

Delaware River Basin Commission

The Flexible Flow Management Program: Effects on the Delaware River Basin

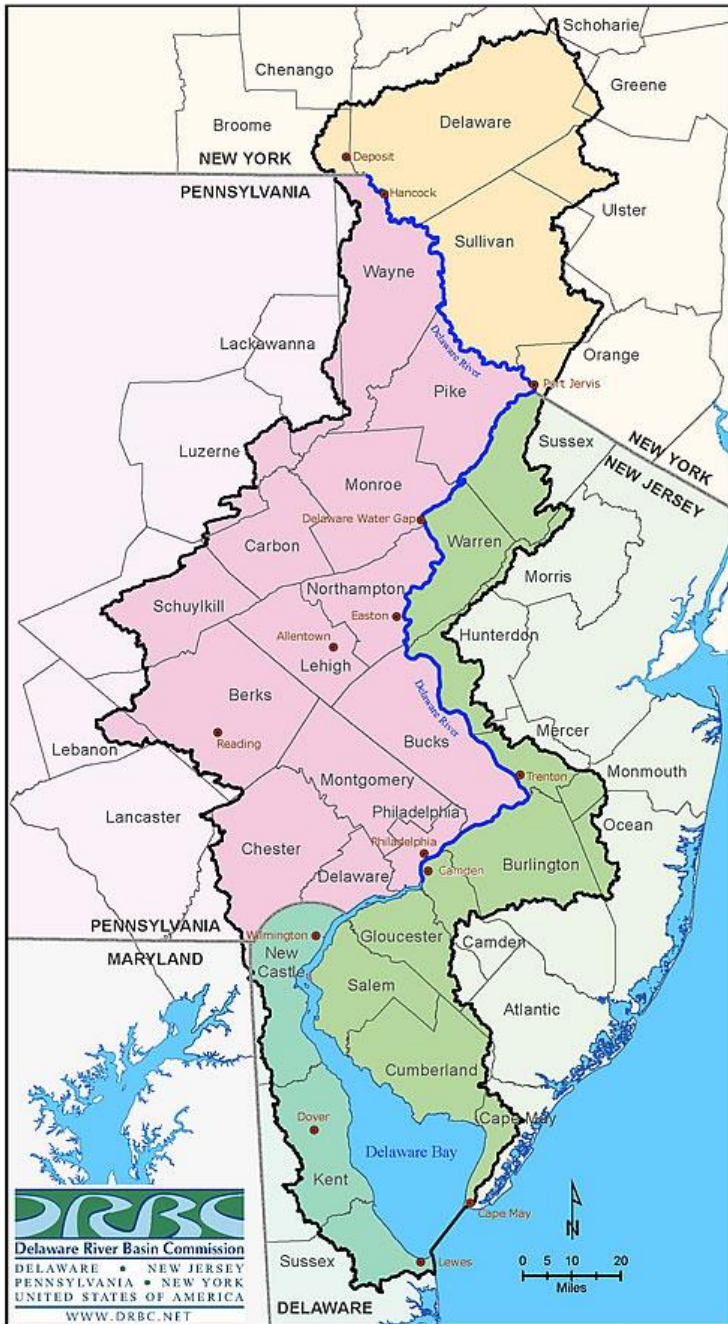
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CDRW Delaware River Watershed Forum
September 28, 2023



The Setting

- Delaware River Main stem 330 miles long
- Forms an interstate boundary along its entire length
- Drains 13,539 square miles of watershed in 4 states
- 14.2 million people (approximately 5% of the U.S. population) rely on the waters of the Delaware River Basin
- 150 miles designated by Congress as “Wild and Scenic” – remarkable scenic, recreational, geologic, fish, wildlife, historical and cultural values



Flexible Flow Management Program

adaptive management – based on “forecast available water”



Pepacton Reservoir. Photo courtesy of NYCDEP.

