

# Delaware River Basin Commission

## The Delaware River Basin and the importance of the Schuylkill

**Steve Tambini**  
**Executive Director**

November 4, 2016  
SAN Annual Meeting



# Objectives

- Today
  - History
  - The Future
  - Today
- Facts and Figures**



**Delaware River Basin Commission**

DELAWARE • NEW JERSEY  
PENNSYLVANIA • NEW YORK  
UNITED STATES OF AMERICA

# Water in the News

U.S.

<http://www.nytimes.com/interactive/2016/01/21/us/flint-lead-water-timeline.html>

## Events That Led to Flint's Water Crisis

FEATURED

## More Pennsylvania counties earn drought designation

Oct 13, 2016

[http://www.dailyitem.com/news/more-pennsylvania-counties-earn-drought-designation/article\\_7182d736-914d-11e6-b3b7-f78753ecb785.html](http://www.dailyitem.com/news/more-pennsylvania-counties-earn-drought-designation/article_7182d736-914d-11e6-b3b7-f78753ecb785.html)

<https://stateimpact.npr.org/pennsylvania/2016/10/27/delaware-river-salt-front-at-six-year-high-after-prolonged-dry-spell/>

## Delaware River salt front at six-year high after prolonged dry spell

OCTOBER 27, 2016 | 5:17 PM

2 Comments

Email

The White House  
Office of the Press Secretary

For Immediate Release

March 21, 2016

## Presidential Memorandum: Building National Capabilities for Long-Term Drought Resilience

<https://www.whitehouse.gov/the-press-office/2016/03/21/presidential-memorandum-building-national-capabilities-long-term-drought>

## America's infrastructure has some serious problems – here's how to fix it

John Mauldin, Mauldin Economics

Oct. 13, 2016, 5:18 PM 1,582 3

<http://www.mauldineconomics.com/editorial/john-mauldin-my-infrastructure-plan-to-save-the-us-economy>

## Justices Wade Into Kansas-Nebraska Water Dispute

<http://www.nationallawjournal.com/supremecourtbrief/id=1202673357540/Justices-Wade-Into-Kansas-Nebraska-Water-Dispute?slreturn=20161008113332>

## ClimateEngine.org Unveiled at White House Water Summit

*DRI, U. Idaho, Google commit to expand new technology to address water issues*

<https://www.dri.edu/newsroom/news-releases/5269-climateengine-org-unveiled-at-white-house-water-summit>



# Jeopardy Contestants Can't Get Schuylkill Clue – Again!

Could you give the correct response to this clue for \$800? These contestants couldn't.

BY DAN MCQUADE | NOVEMBER 2, 2016 AT 9:34 AM

SHARE 0

TWEET 1

g+1 0

Pin it 0

EMAIL 0

10 COMMENTS



<http://www.phillymag.com/news/2016/11/02/jeopardy-schuylkill-clue/>

# Schuylkill River "Today" @ Philadelphia

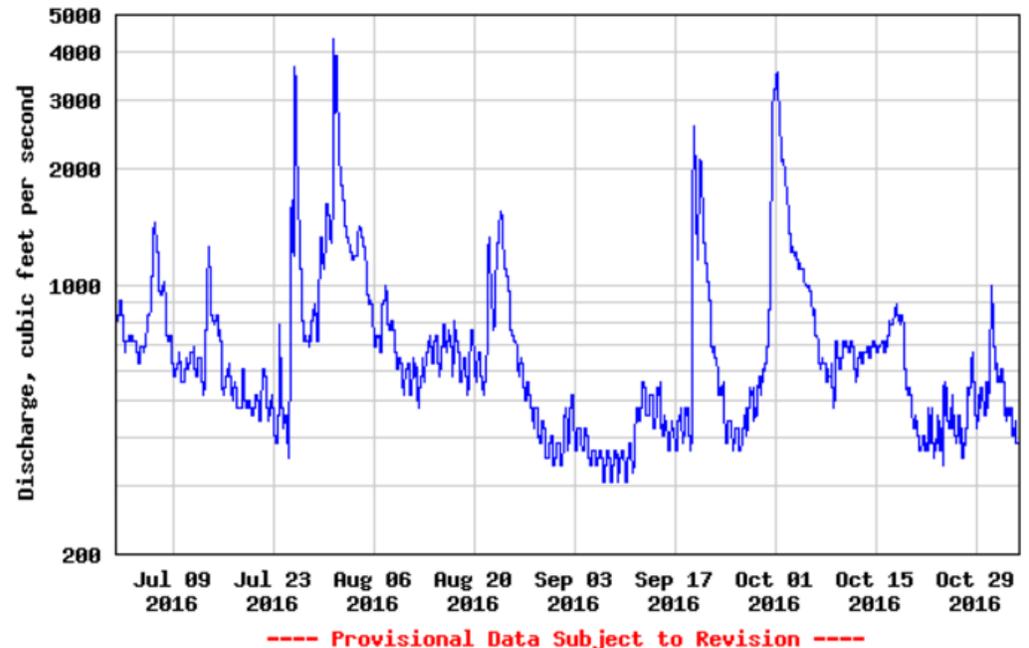
**Discharge, cubic feet per second**

Most recent instantaneous value: 387 11-03-2016 15:00 EDT

Daily discharge, cubic feet per second -- statistics for Nov 3  
based on 85 years of record [more](#)

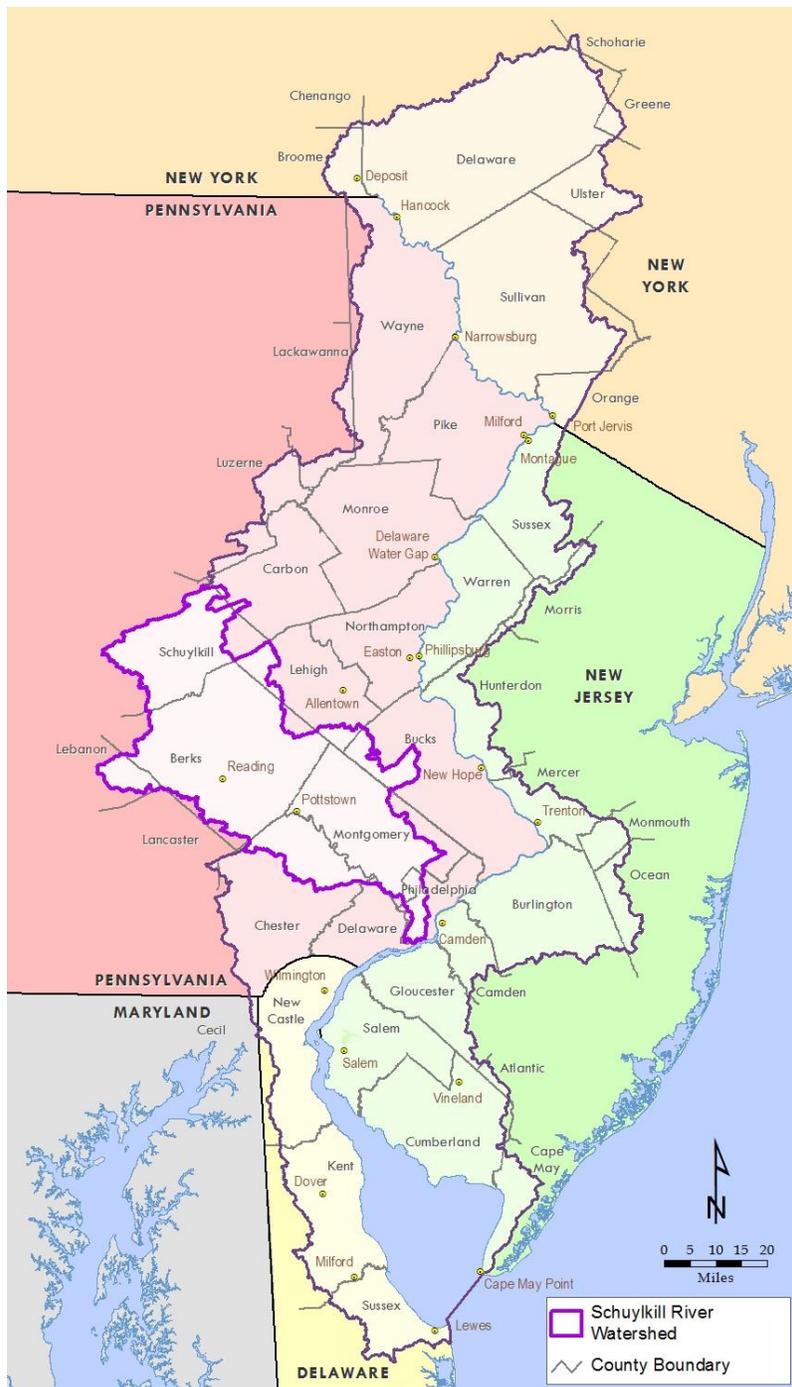
Min (1965)	Most Recent Instantaneous Value Nov 3	25th percentile	Median	Mean	75th percentile	Max (1957)
87	387	697	1280	2140	2800	13000

USGS 01474500 Schuylkill River at Philadelphia, PA



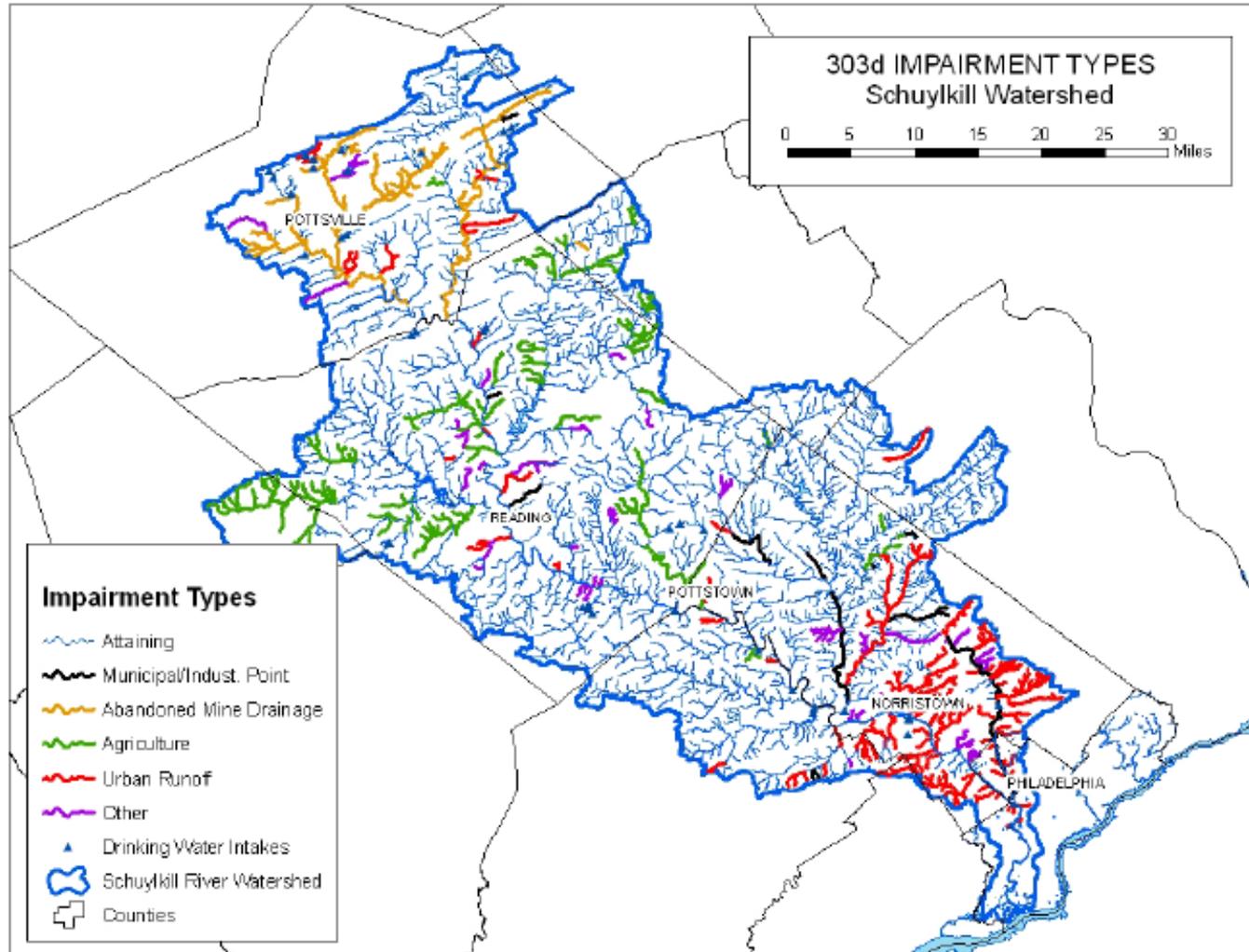
Source: USGS Gage 01474500 Schuylkill  
River at Philadelphia, PA

