS wells is defined as the 25- to 75- percentile depth to water.

Figure 8 presents the historical groundwater levels as the 25th and 75th percentile values, the median of the daily mean, and the observed daily mean in 2016 for the five observation wells.

Delaware

The groundwater level in the New Castle County coastal plain well, which is based on the observed monthly mean, remained within the normal range (25th to 75th percentile) until December 2016 when it dropped to slightly below the normal range of water level. Figure 9 presents the historical groundwater levels as the 25th and 75th percentile values, the long-term median, and the observed monthly mean in 2016 for this Delaware Geological Survey (DGS) well.

New Jersey

The groundwater level in the USGS Cumberland County coastal plain well remained within the normal (25th to 75th percentile) to above-normal range during 2016. Figure 10 presents the historical groundwater levels as the 25th and 75th percentile values, the median of daily mean, and the observed daily mean in 2016 for this well.

Salt Front

The salt front is defined as the 250 parts-per-million (PPM) isochlor. The seven-day average location of the salt front is used by DRBC as an indicator of salinity intrusion in the Delaware Estuary. The salt front's location fluctuates along the main stem Delaware River as streamflow increases or decreases in response to inflows, diluting or concentrating chlorides in the river. Long-term median mid-month locations range from river mile 67 in April (two miles downstream of the Delaware Memorial Bridge) to river mile 76 in September (two miles downstream of the Pennsylvania-Delaware State line).[8]

The farthest upstream location of the salt front during 2016 was river mile 90 in late November. This location is 12 miles upstream of the Pennsylvania-Delaware State line. By comparison, the farthest recorded upstream location of the salt front measured during the 1960's drought of record was river mile 102. Figure 11 presents the seven-day average location of the 250-PPM isochlor during 2016.

[8] The normal salt front location has been updated based on data from January 1998-February 2013.

2016 Chronology of Drought in the Delaware River Basin

March 1, 2016	New Jersey Department of Environmental Protection (NJDEP) lifted the drought watch that had been in effect for portions of 12 counties since September 2015. This action returned the entire state to normal status, including five Delaware River Basin (DRB) counties: Hunterdon, Mercer, Monmouth, Morris and Ocean.
July 15, 2016	New York State Department of Environmental Conservation (NYSDEC) issued a drought watch for the entire state, impacting all eight counties located totally or partially within the DRB.
July 25, 2016	NJDEP issued a drought watch for most of northern New Jersey, including DRB counties Sussex, Warren, Hunterdon, Mercer and Morris.
August 2, 2016	Pennsylvania Department of Environmental Protection (PADEP) issued a drought watch for six DRB counties: Berks, Carbon, Lehigh, Northampton, Schuylkill and Lebanon.
September 6, 2016	PADEP expanded the drought watch to include three additional DRB counties: Chester, Delaware and Philadelphia. A total of nine DRB counties in Pennsylvania were now under drought watch status.
October 5, 2016	NJDEP expanded the drought watch to include Burlington, Camden, Gloucester, Monmouth, Ocean and Salem counties. A total of 11 New Jersey counties located totally or partially in the DRB were now under drought watch.
October 21, 2016	NJDEP upgraded drought status to drought warning in Hunterdon, Mercer, Monmouth, Morris, Ocean, Sussex and Warren counties. A drought watch remained in effect for Burlington, Gloucester, Camden and Salem counties. The only three counties to remain in normal status were Atlantic, Cumberland and Cape May counties, where rainfall over the past few months remained normal to above normal.
October 26, 2016	Beltzville Reservoir storage dropped below the 615' drought warning elevation. A Lower Basin Drought Warning was not triggered, however, since Blue Marsh storage remained above the 283' drought warning elevation for that reservoir.
November 3, 2016	PADEP upgraded drought status to drought warning in Carbon, Lehigh, Monroe and Northampton counties. Drought watch status was expanded to include Bucks, Luzerne, Lackawanna, Lancaster, Montgomery, Pike and Wayne counties. All of Pennsylvania's DRB counties were now under either drought watch or drought warning status.
November 9, 2016	In response to declining reservoir storage and increasing rainfall deficits, DRBC held a hearing to accept public input about drought issues impacting the basin.
November 23, 2016	DRBC held a special meeting where it adopted Resolution 2016-7 which provided for coordinated actions to manage regional reservoir operations, out-of-basin diversions and Delaware River flow objectives. The entire DRB was deemed to be in drought watch stage based on storage in the New York City (NYC) reservoirs. The flow targets on the Delaware River at Montague, N.J. and Trenton, N.J. were reduced to 1,650 cubic feet per second (cfs) and 2,700 cfs, respectively. Conservation releases were reduced from the NYC reservoirs as well as from Beltzville and Blue Marsh reservoirs in the Lower Basin. The difference between the amount of water diverted from the basin by New Jersey and lower values in the diversion ranges listed in Table 1 of the resolution were to be drawn from a bank of water capped at 1.48 billion gallons (BG), or 2,300 cfs-days, established by the parties to the 1954 U.S. Supreme Court Decree.

November 28, 2016 Consumptive use replacement from Merrill Creek Reservoir began on this date.

Also, the lowest combined storage level in the three NYC Delaware reservoirs **(106.406 BG or 39.3% of capacity)** during 2016 was reached *[Cannonsville Reservoir: 17.319 BG (18.1%); Pepacton Reservoir: 69.776 BG (49.8 %); and Neversink Reservoir: 19.311 BG (55.3 %)]*.

November 29, 2016 Storage in the basin's reservoirs began to increase in response to heavy rainfall in the region.

December 1, 2016 Blue Marsh Reservoir storage increased to the normal winter pool elevation of 285'. Storage in Beltzville Reservoir was steadily rising, but still below the drought warning elevation line.

December 31, 2016 The basin remained under a drought watch. Combined storage in the NYC Delaware reservoirs was 135.7 BG (50.1%), which was 89.1 BG below long-term daily median and 9.8 BG above the drought watch curve. Storage needed to be at least 15 BG above the drought watch curve for five consecutive days to automatically end the drought watch. The salt front was located at river mile 73, or four miles upstream of the normal salt front location for December. Beltzville and Blue Marsh reservoir storage was at 73.1% and 100.5% of normal capacity, respectively.