- * Protect Water Supplies
- * Drought Management (Water Code)
- * Habitat Protection Program
- * Spill Mitigation
- * Studies – salinity, storage, water for NJ

Competing Goals for Basin Waters and Storage

* Goals

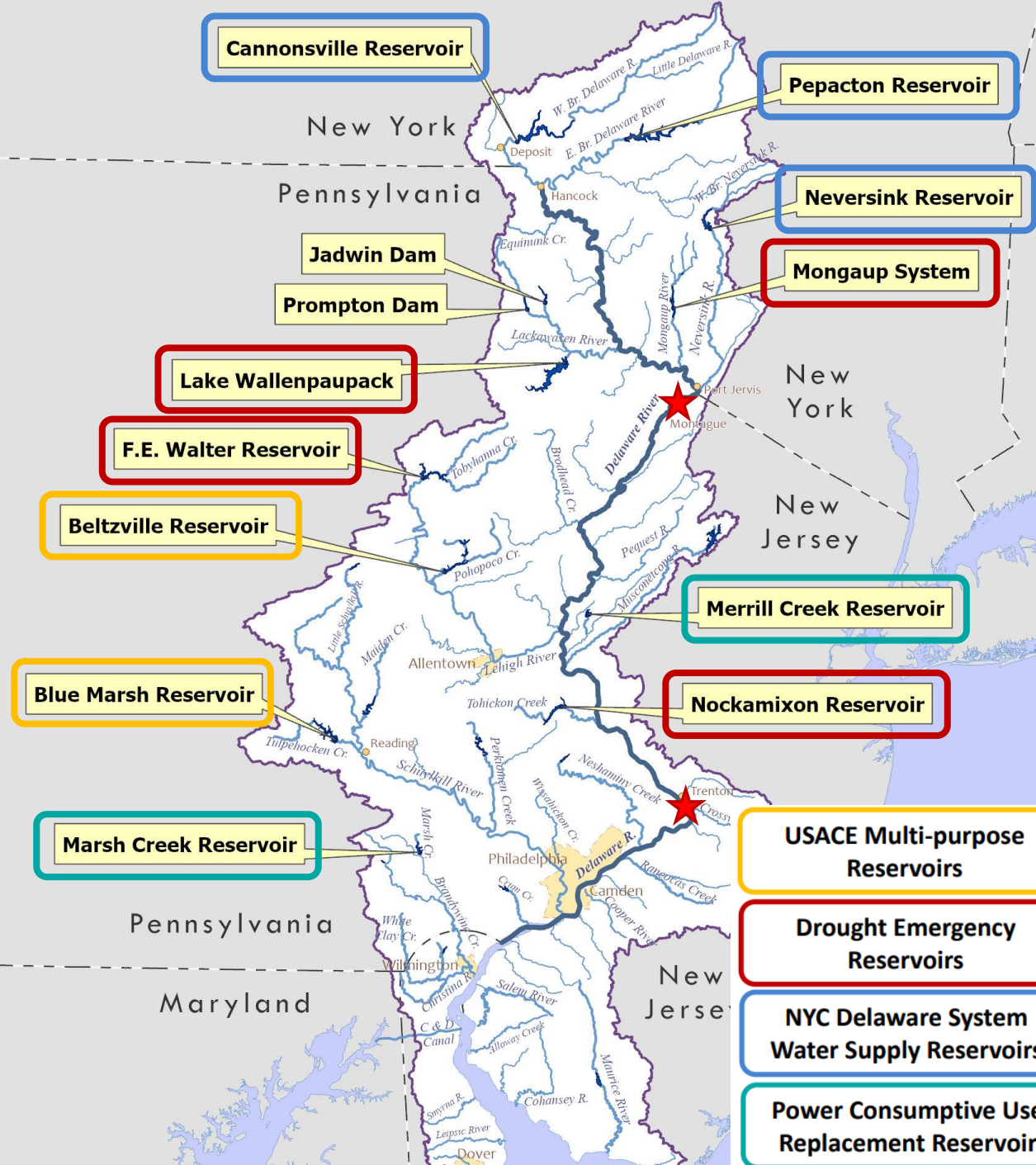
- * Recreation
- * Flood Risk/Damage Reduction
- * Water Supply - Low flow augmentation, Industry, Manufacturing, Cooling
- * Water Quality – Salinity, Temperature, Dissolved Oxygen, Fish and Wildlife
- * Power Generation – Hydropower, Thermoelectric