# Schuylkill River Watershed

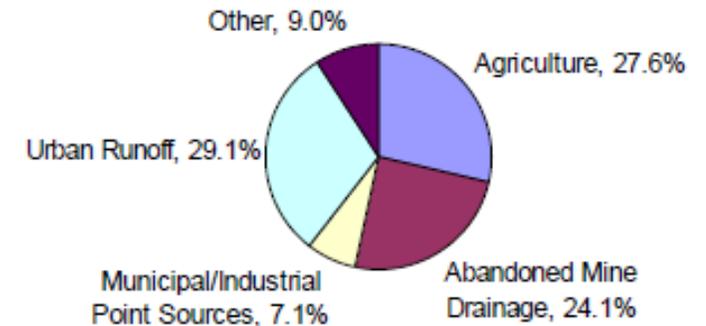


- Largest tributary (HUC8) watershed in the Delaware River Basin.
- Drains 1,911 square miles (all in Pennsylvania)
- Drains ~14% of the Delaware River Watershed.
- Average annual water withdrawals = 403 MGD
- DRBC manages ~500 water withdrawal and wastewater discharge docket in the watershed (26% of all DRBC dockets)

# Schuylkill River Watershed



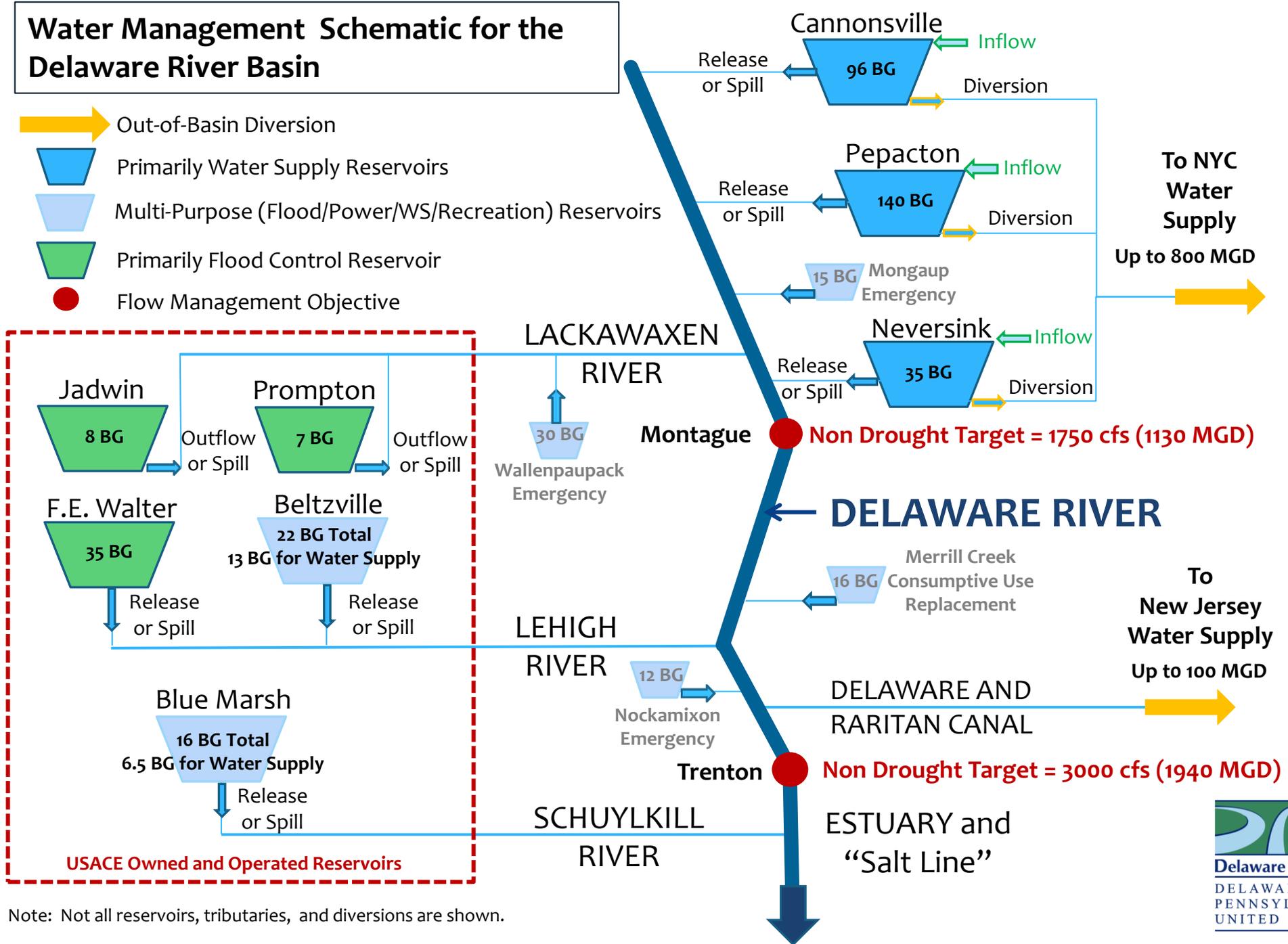
## Causes of Impairment within the Schuylkill River Watershed



From: Philadelphia Water Department, Schuylkill River Watershed, Source Water Protection Plan

# Water Management Schematic for the Delaware River Basin

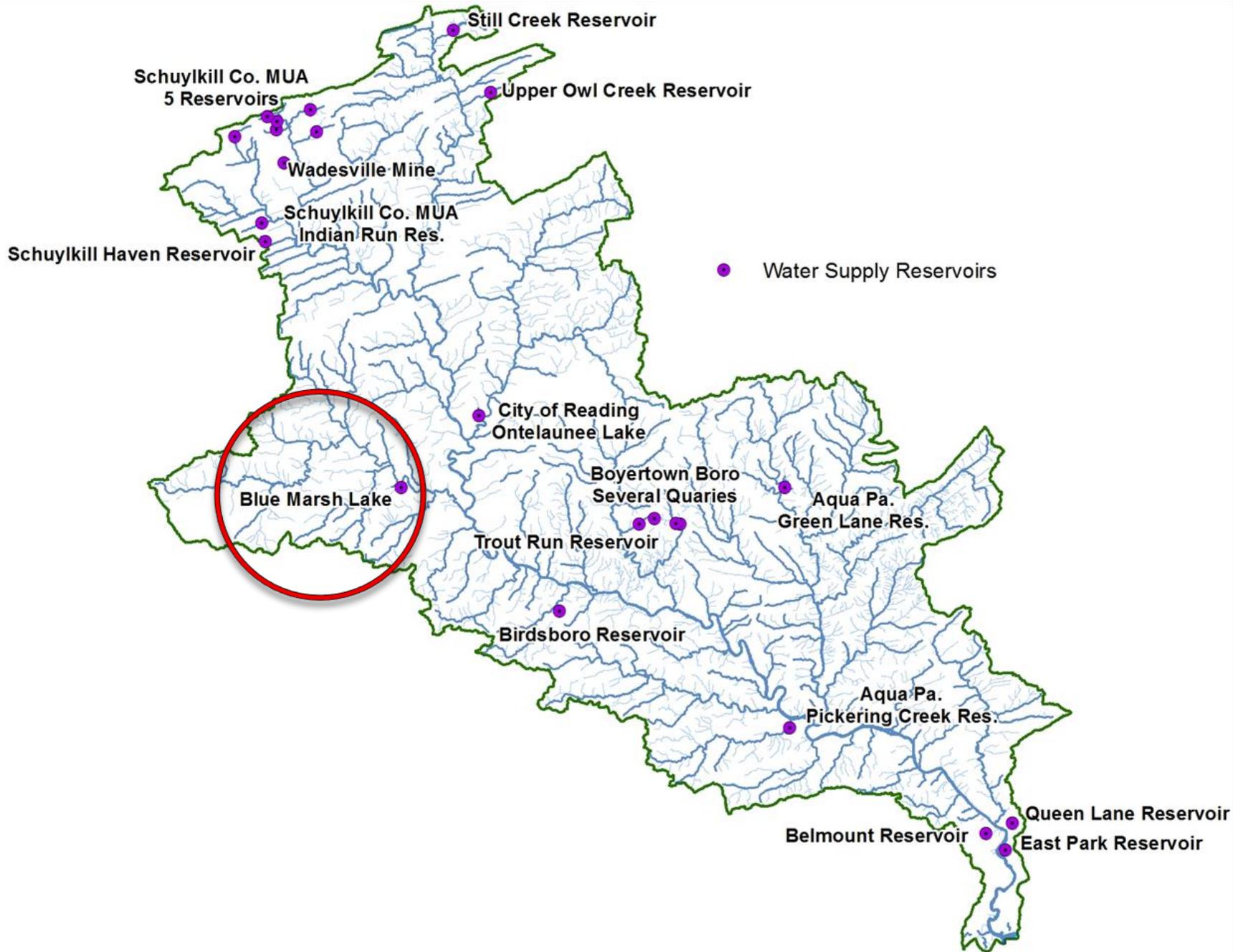
-  Out-of-Basin Diversion
-  Primarily Water Supply Reservoirs
-  Multi-Purpose (Flood/Power/WS/Recreation) Reservoirs
-  Primarily Flood Control Reservoirs
-  Flow Management Objective



Note: Not all reservoirs, tributaries, and diversions are shown.



# Reservoirs



# Definitions



Withdrawals = All

Consumptive Use = the water ... lost to the atmosphere from cooling devices, evaporated from water surfaces, exported from the Delaware River Basin, or any other **water use for which the water withdrawn is not returned to the surface waters of the basin** undiminished in quantity.