Figure 1: 2016 Annual Precipitation in the Delaware River Basin

Total Precipitation (top) and Total Departure from Normal (bottom) in Inches

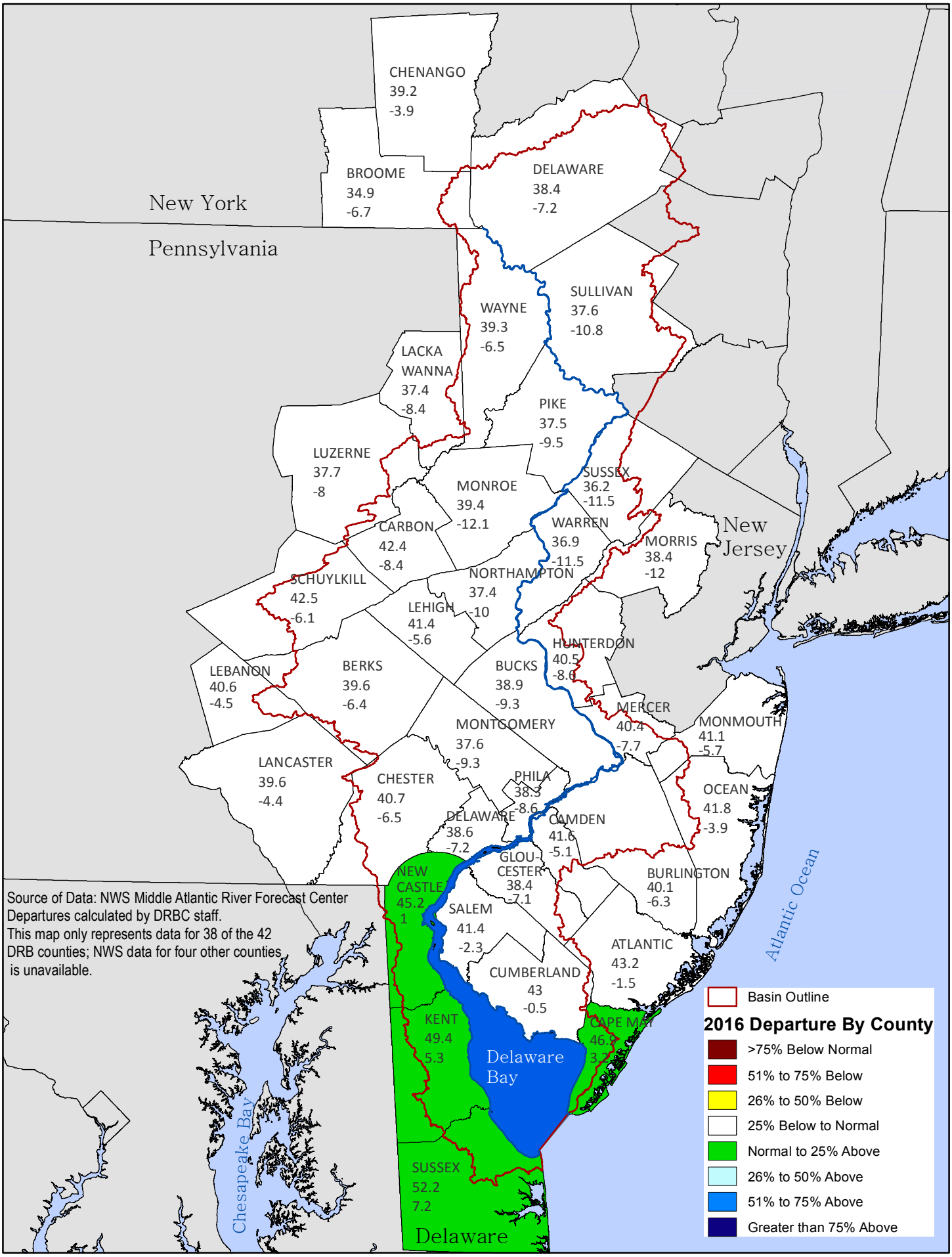


TABLE 1: 2016 PRECIPITATION AT SELECTED STATIONS IN THE DELAWARE RIVER BASIN (INCHES)

	AVG ABOVE MONTAGUE, NJ		ALLENTOWN, PA		AVG ABOVE TRENTON, NJ		READING, PA		PHILADELPHIA, PA		WILMINGTON, DE	
	NORM	OBS	NORM	OBS	NORM	OBS	NORM	OBS	NORM	OBS	NORM	OBS
JANUARY	3.10	1.73	3.03	3.17	3.28	2.30	3.05	3.53	3.03	2.63	3.01	2.30
FEBRUARY	2.58	4.31	2.70	5.86	2.79	4.80	2.48	3.28	2.65	4.36	2.68	4.43
MARCH	3.42	1.39	3.39	0.96	3.59	1.20	3.48	0.96	3.79	2.01	3.92	1.80
APRIL	3.92	2.65	3.56	1.79	4.04	2.60	3.77	1.79	3.56	1.75	3.5	1.84
MAY	4.20	3.55	4.14	4.05	4.36	3.80	4.24	4.38	3.71	6.65	3.95	7.30
JUNE	4.41	3.21	4.31	1.87	4.66	3.40	3.78	1.82	3.43	1.87	3.88	3.69
JULY	4.17	6.27	4.95	6.72	4.48	5.90	4.52	3.97	4.35	3.88	4.57	6.35
AUGUST	3.85	4.26	3.69	1.99	4.11	3.60	3.64	4.72	3.50	1.70	3.25	1.55
SEPTEMBER	4.35	1.99	4.62	3.42	4.65	3.70	4.34	4.65	3.78	3.52	4.32	4.80
OCTOBER	4.15	3.24	3.88	1.23	4.41	2.30	3.22	0.88	3.18	2.06	3.42	2.22
NOVEMBER	3.76	2.08	3.50	3.33	3.87	2.90	3.46	2.65	2.99	2.17	3.10	1.91
DECEMBER	3.38	3.41	3.58	2.43	3.76	2.70	3.29	2.13	3.56	2.72	3.48	2.59
TOTAL 2016	**45.29**	**38.09**	**45.35**	**36.82**	**48.00**	**39.20**	**43.27**	**34.76**	**41.53**	**35.32**	**43.08**	**40.78**
DIFF 2016		**-7.20**		**-8.53**		**-8.80**		**-8.51**		**-6.21**		**-2.30**

NOTES:

1. Average Above Montague, N.J. is based on the weighted average of 10 stations.
2. Average Above Trenton, N.J. is based on the weighted average of 99 stations.
3. Precipitation normals for all stations represent average precipitation for period of record (POR) 1981-2010.

Source: National Weather Service, Mt. Holly, N.J.

NORM = Normal
OBS = Observed

TABLE 2: 2016 STREAMFLOW (IN CFS) IN THE DELAWARE RIVER BASIN

OBSERVED MONTHLY MEAN FLOW VERSUS NORMAL[1] MONTHLY FLOW							
		Delaware River @ Montague	Lehigh River @ Lehighton	Lehigh River @ Bethlehem	Delaware River @ Trenton	Schuylkill River @ Pottstown	Schuylkill River @ Philadelphia
Jan	OBS	6,229	1,466	2,893	13,765	2,232	2,873
	% NORM	122.7%	115.4%	104.1%	98.3%	122.1%	104.7%
Feb	OBS	8,436	2,206	5,149	21,742	5,554	8,450
	% NORM	166.8%	213.3%	188.3%	185.2%	246.3%	219.0%
Mar	OBS	5,519	1,076	2,306	11,454	1,881	2,723
	% NORM	62.6%	60.9%	60.1%	62.9%	66.3%	59.2%
Apr	OBS	4,110	852	1,701	7,747	1,451	1,933
	% NORM	38.6%	48.6%	46.6%	38.5%	54.8%	48.7%
May	OBS	5,065	1,014	1,931	9,492	1,676	2,722
	% NORM	87.5%	79.1%	72.5%	81.3%	94.1%	104.2%
Jun	OBS	2,543	614	1,360	5,333	896	1,185
	% NORM	80.3%	63.7%	68.4%	74.2%	64.5%	64.2%
Jul	OBS	2,440	443	997	4,699	698	841
	% NORM	99.9%	66.7%	69.6%	86.2%	65.5%	62.6%
Aug	OBS	3,216	555	1,130	5,862	715	853
	% NORM	148.3%	112.6%	101.3%	132.0%	95.5%	78.6%
Sep	OBS	1,943	283	742	3,023	597	586
	% NORM	96.4%	59.4%	67.5%	68.1%	76.4%	53.2%
Oct	OBS	1,970	292	869	3,104	790	744
	% NORM	74.2%	30.1%	48.4%	51.6%	79.4%	53.8%
Nov	OBS	1,988	261	618	3,127	475	474
	% NORM	43.6%	20.2%	26.0%	31.2%	27.8%	20.1%
Dec	OBS	3,950	567	1,253	6,755	1,238	1,833
	% NORM	78.2%	30.2%	38.8%	52.3%	51.0%	50.8%