* Resources (**FINITE**)

- * Nature
- * Storage
- * Direct from river



Meeting Goals



- * Mother Nature (precipitation)
- * Storage (different types for different purposes)
- * Minimum flow requirements (a.k.a. flow objectives)
- * Drought Management Programs
- * Permitting programs
 - * Water Use
 - * Water Quality

1954 Supreme Court Decree

- * Montague Flow Objective (1750 cfs)
– note **NOT for Trenton**
- * NYC treatment of Port Jervis
wastewater
- * Limits to NYC and NJ out-of-basin
diversions
- * Established River Master



Flooding

1955 Flood: Hurricane Diane

Photo courtesy lehighvalleylive.com



Still the worst flood on record in many locations

- * Devastating flooding early in the 1902, 1903, 1904
- * Federal government planned flood control reservoirs in the Lackawaxen, Lehigh, and Schuylkill Watersheds
- * Prompton, Jadwin, FE Walter (1950s)
- * Beltzville, Blue Marsh (1970s)

FOUR STATES SIGN DELAWARE PACT

President Joins in Approving
Vast Program for Basin
Backed by Governors



Delaware River Basin Commission

* Established by Compact by DE, NJ, NYS, PA, **U.S.A.** in 1961 to address:

- * Water supply shortages – venue for cooperation
- * Devastating flooding
- * Severe pollution in the main stem and tributaries
- * Required to cooperate and collaborate with States and Federal Agencies
- * Authorized to change provisions of the 1954 Supreme Court Decree **only WITH** the unanimous consent of the decree parties (four states and NYC, not USA)



1960s - Drought

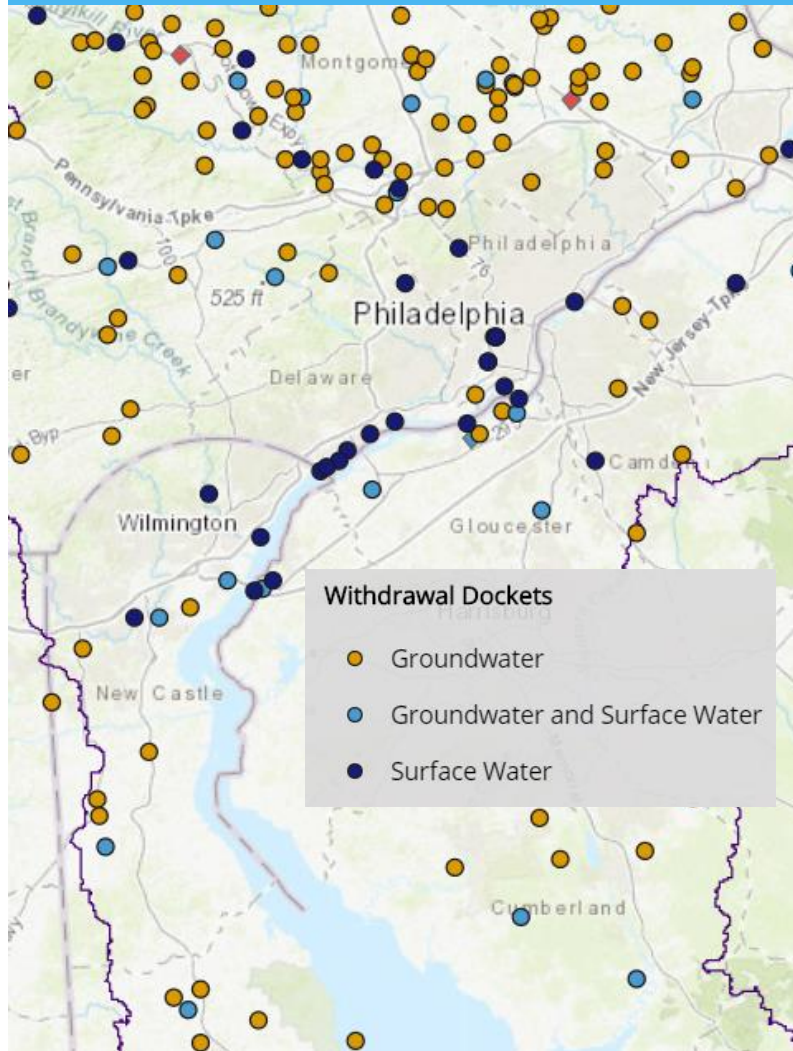
- Insufficient water for NYC to meet Montague and take diversion
- Commission declared a Drought Emergency
- DRBC Emergency Resolutions and Conservation Orders reduced Montague Flow Objective and limited NYC Diversion
- Salt Front* reached RM 102 – 8 miles from Philadelphia drinking water intake