1 million gallons per day (**MGD**) = 1.55 cubic feet per second (**cfs**)

# The DRBC and the Schuylkill

- DRBC has the authority to allocate all water withdrawals above 100,000 gpd
  - PADEP only reviews Public Water Suppliers
- DRBC manages consumptive use “make up” water for power producers
- DRBC operates SE Ground Water Protected Area on behalf of PA
  - Withdrawals >10,000 gpd
  - Potentially stressed areas, stressed areas; limits on withdrawals
- DRBC “owns” volume in Blue Marsh Reservoir
- DRBC has basin wide WQ standards.



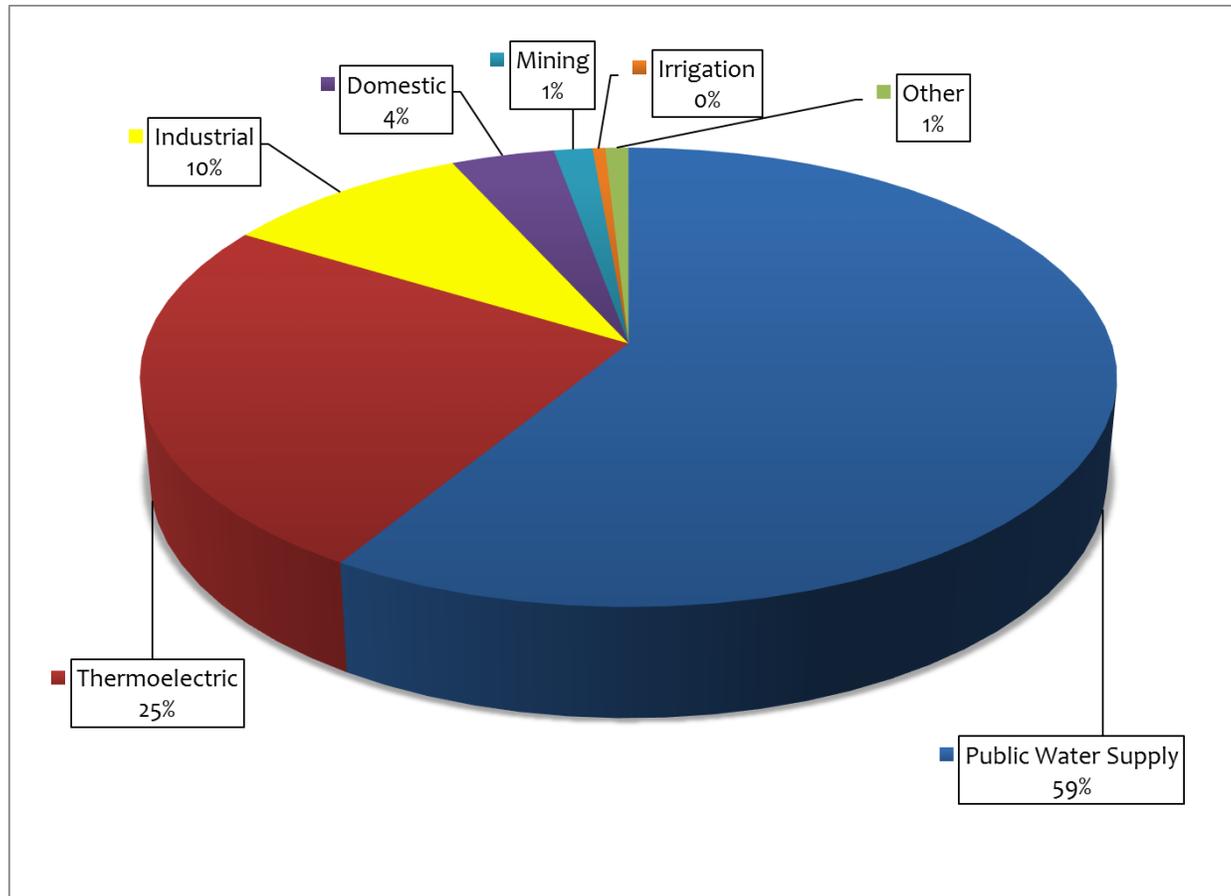
# Water Demand (use, withdrawal, diversion)

**How is water used in the Schuylkill?**

**What is the consumptive water use?**

# Total Water Withdrawals 2008 to 2012

Schuylkill River Basin 403 MGD Annual Average



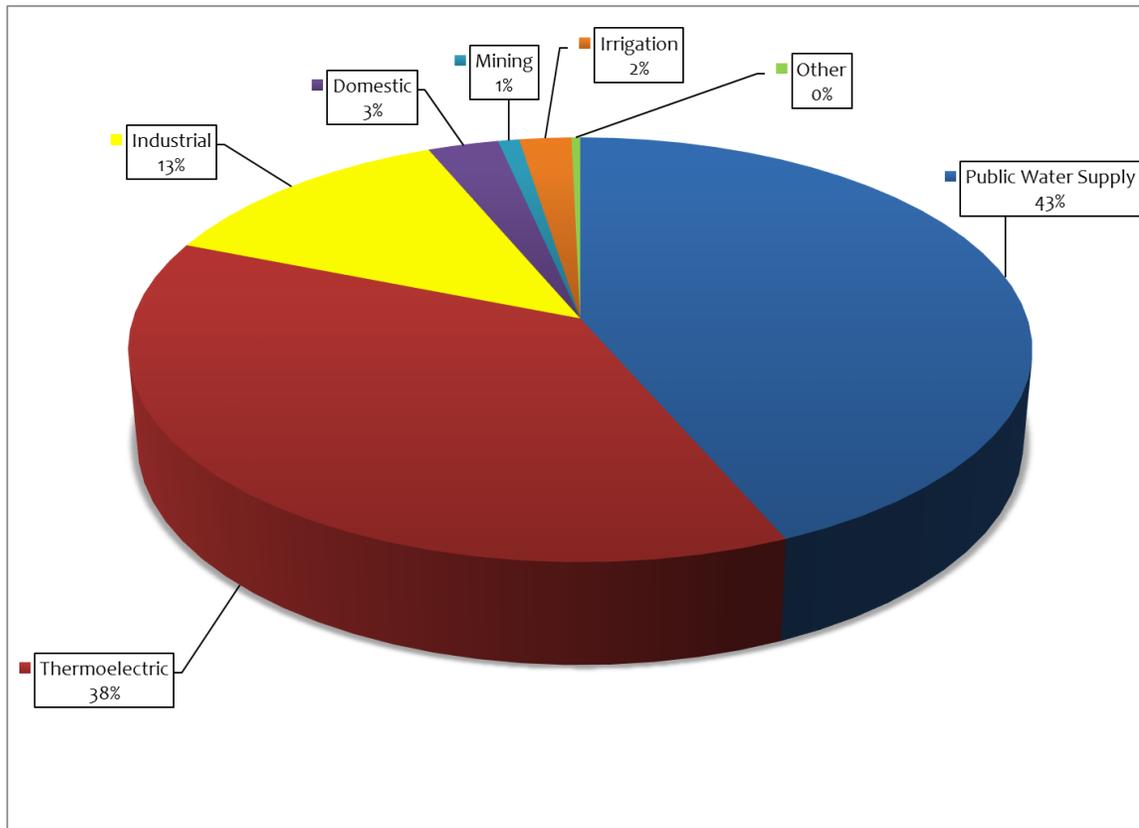
Top Ten Water Withdrawals  
Schuylkill River Basin

Docket Holder	MGD
Philadelphia Water Department	115.8
Aqua Pennsylvania- Main	51.4
Veolia Energy - Grays Ferry Cogeneration Facility	42.4
Exelon - Limerick Generating Station	31.0
Philadelphia Energy Solutions R&M - Girard Point	15.5
Reading Area Water Authority (RAWA)	13.9
Exelon - Schuylkill Generating Station	11.4
Pennsylvania American Water Company - Norristown	11.2
GenOn Energy, Inc. - Titus Power Plant	8.4
Sunoco, Inc. - Point Breeze	7.2

# Consumptive Water Use 2008 to 2012



Schuykill River Basin 82 MGD Annual Average

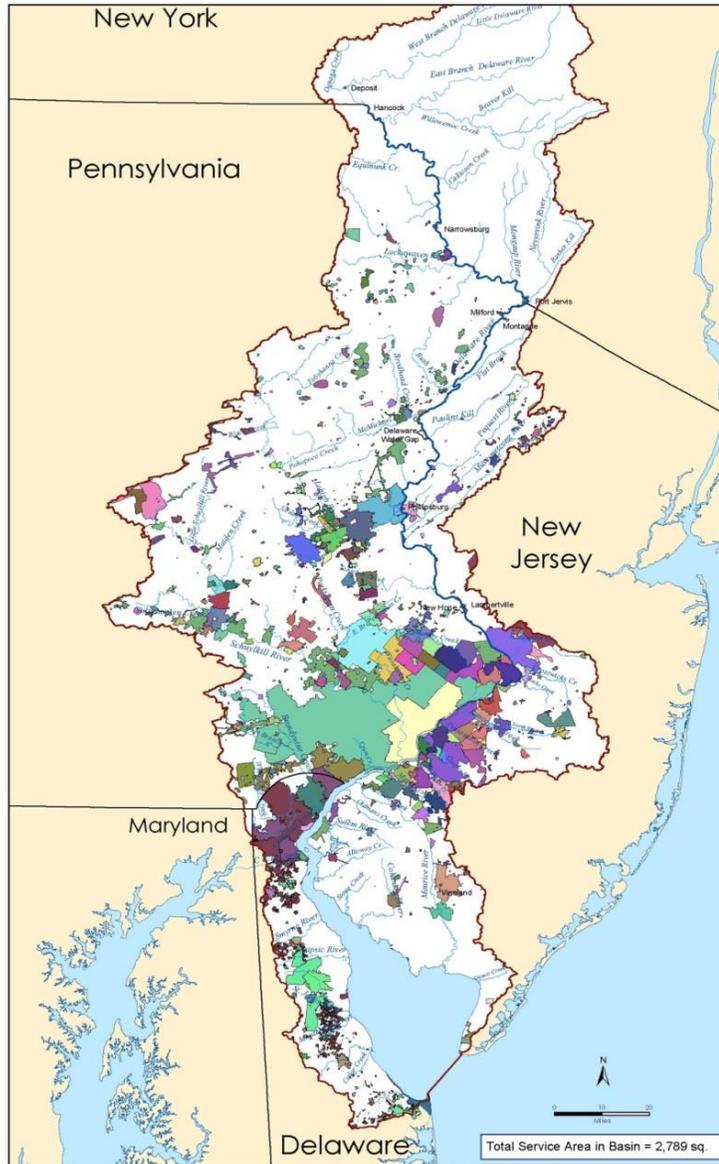


Top Ten Consumptive Water Users  
Schuykill River Basin

Docket Holder	MGD
Exelon - Limerick Generating Station	24.41
Philadelphia Water Department	17.37
Aqua Pennsylvania- Main	7.71
Philadelphia Energy Solutions R&M - Girard Point	7.38
Exelon - Schuylkill Generating Station	3.42
Sunoco, Inc. - Point Breeze	2.16
Reading Area Water Authority (RAWA)	2.08
Pennsylvania American Water Company - Norristown	1.68
AES Ironwood, L.L.C.	0.93
Schuylkill County Municipal Authority	0.73