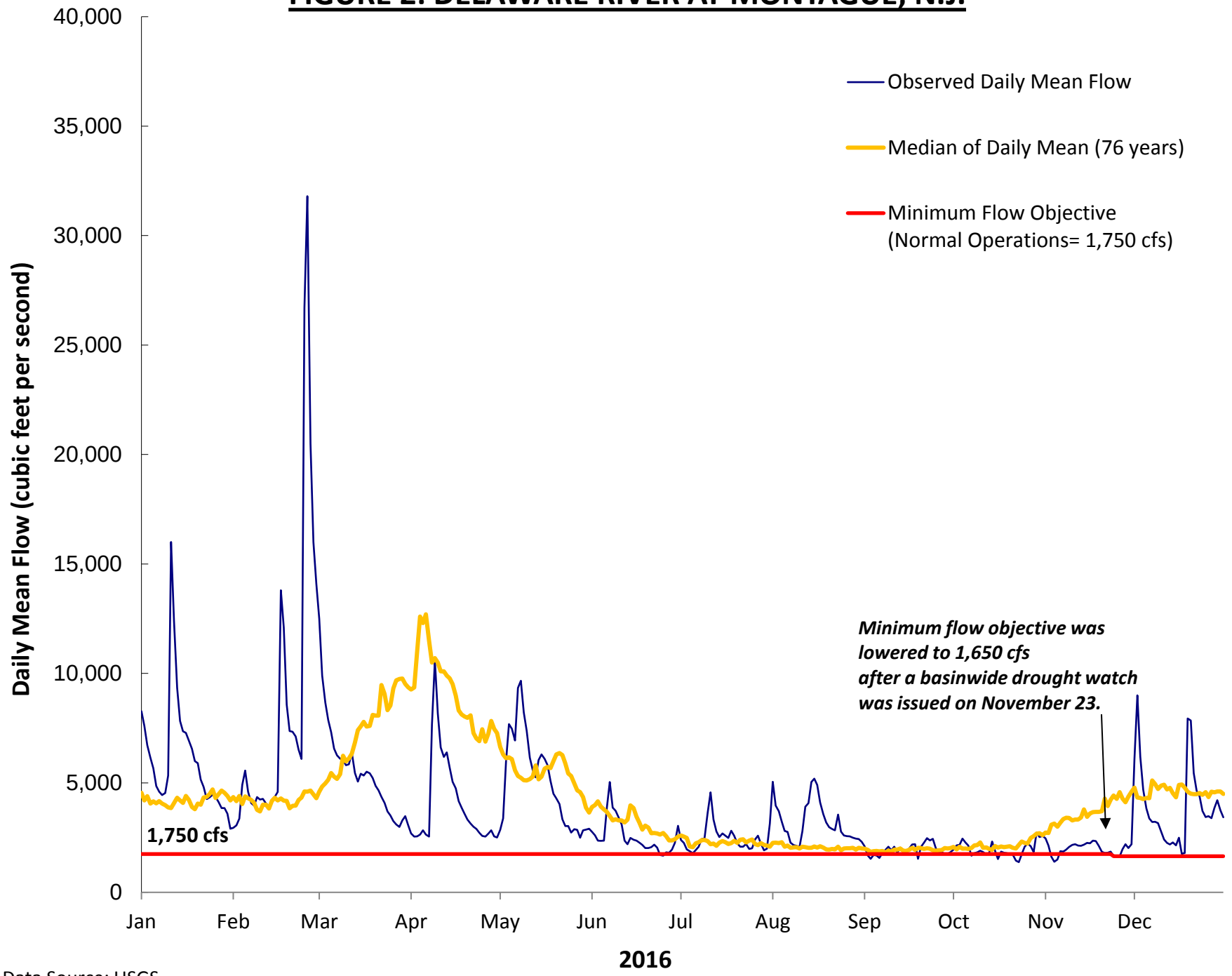
Source: United States Geological Survey streamgage measurements. Based on provisional data and subject to change.

Note:

[1]Median of monthly mean flow values for the following periods of record (POR) were used to calculate the normal monthly flow:

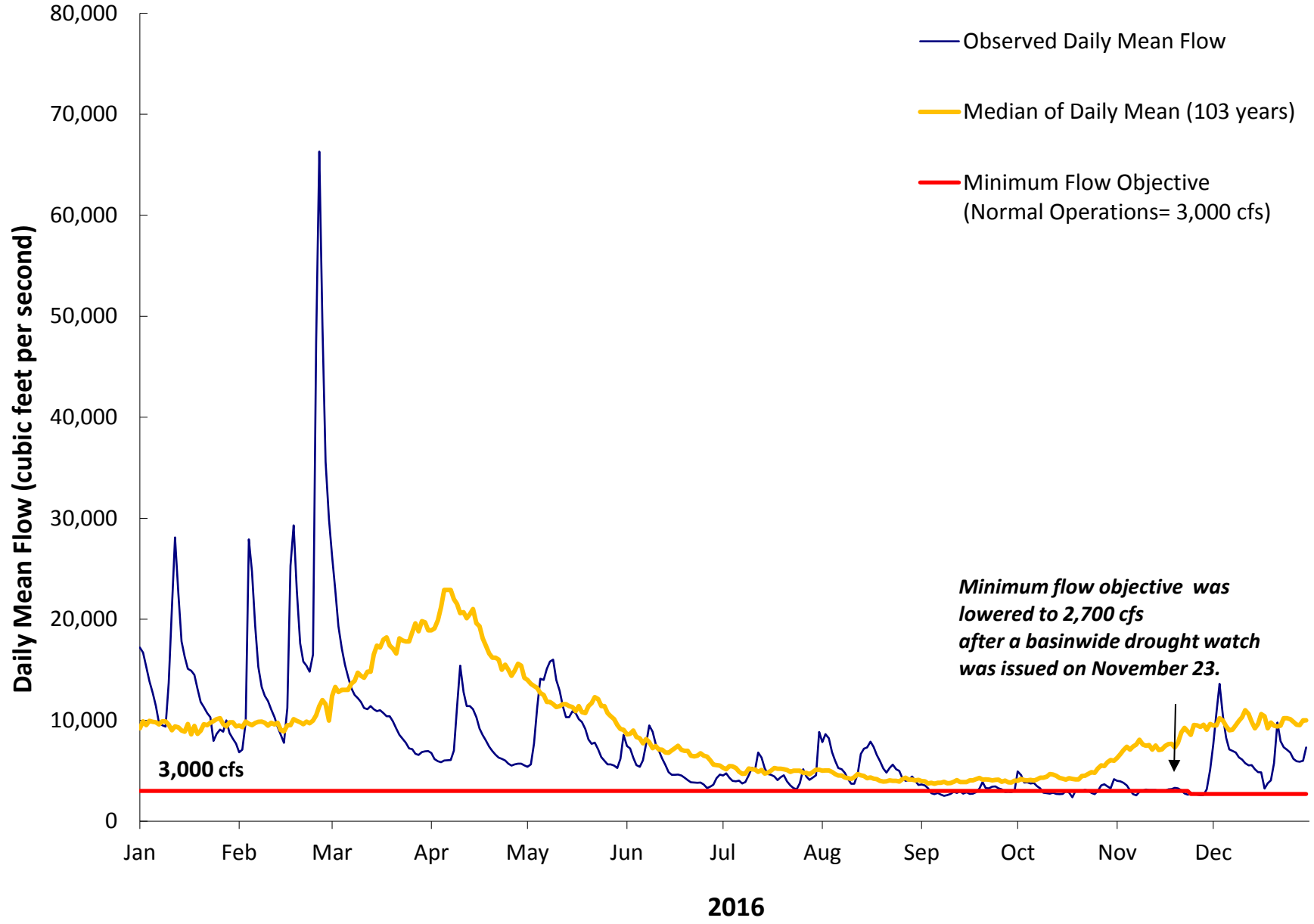
Gage	**POR for Median**
Montague	1956-2011
Lehighton	1983-2011
Bethlehem	1972-2011
Trenton	1972-2011
Pottstown	1980-2011
Philadelphia	1980-2011

FIGURE 2: DELAWARE RIVER AT MONTAGUE, N.J.