* The maximum daily chloride concentration was greater than 250 mg/l, not the 7-dma, which was RM 100). Salt Front = 7-dma 250 mg/l isochlor.

Water Users

Drinking Water Providers – Manufacturing – Refining – Energy Production



<https://www.nj.gov/drbc/basin/map/interactive-map.html>



Photo: Phila.gov



Photo: DRBC



<http://wikimapia.org/21274124/Kimberly-Clark-Inc-Chester-Papermill#/photo/1905408>

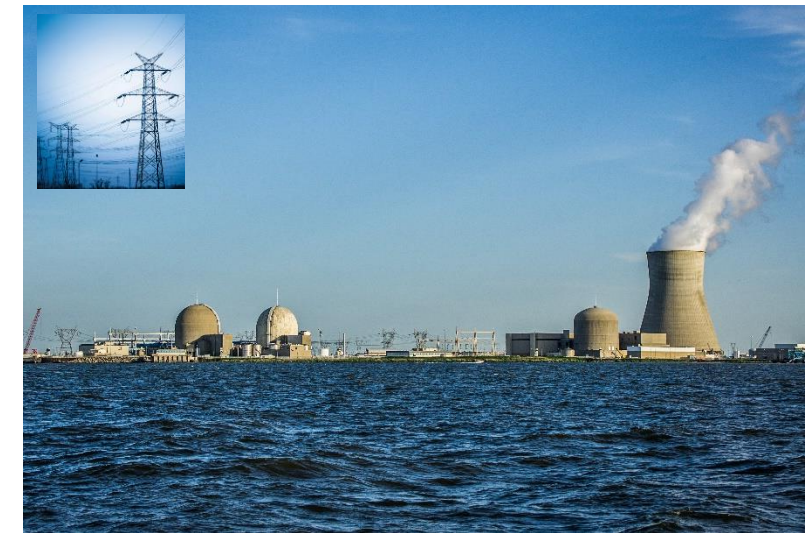
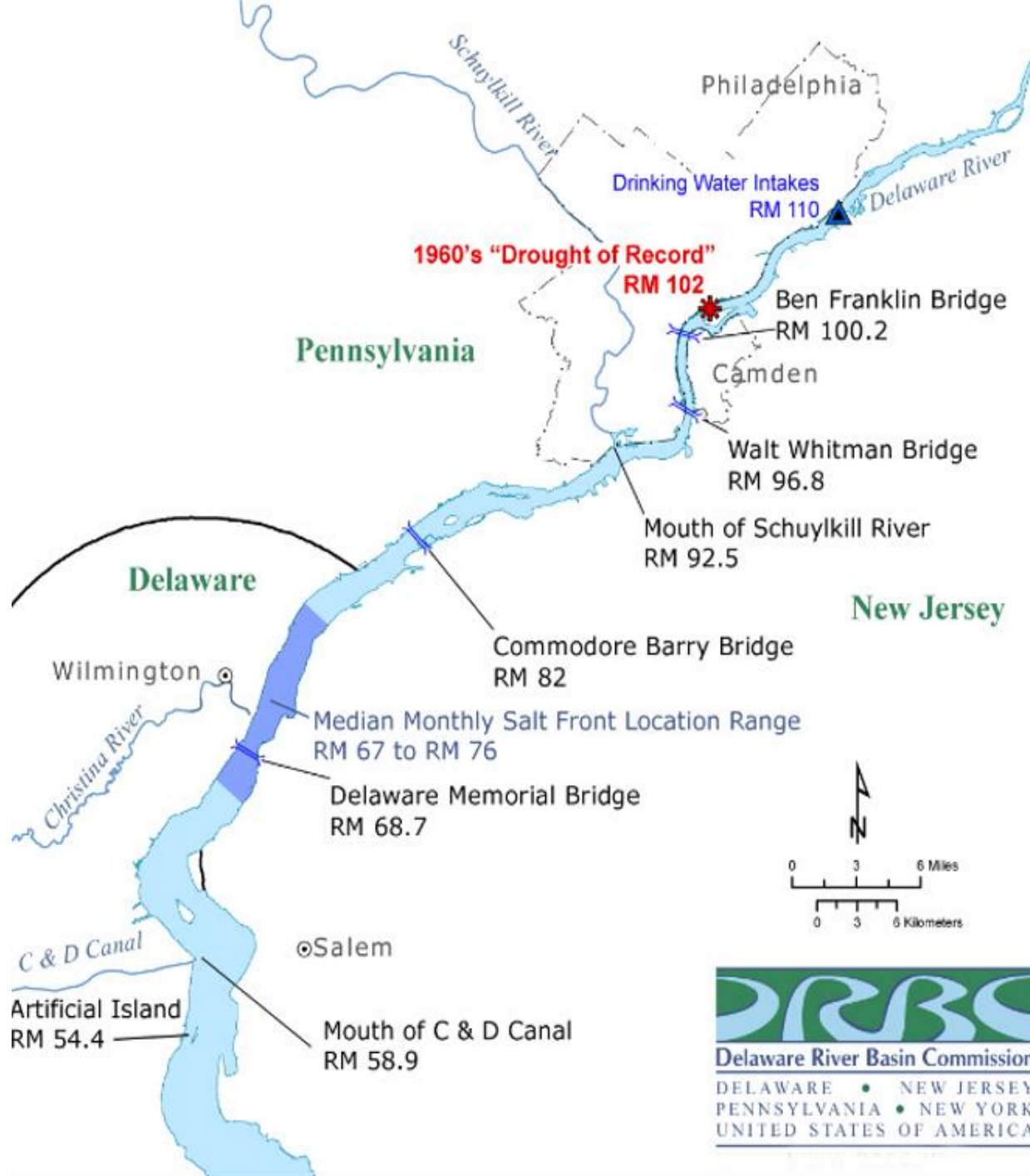


Photo: Peretz Partensky, <https://www.flickr.com/photos/ifl/7238282472/>; CC BY-SA 2.0 Deed; unedited

Salt Front

monitoring salinity to protect water users



- * Where salt water from the ocean meets fresh water from the land
- * 250 mg/l isochlor
- * 7-day average for reservoir operations
- * Concerns
 - * Corrosion
 - * Drinking Water - taste and odor
 - * Health effects
 - * Manufacturing processes

Good Faith Agreement

drought management – conservation – storage - fisheries

- * Commission directs Decree Parties and staff:
develop a plan to manage droughts
- * *DRBC Advisory Committee* - Regulated Flow Advisory Committee (formerly FMTAC)
- * Informed by Level B and other studies
- * **DRBC codified Drought Management Plans (LAW)**
- * **Established TRENTON FLOW OBJECTIVE**
- * Reservoir modifications and construction

DELAWARE RIVER BASIN WATER CODE 18 CFR Part 410

Flow Objective at Trenton (head of tide)