# Average Withdrawals and Consumptive Uses

Water Service Areas in the Delaware River Basin



Delaware River Basin	Schuylkill River Basin	% in Schuylkill
----------------------	------------------------	-----------------

<b>Total Withdrawals</b>	<b>7,309</b>	<b>403</b>	<b>5.5%</b>
Thermoelectric Power	4,540	101	2.2%
Public Water Supply	879	237	26.9%
Industrial	513	38	7.5%

Delaware River Basin	Schuylkill River Basin	% in Schuylkill
----------------------	------------------------	-----------------

<b>Total Consumptive Use</b>	<b>952</b>	<b>82</b>	<b>8.6%</b>
Thermoelectric Power	91	31	33.8%
Public Water Supply	132	36	26.9%
Industrial	33	10	31.5%

# Exelon Limerick Generating Station - DRBC Docket Highlights

## Allocations:

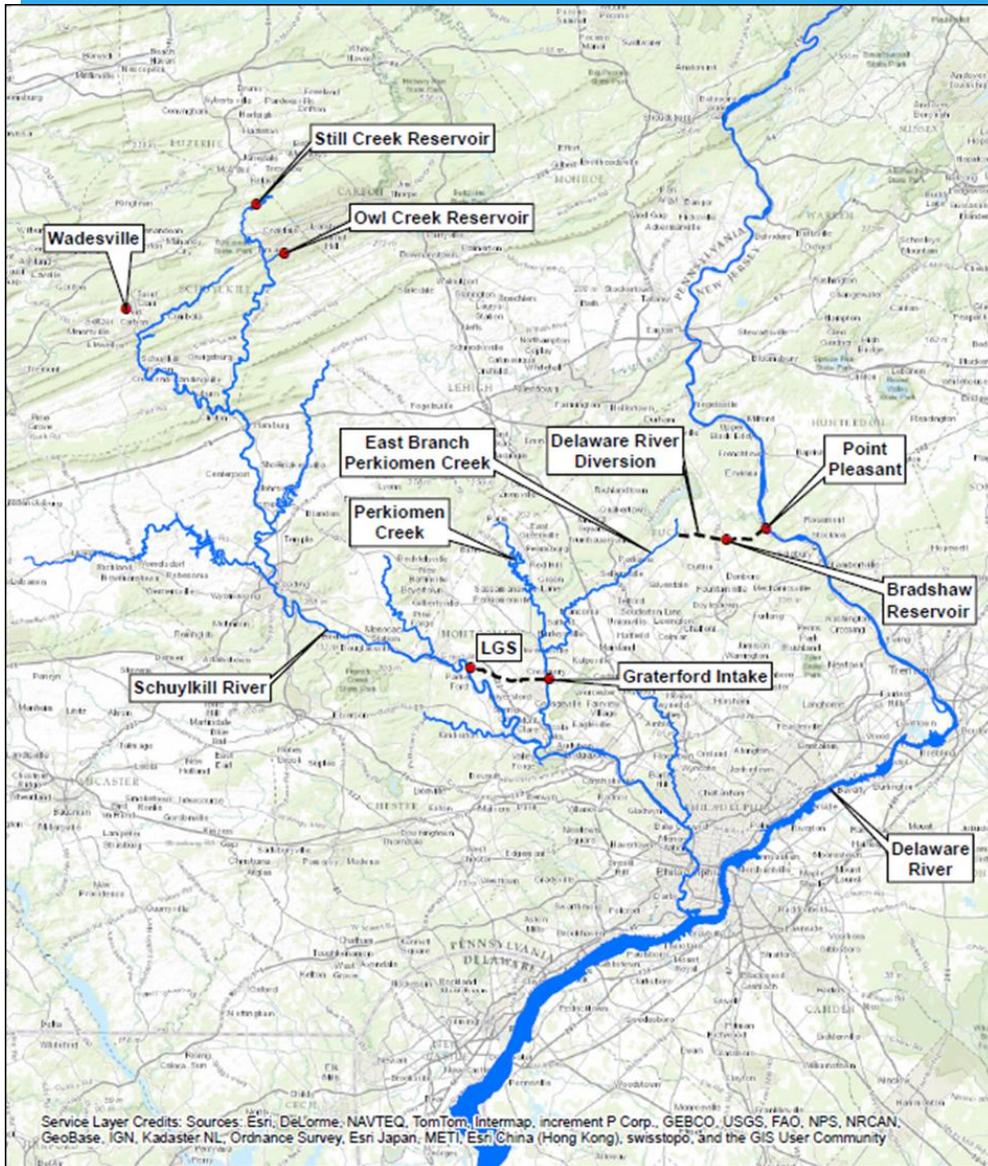
- \* Schuylkill River: up to **58.2 MGD** (90.0 cfs)
  - **44.0 MGD** consumptive (68.1 cfs)
  - **14.2 MGD** non-consumptive (21.9 cfs)
- \* Perkiomen Creek (via the Delaware River Diversion System): up to **42 MGD.** (65.0 cfs)

## Consumptive Use Replacement Requirement:

- Flows @ Pottstown <560 cfs
- 1:1 gallon replacement
- Q7-10 = 313 cfs



# Exelon Limerick Generating Station - DRBC Docket Highlights



## DRBC Docket Highlights

### Augmentation Sources

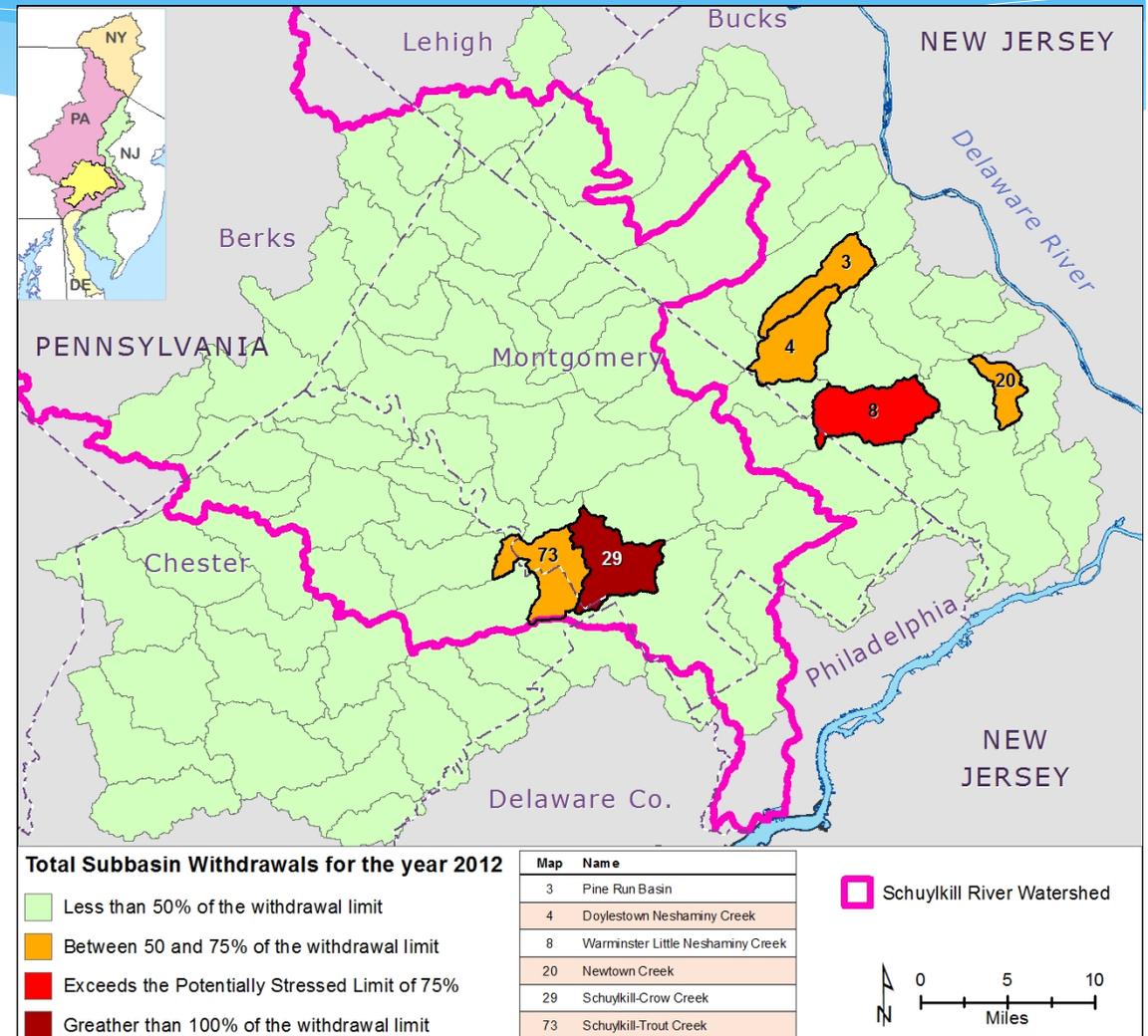
- \* Wadesville Mine Pool (up to 14.4 MGD)
- \* Still Creek Reservoir (up to 36 MGD)
- \* Owl Creek Reservoir (up to 8 MGD)
- \* Perkiomen Creek
- \* Delaware River (Merrill Creek reservoir via Diversion)

### Schuylkill River Restoration Fund

- \* Docket condition
- \* ~\$200,000 annually by Exelon
- \* Awarded over \$3M to over 80 best management projects since 2006.
- \* Thanks to all sponsors including Aqua, PWD

# SEPA Groundwater Protected Area Schuylkill Overlap

- \* DRBC operates on behalf of PADEP
- \* 1980: Delineated & Created due to:
  - \* Increasing population & groundwater demands
  - \* Increasing frequency of interferences between users
  - \* Lowering of stream water levels
  - \* Low recharge rates of bedrock geology
- \* 1981: GWPA Regulations Effective
  - \* Permits required for users >10,000 gpd
- \* 1998-1999: Numerical withdrawal limits established