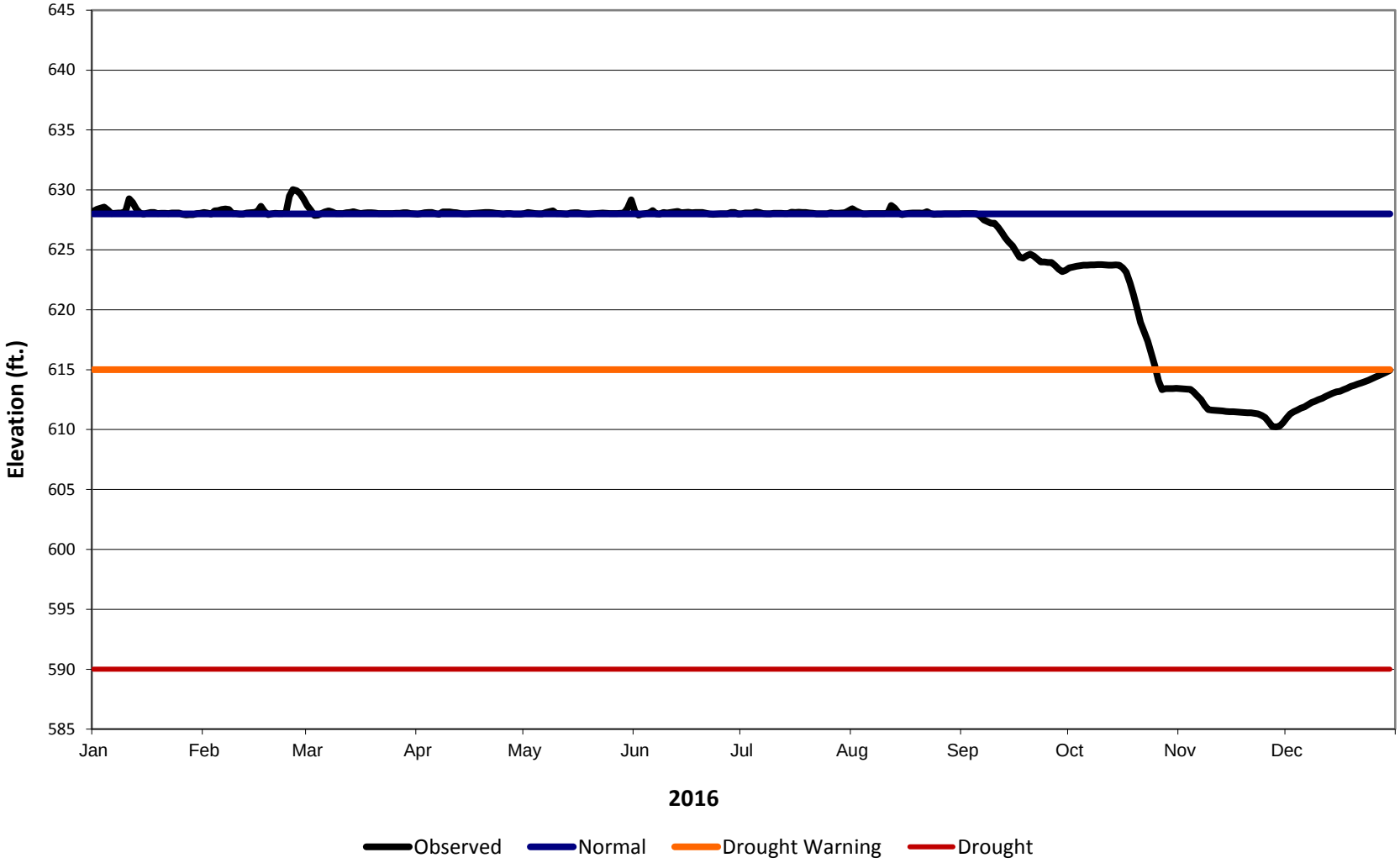
Data Source: USGS
Graph generated by DRBC staff.

FIGURE 3: DELAWARE RIVER AT TRENTON, N.J.



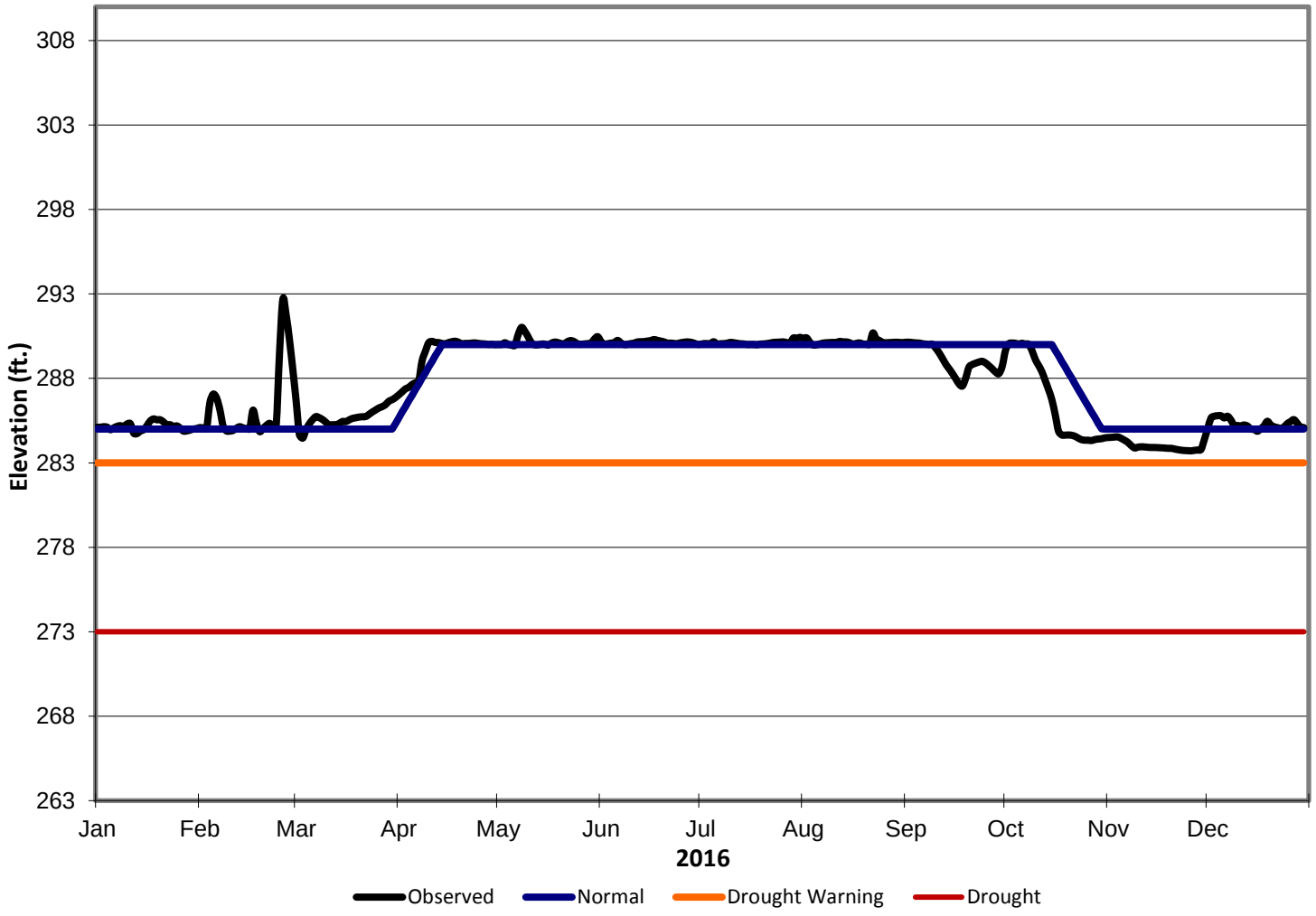
Data Source: USGS
Graph generated by DRBC staff.