# Blue Marsh Reservoir

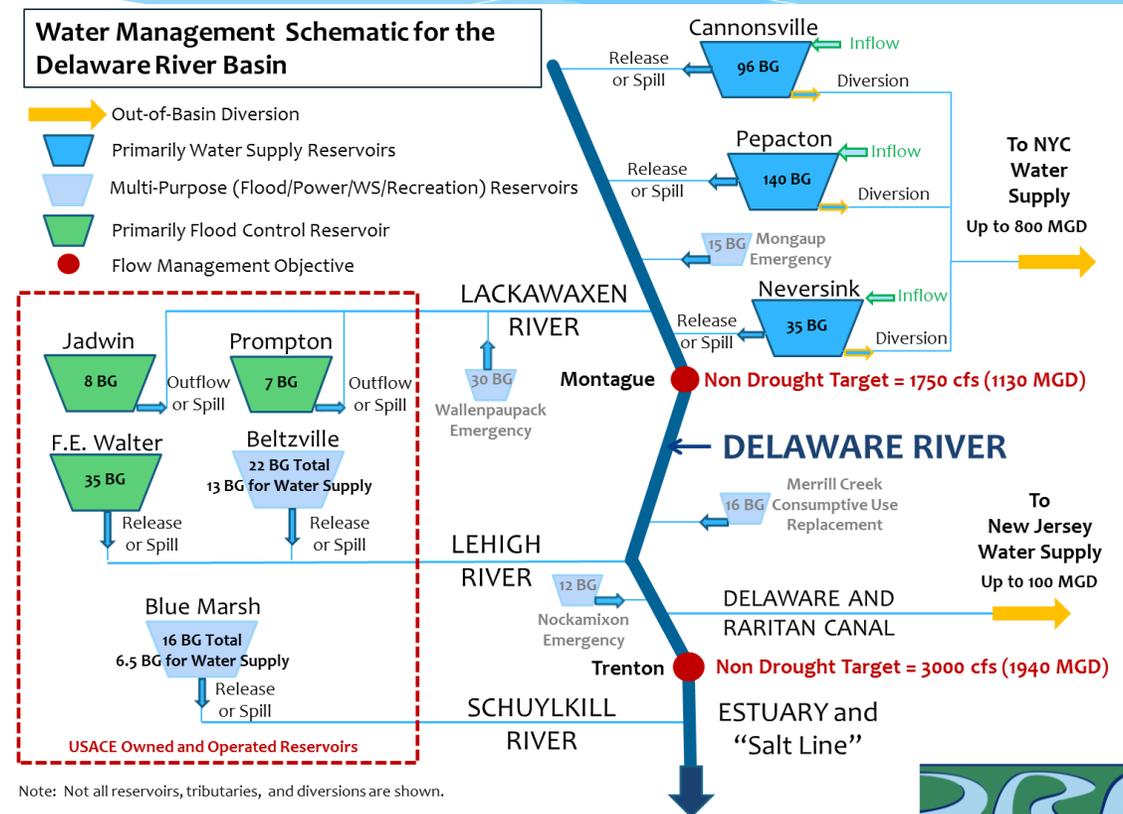
- 1 out of 20 reservoir projects included in DRBC's 1<sup>st</sup> Comprehensive Plan (1962)
- Only 2 of 20 reservoir projects have since been constructed (other being Beltzville Reservoir in the Lehigh)
- Only DRBC storage in the Schuylkill River Basin
- Owned/operated by USACOE
- Multi-purpose (water supply, water quality, recreation, flood protection)
  - 16 BG Total
  - 6.5 BG for Water Supply/Quality
- Constructed between 1974-1979



# 2060 Planning Questions

## Water Availability

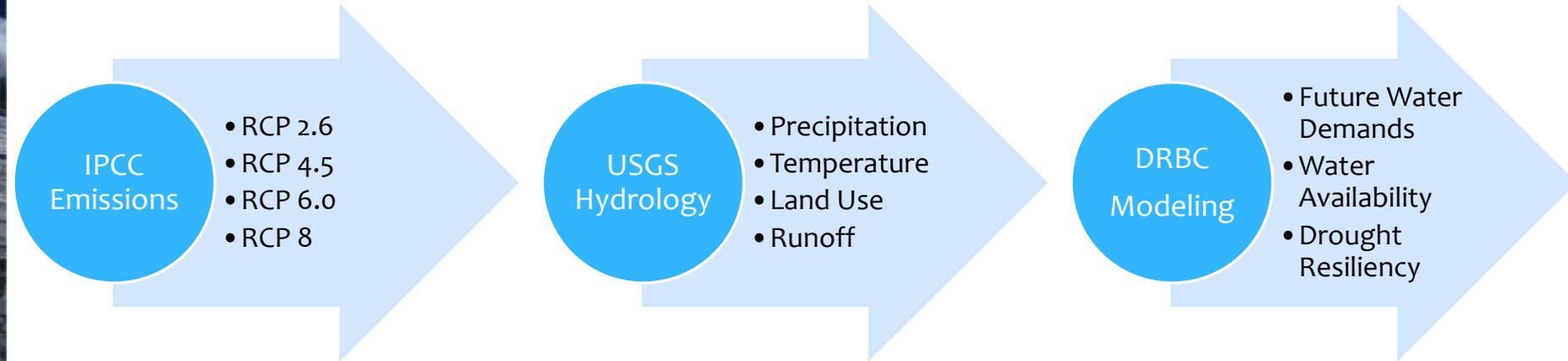
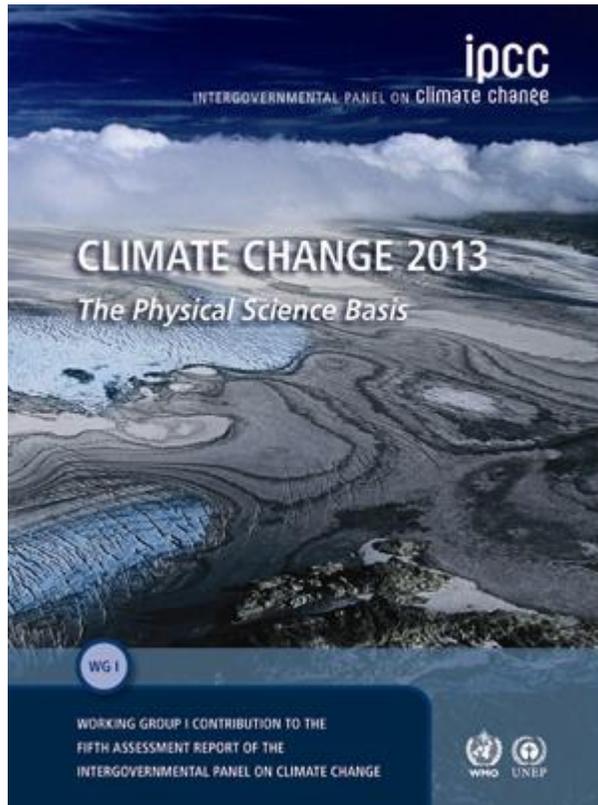
- Adequacy of available storage?
- Adequacy of emergency storage?
- Number of “drought days”?
- Water budget in major sub basins:
  - Will the available Water Supply meet the anticipated Water Demand?



# 2030 / 2060 Planning Scenarios

	Baseline	2030 / 2060
<b>Water Demands</b>	Existing	Projected
<b>Water Efficiency</b>	Existing	Higher Standards
<b>Climate: Precipitation/ Runoff/ and Use</b>	Drought of Record (1960's)	IPCC / USGS Scenarios
<b>Climate: Sea Level Rise</b>	Existing Trends	IPCC + Regional Studies
<b>Pass-by flows and Conservation Releases</b>	Existing	EcoFlow Scenarios
<b>Consumptive Use Make Up Water</b>	Existing	EcoFlow Scenarios
<b>Drought Operating Rules</b>	FFMP / DRBC Water Code	FFMP / DRBC Water Code

# Climate Scenarios



IPCC = International Panel on Climate Change

RCP = Representative Concentration Pathways  
(Greenhouse Gas Emissions)

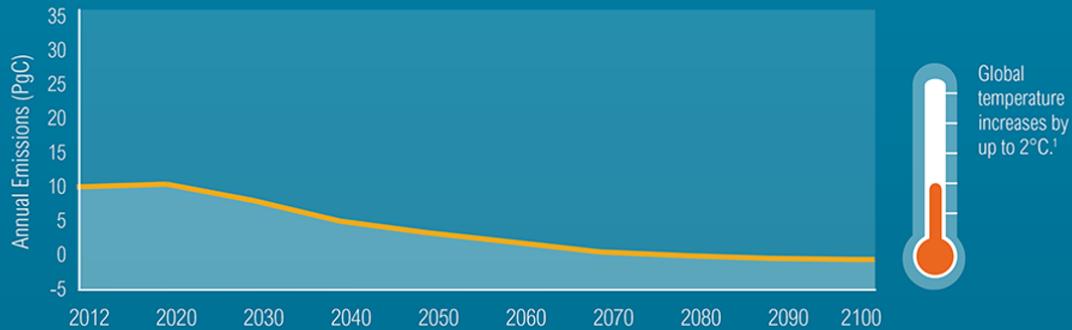
<http://www.ipcc.ch/report/ar5/wg1/>

# Representative Concentration Pathways (RCPs):

<http://www.wri.org/ipcc-infographics>

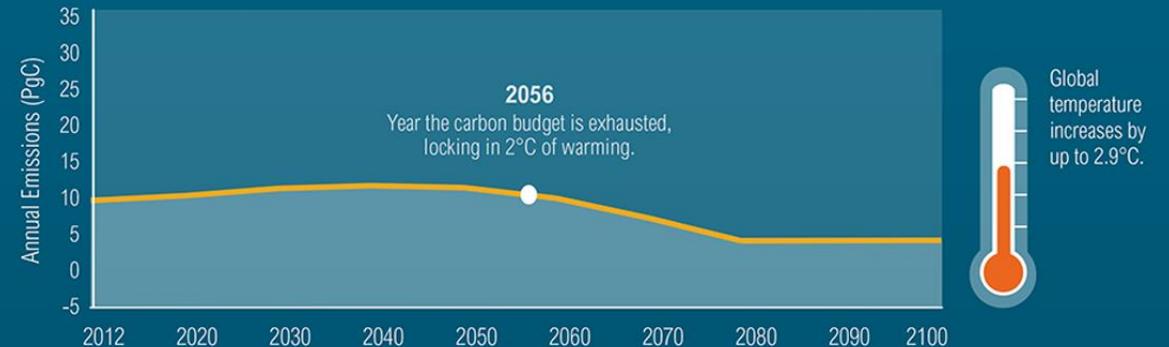
## LOW EMISSIONS PATHWAY RCP 2.6

Carbon dioxide emissions peak by 2020 and then drop 66 percent below 2010 levels by 2050. While the world will still experience some climate impacts under this pathway, they grow exponentially worse under higher emissions scenarios.



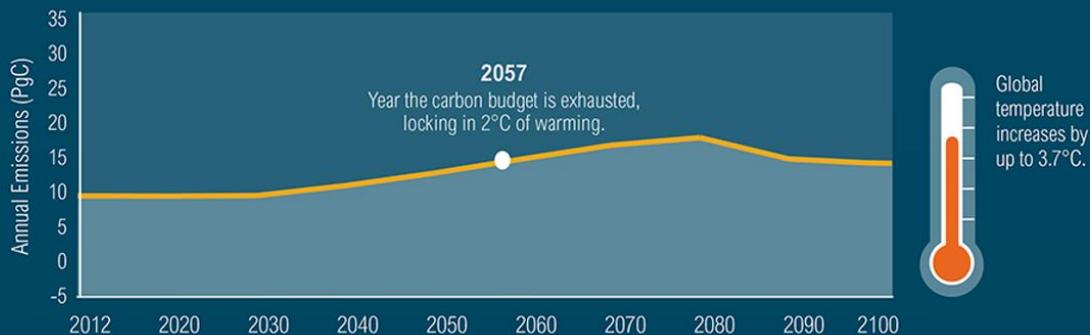
## MEDIUM EMISSIONS PATHWAY RCP 4.5

Carbon dioxide emissions peak by 2040, but still rise 19 percent above 2010 levels by 2050.