FIGURE 4: BELTZVILLE RESERVOIR ELEVATION
2016



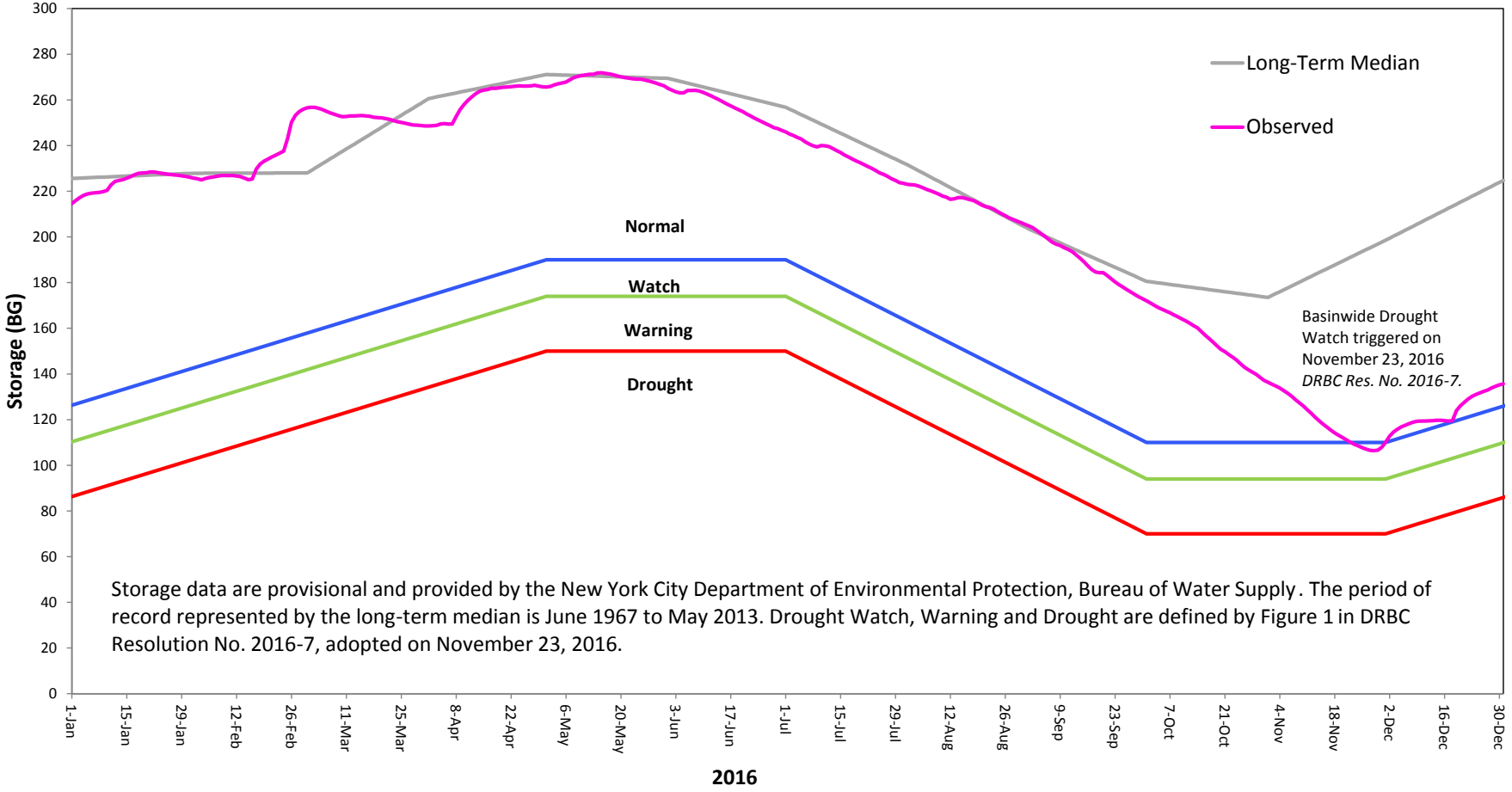
Notes:
1. The normal pool elevation is 628 feet.
2. Data was provided by the Army Corps of Engineers (morning values). Graph generated by DRBC staff.

FIGURE 5: BLUE MARSH RESERVOIR ELEVATION
2016



Notes:
1. Winter Pool=285 feet (October- March)/Summer Pool=290 feet (April-September).
2. Data was provided by the Army Corps of Engineers (morning values). Graph generated by DRBC staff.

FIGURE 6: NEW YORK CITY DELAWARE RIVER BASIN STORAGE 2016



Storage data are provisional and provided by the New York City Department of Environmental Protection, Bureau of Water Supply. The period of record represented by the long-term median is June 1967 to May 2013. Drought Watch, Warning and Drought are defined by Figure 1 in DRBC Resolution No. 2016-7, adopted on November 23, 2016.

FIGURE 7: USGS WELL-SULLIVAN CO., NEW YORK
2016 Observations of Depth to Water

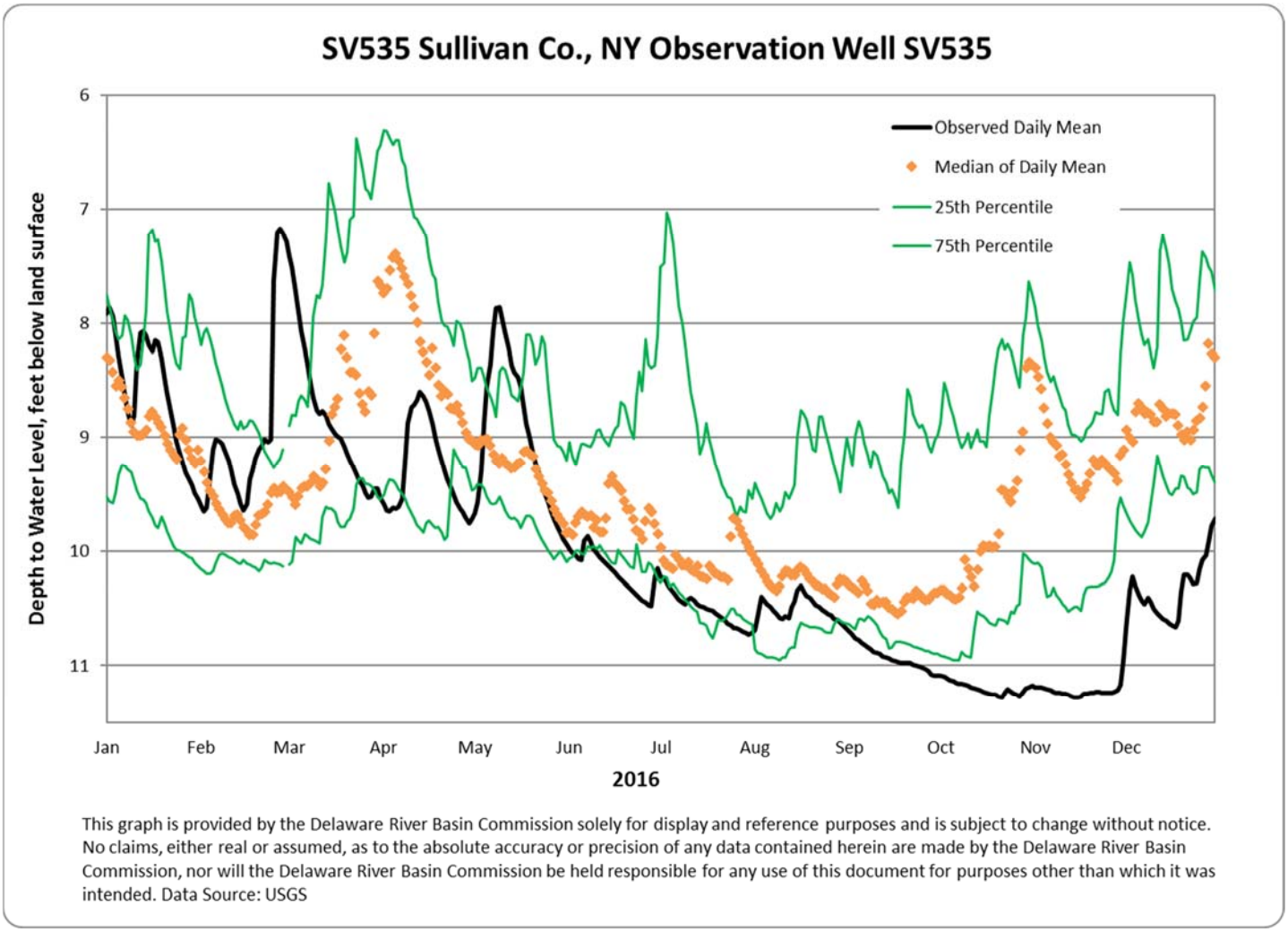
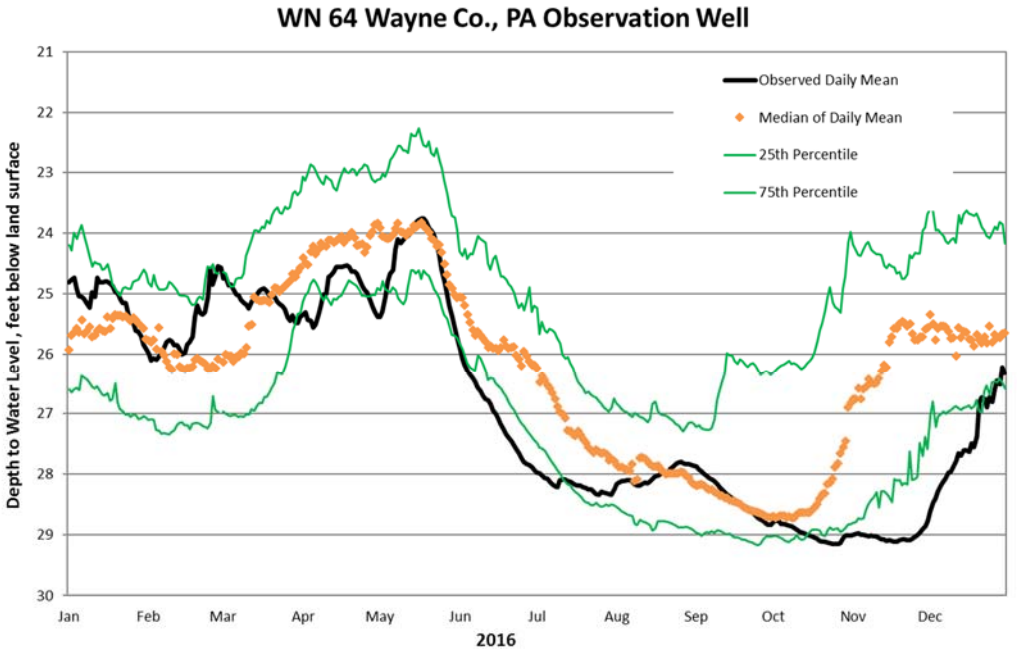
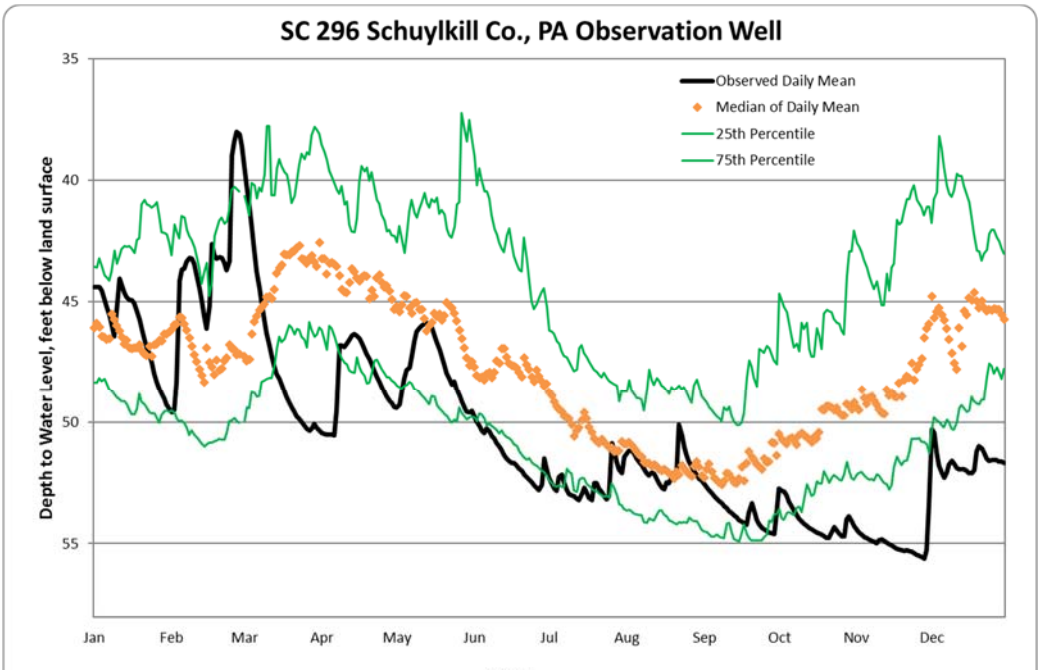