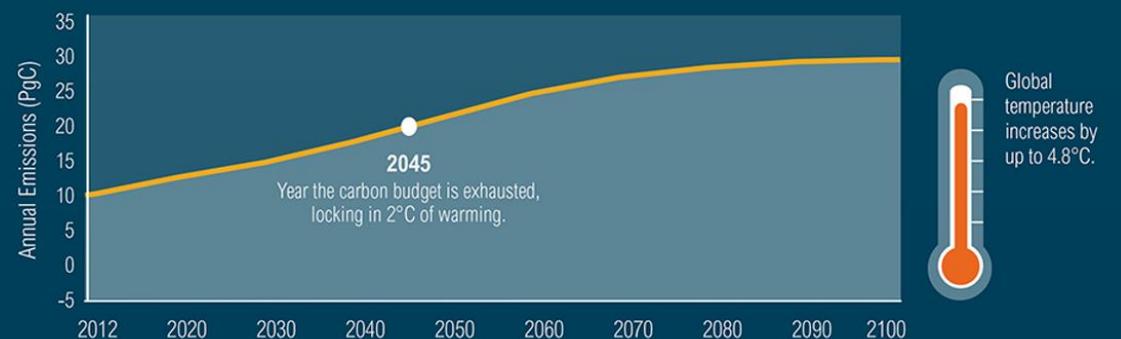
## HIGH EMISSIONS PATHWAY RCP 6.0

Carbon dioxide emissions peak by 2080, but still rise 34 percent above 2010 levels by 2050.



## HIGHEST EMISSIONS SCENARIO RCP 8.5

Annual carbon dioxide emissions continue to rise through 2100, rising 108 percent above 2010 levels by 2050.



# Have we seen the Drought of Record?

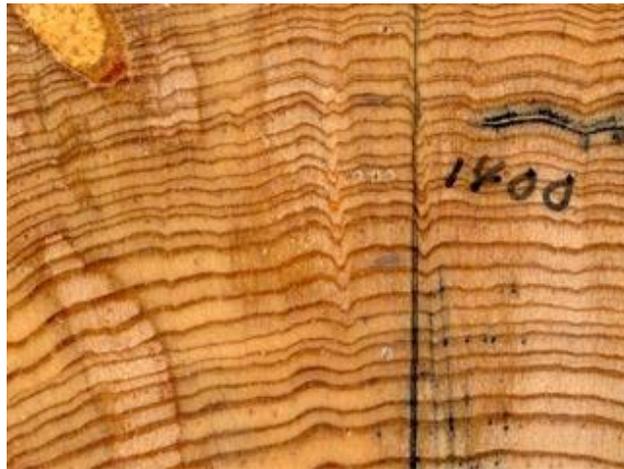
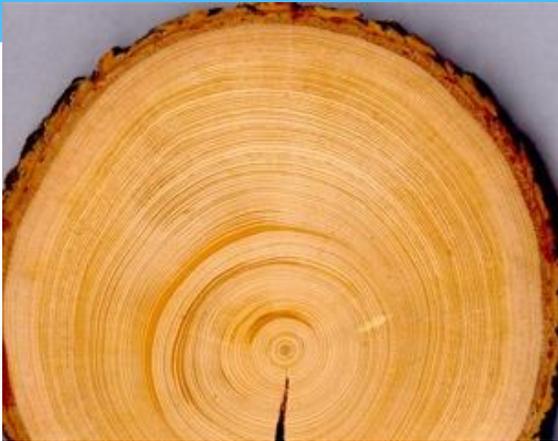


Photo: Henri D. Grissino-Mayer  
Department of Geography,  
The University of Tennessee

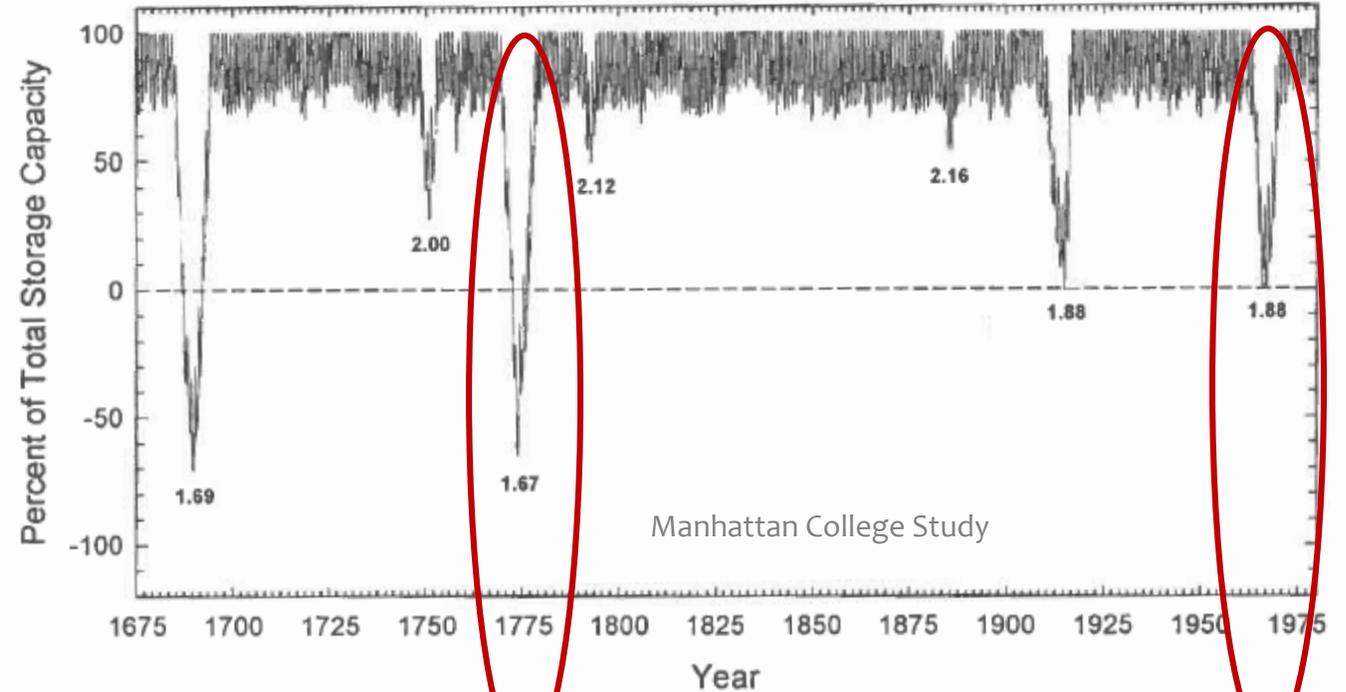


Figure S 4. Monthly Inflow Model - Tree-Ring Reconstructed Monthly Inflow Data Obtained by Disaggregation (1675 - 1980). The total storage capacity of the system is 547.5 BG. The bold numbers represent the total system yields associated with the selected droughts. The outflow from the system is set to that corresponding to the total system yield for the 1960s drought (1.88 BGD). Therefore, any droughts with a lower total system yield than 1.88 BGD will result in negative storage capacities.

Source: Department of Environmental Engineering, Manhattan College, Kaitlin J. Bars, Kevin R. Ellenwood, Joseph J. Nemes, Kevin J. Rader. Tree Ring Analysis as a predictor of pre-1927 reservoir inflows, April 26, 2004.

# Schuylkill River "Today" @ Philadelphia

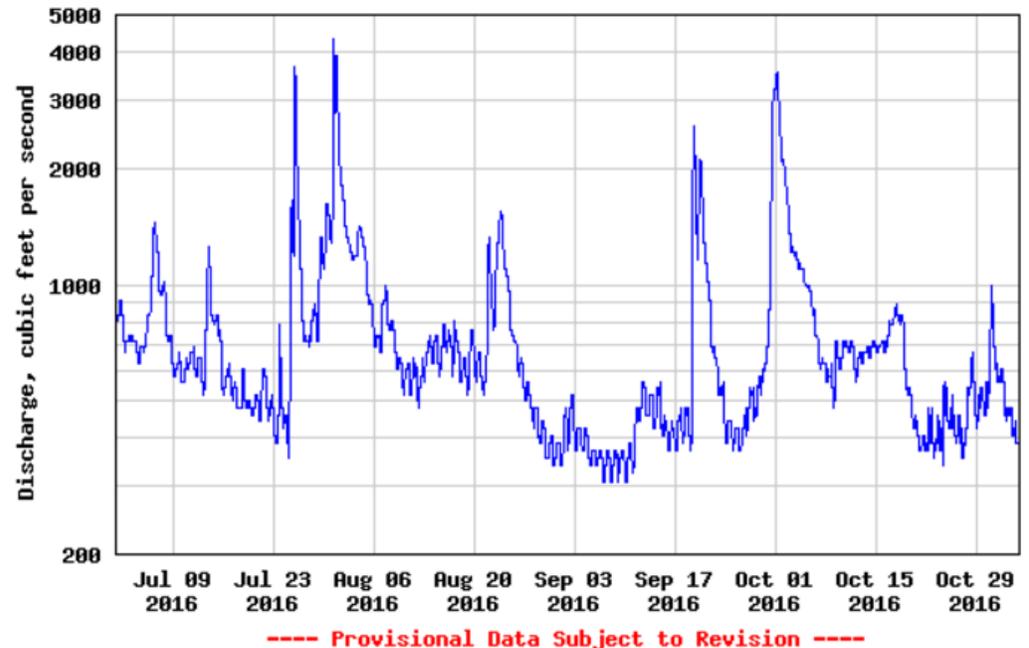
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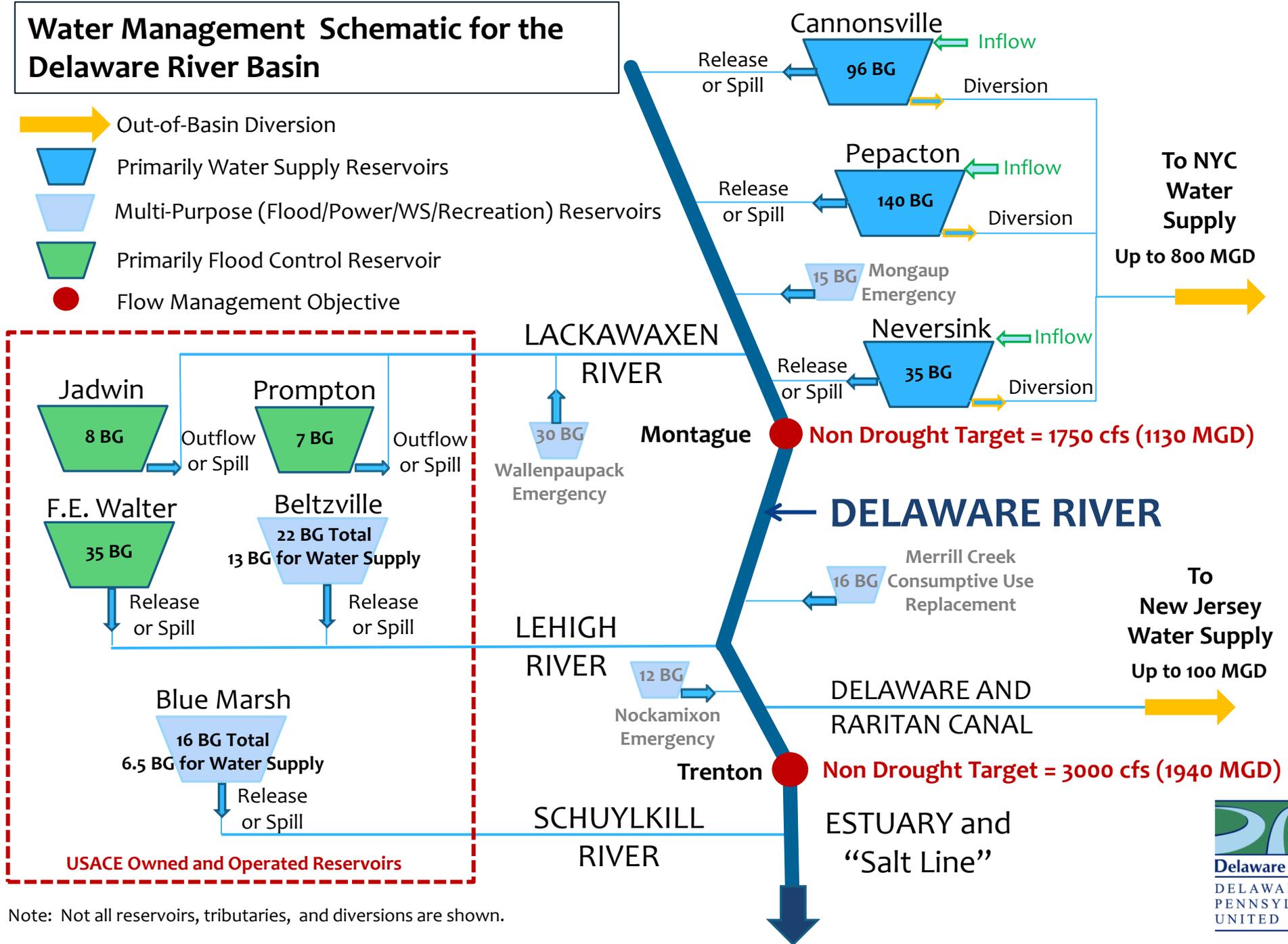
USGS 01474500 Schuylkill River at Philadelphia, PA