FIGURE 8: FIVE SELECTED USGS OBSERVATION WELLS LOCATED IN PENNSYLVANIA

2016 Observations of Depth to Water

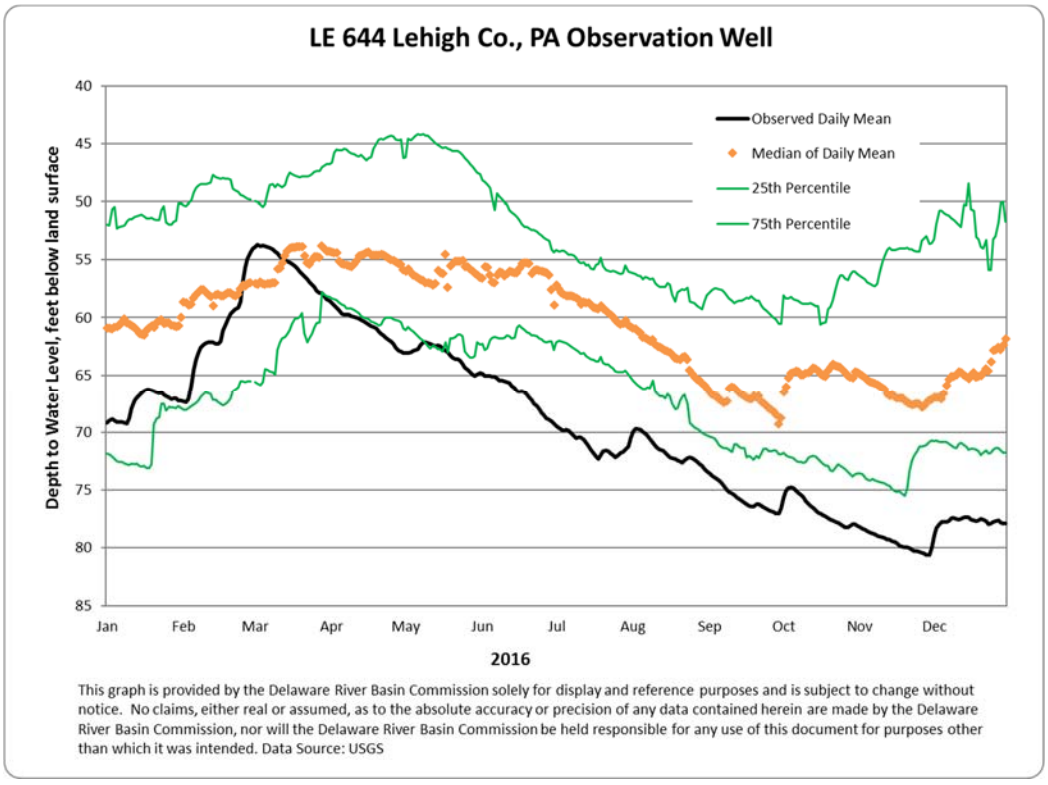


This graph is provided by the Delaware River Basin Commission solely for display and reference purposes and is subject to change without notice. No claims, either real or assumed, as to the absolute accuracy or precision of any data contained herein are made by the Delaware River Basin Commission, nor will the Delaware River Basin Commission be held responsible for any use of this document for purposes other than which it was intended. Data Source: USGS



This graph is provided by the Delaware River Basin Commission solely for display and reference purposes and is subject to change without notice. No claims, either real or assumed, as to the absolute accuracy or precision of any data contained herein are made by the Delaware River Basin Commission, nor will the Delaware River Basin Commission be held responsible for any use of this document for purposes other than which it was intended. Data Source: USGS

Figure 8 Continued



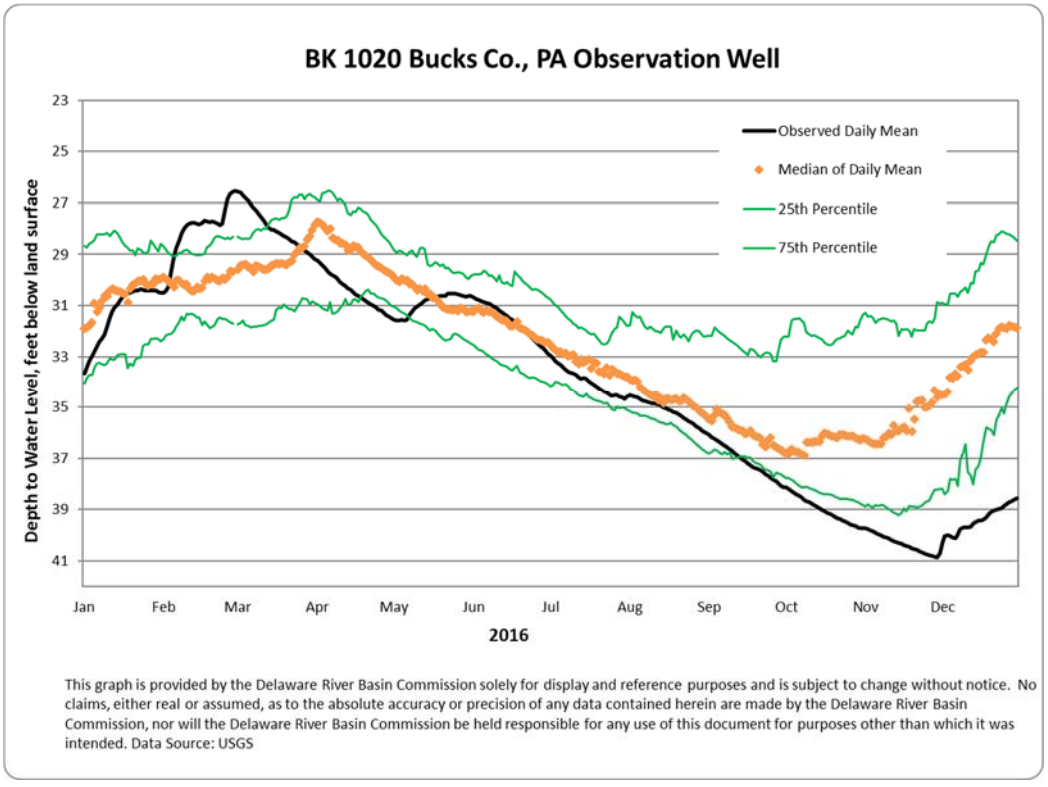


Figure 8 Continued

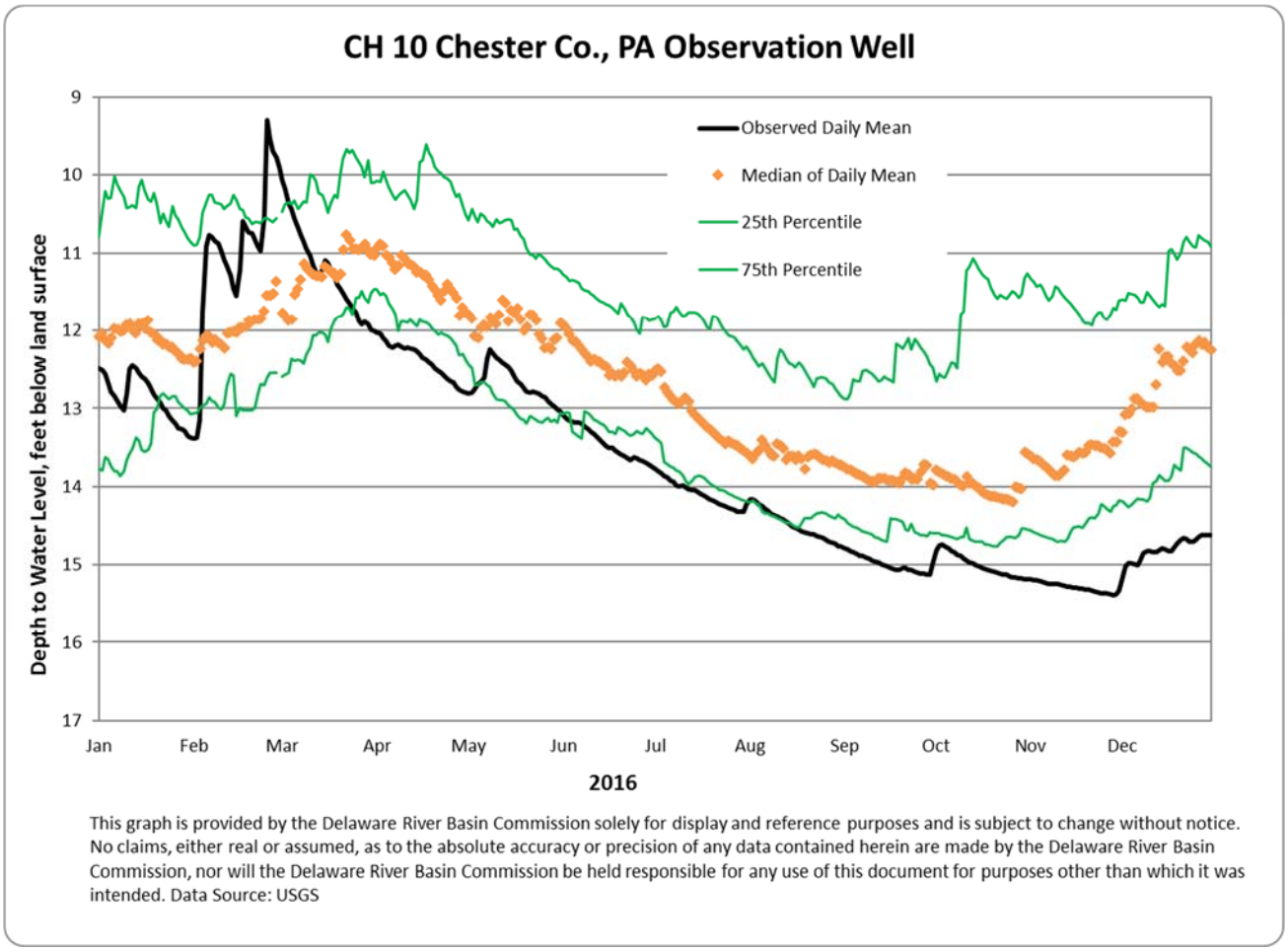


FIGURE 9: DGS Well- NEW CASTLE CO., DELAWARE
2016 Observations of Depth to Water

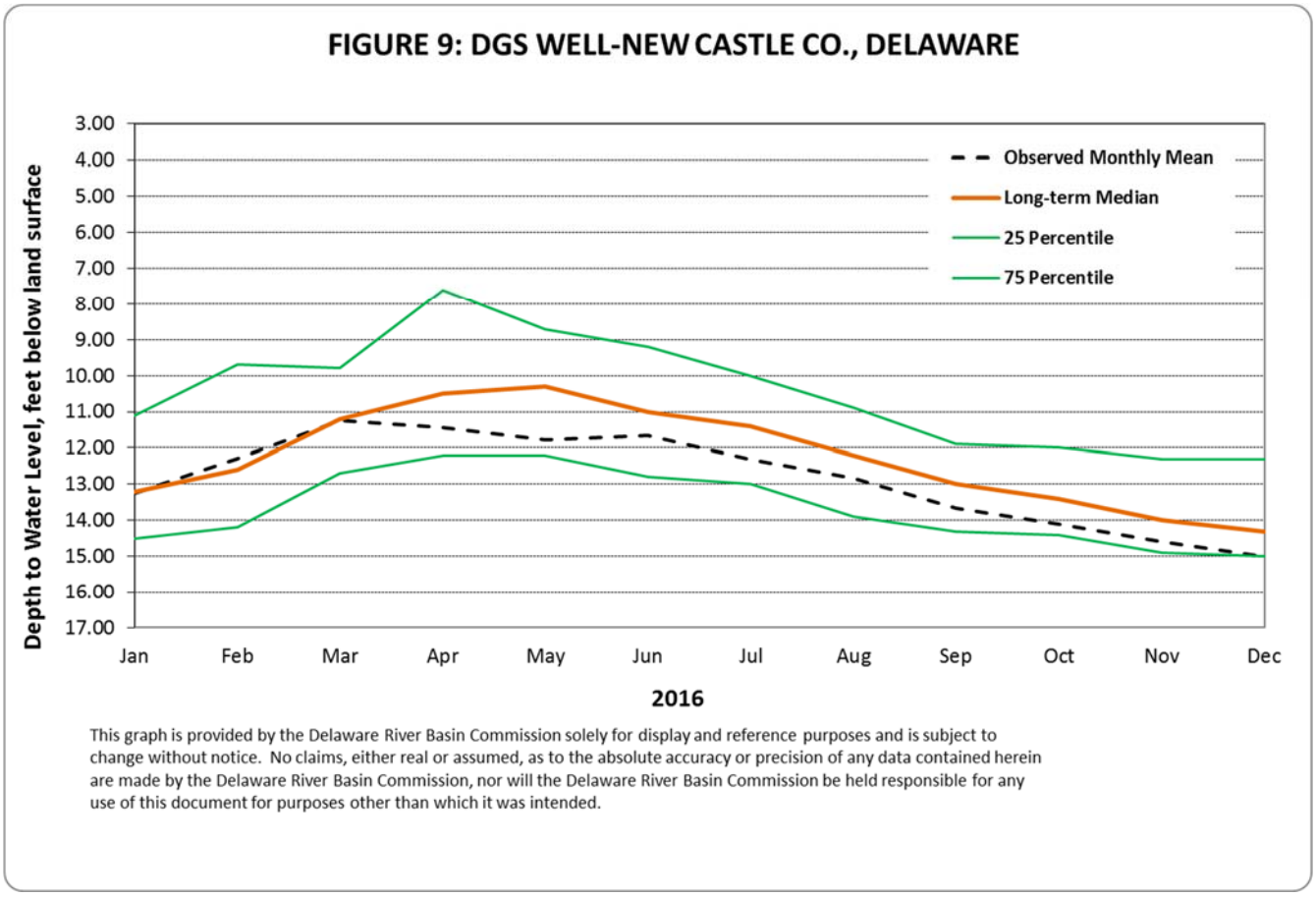


FIGURE 10: USGS WELL-Cumberland Co., New Jersey
2016 Observations of Depth to Water