Source: USGS Gage 01474500 Schuylkill  
River at Philadelphia, PA

# Water Management Schematic for the Delaware River Basin

-  Out-of-Basin Diversion
-  Primarily Water Supply Reservoirs
-  Multi-Purpose (Flood/Power/WS/Recreation) Reservoirs
-  Primarily Flood Control Reservoirs
-  Flow Management Objective



Note: Not all reservoirs, tributaries, and diversions are shown.



# Trenton Flow Objective

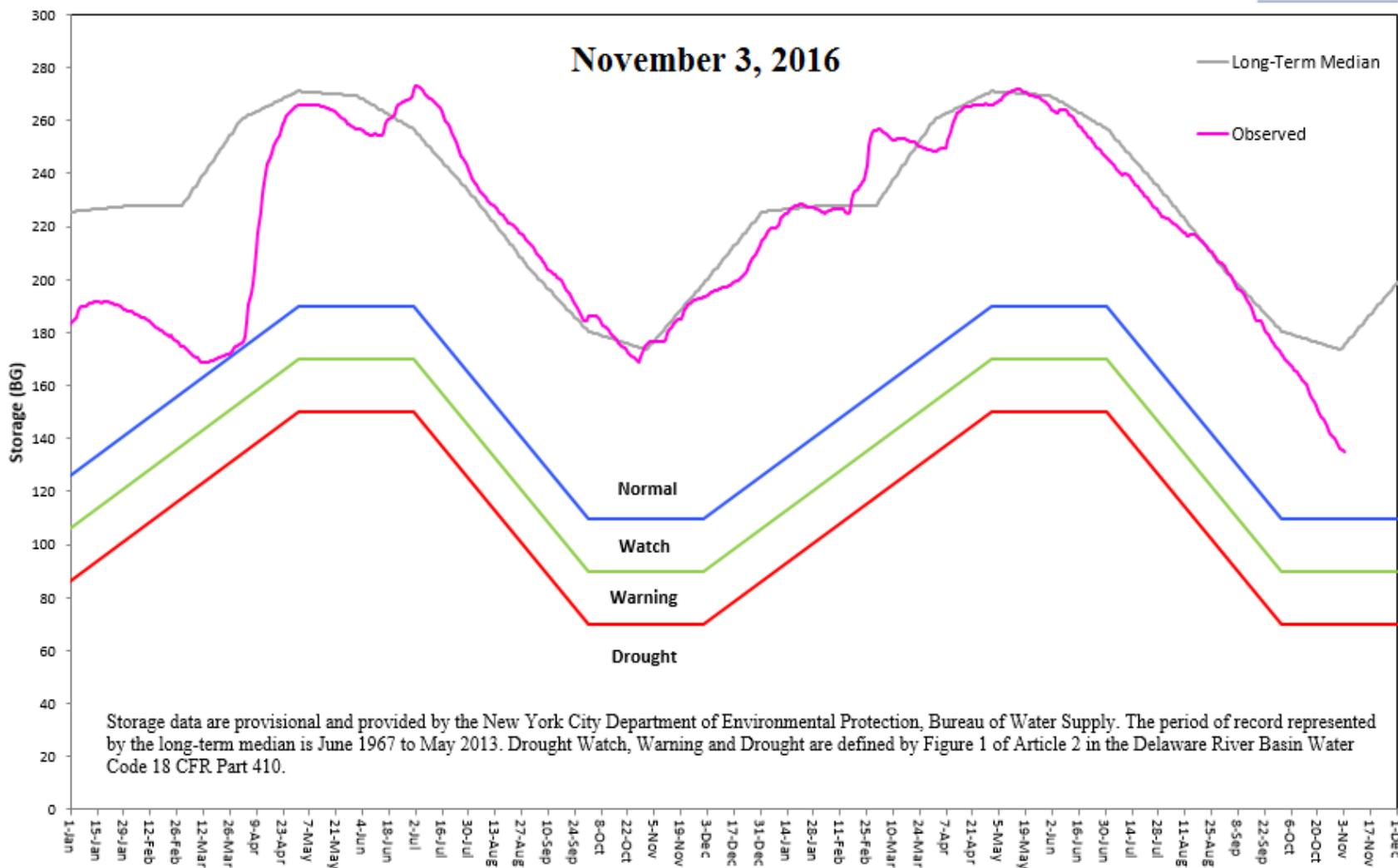
## Concept:

- ✓ Based on drought status
  - ✓ Basinwide – NYC Storage
  - ✓ Lower Basin – Beltzville and Blue Marsh Storage
- ✓ Varies Seasonally
- ✓ Varies with location of the “salt front” (drought emergency)

## Goals:

- ✓ Salinity Repulsion
  - ✓ Drinking Water
  - ✓ Industry
  - ✓ Power
- ✓ Freshwater Inflows to Estuary

# New York City Delaware River Basin Storage

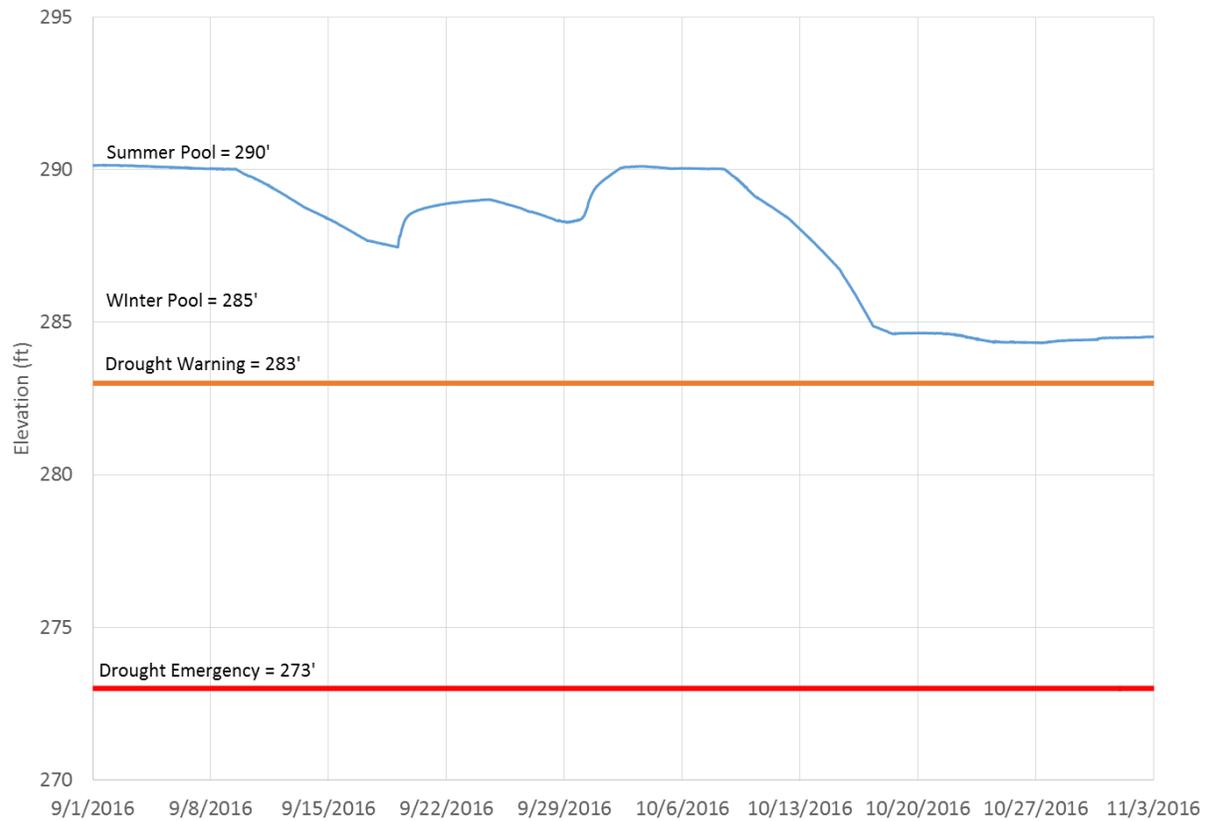


Useable Storage					2015-16			
Storage	Cannonsville	Pepacton	Neversink	Total	BG Above Drought Watch =	25	BG Below Daily Storage Median =	40
BG	27.9	84.1	22.8	134.8	BG Above Drought Warning =	45	BG Below One Year Ago =	42
%	29.2%	60.0%	65.2%	49.8%	BG Above Drought =	65		