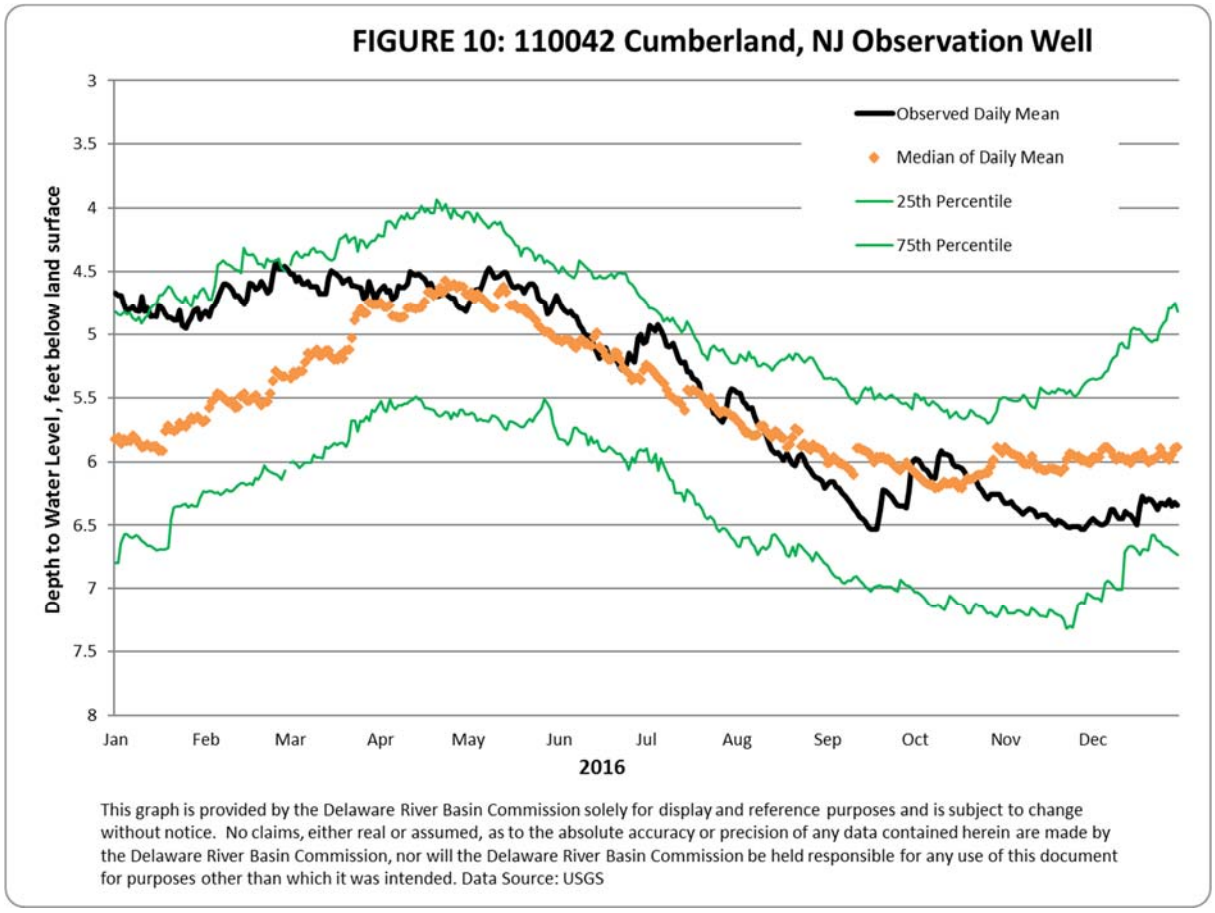
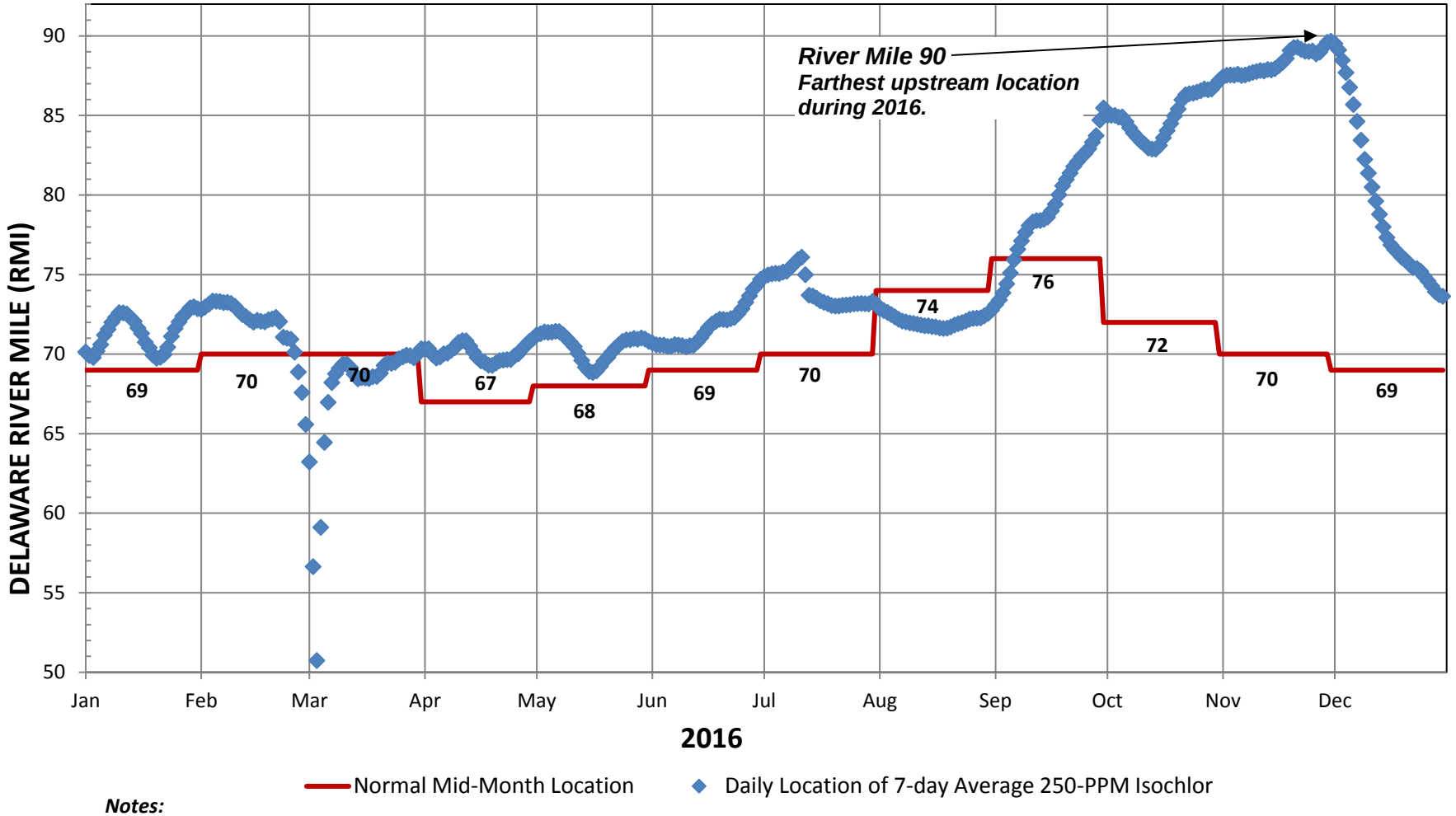


FIGURE 11: 7-DAY AVERAGE LOCATION OF THE 250-PPM ISOCHLOR



Notes:
1. DRBC does not estimate locations below river mile 54.
2. The normal mid-month location of the salt line represents the median location based on data from January 1998 through February 2013.
3. Data sources are USGS and Kimberly Clark Corporation.
4. PPM=parts per million