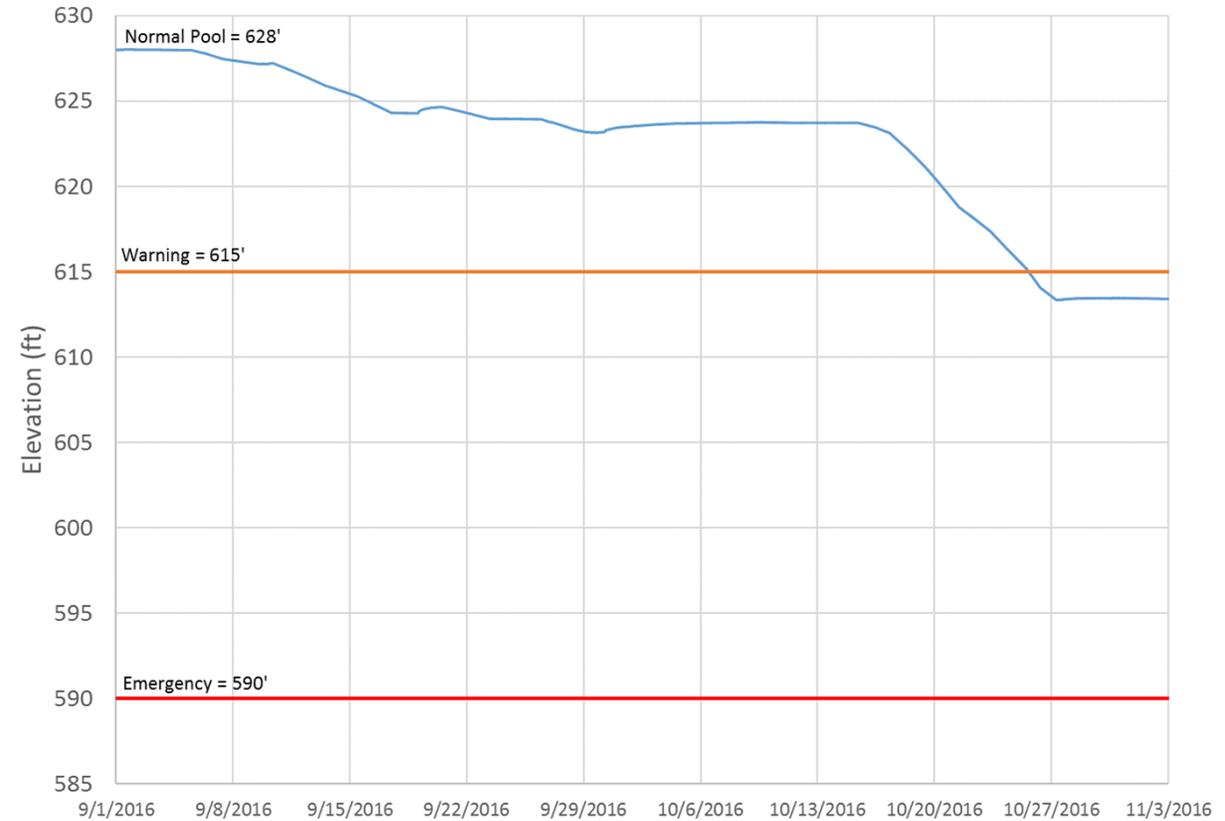
# November 3, 2016



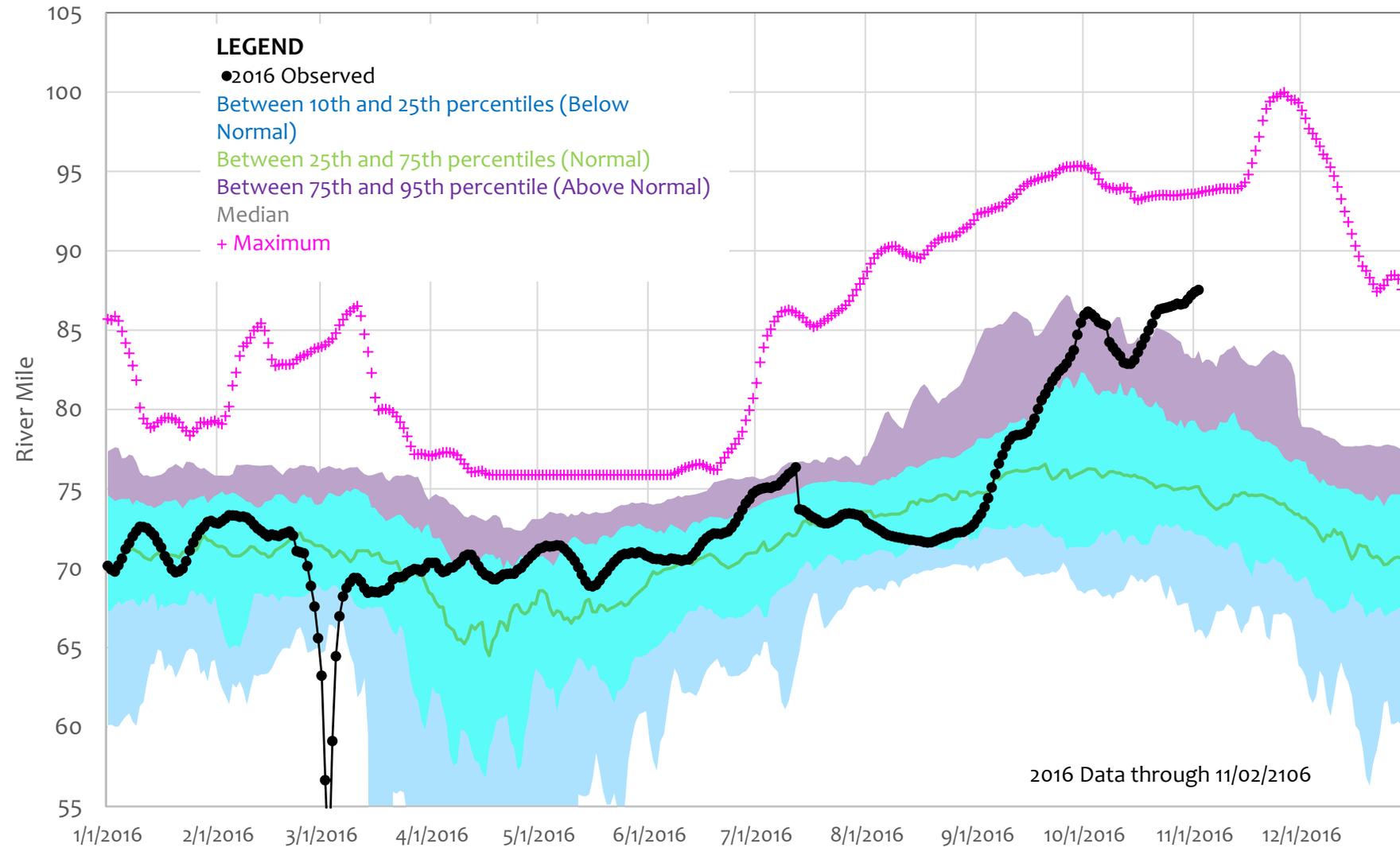
### Blue Marsh



### Beltzville Elevation



## Estimated Salt Front (250 mg/l isochlor) Current Observed River Mile and Historic Range (1963-2016)

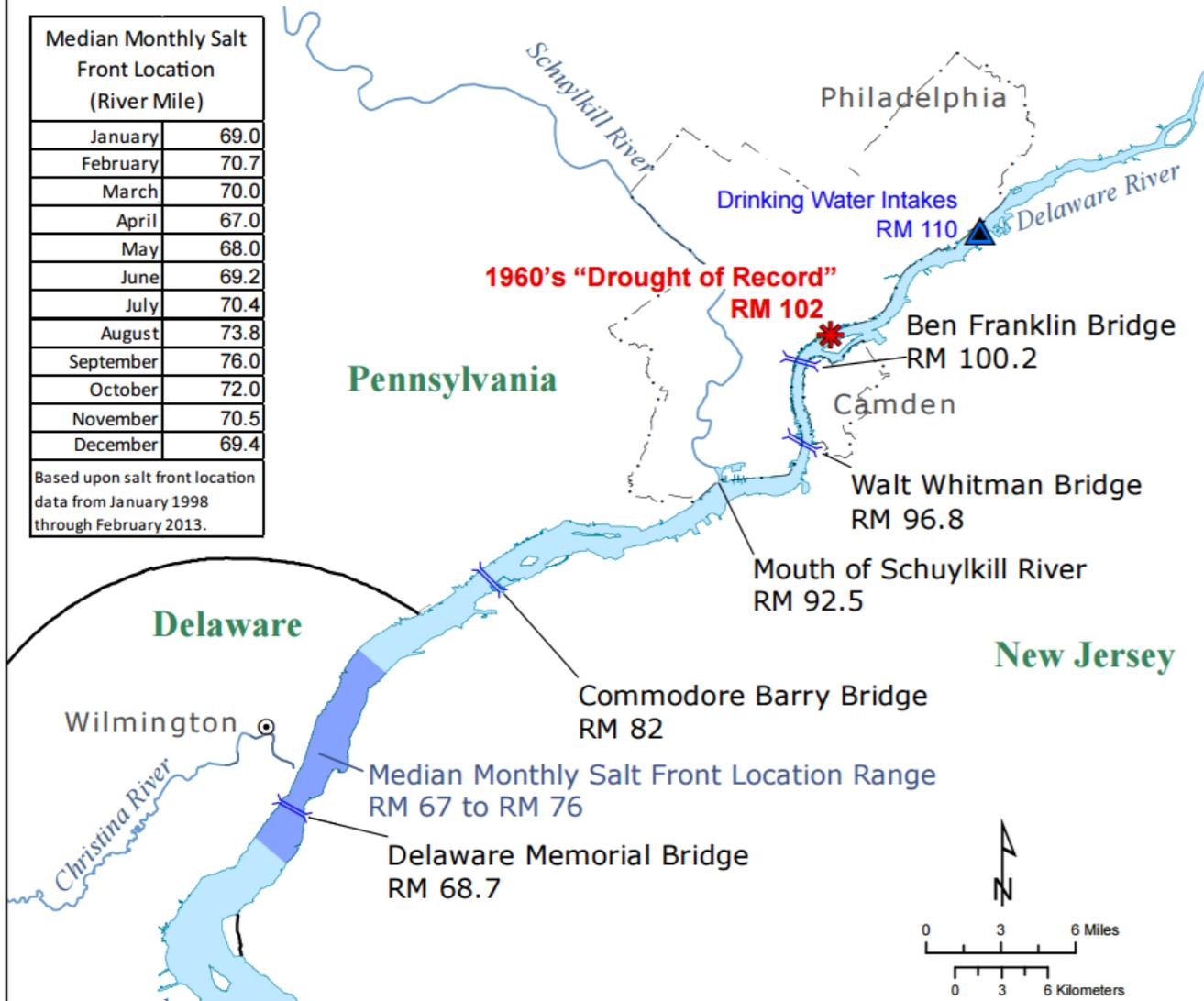


# Farthest Recorded Upstream Salt Front Location in the Delaware River - November 1964

“Salt Line”

Median Monthly Salt Front Location (River Mile)	
January	69.0
February	70.7
March	70.0
April	67.0
May	68.0
June	69.2
July	70.4
August	73.8
September	76.0
October	72.0
November	70.5
December	69.4

Based upon salt front location data from January 1998 through February 2013.



**Normal Location = RM 70**

**Current Location = RM 87**

# Drought Conditions Hearing

- November 9, 2016, 1:30 pm
- Washington Crossing Historic Park Visitor Center, 1112 River Road, Washington Crossing, Pa
- The Commission will accept public input on the persistent dry conditions throughout the basin and how to address them. The Commission would then be prepared, if conditions worsen, to consider a declaration of water supply emergency under section 10.4 of the Compact.

[WWW.DRBC.NET](http://WWW.DRBC.NET)

1965 @ Trenton, NJ



# Planning for the future

## Break the “Hydro-Illogical cycle”



<http://www.slideshare.net/NAPEXpo2014/donald-wilHITE-university-of-lincoln-integrated-national>

**“When the well’s  
dry, we know the  
worth of water.”  
- Benjamin  
Franklin**

# Steve Tambini, Executive Director

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*www.drbc.net*



**Delaware River Basin Commission**

DELAWARE • NEW JERSEY  
PENNSYLVANIA • NEW YORK  
UNITED STATES OF AMERICA

*Managing Our Shared Water  
Resources since 1961*