Phased Flow Objectives and Diversions

Reservoir Storage / Flow Augmentation

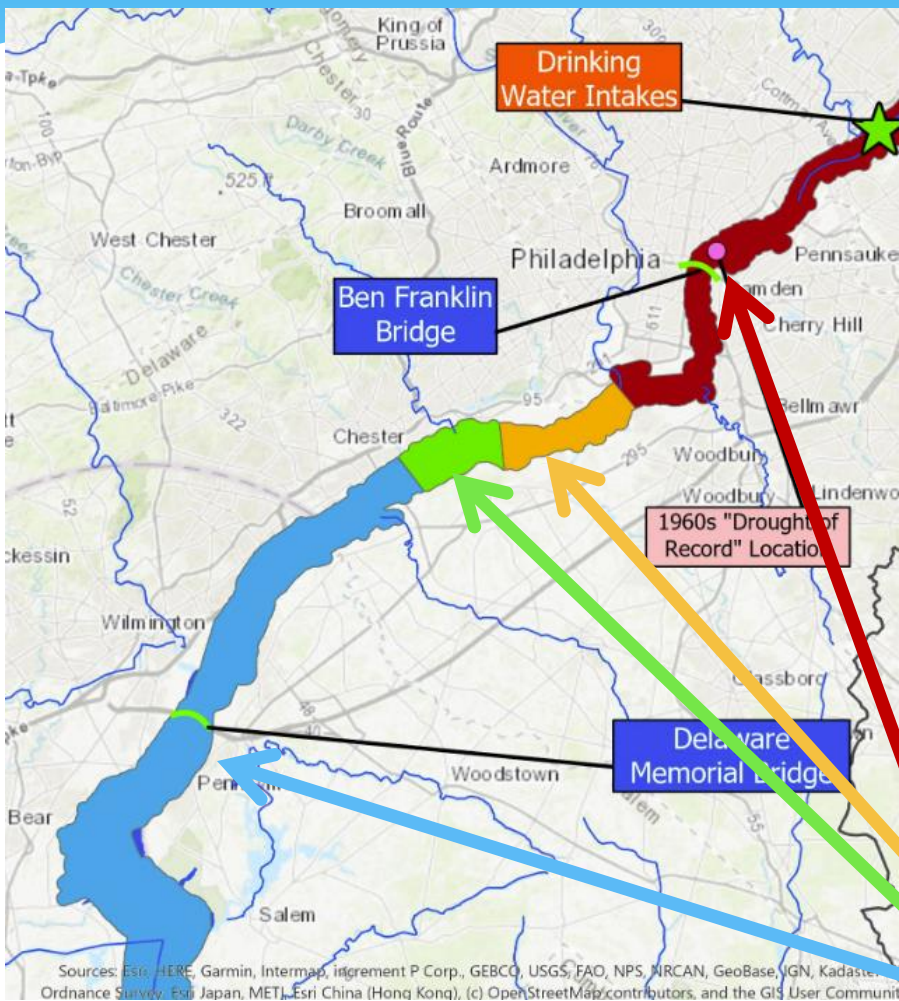
Regulation of Consumptive Uses

Water Conservation

1960s drought as the planning standard

20

Trenton Flow Objective During Drought Emergency



Phased Reductions in the Trenton Flow Objective

NYC storage condition	NYC Div. Mgd	NJ Div. mgd	Montague flow objective cfs	Trenton flow objective cfs
Normal	800	100	1,750	3,000
Upper Half-Drought Warning	680	85	1,655	2,700
Lower Half-Drought Warning	560	70	1,550	2,700
Drought	520	65	1,100-1,650*	2,500-2,900*
Severe Drought (to be negotiated based on conditions)				
* Varies with time of year and location of salt front as shown in Table 2.				

Flow Objective During **Drought Emergencies**

7-day average location of Salt Front	Trenton Drought Emergency Flow Objective (cfs)		
	Dec-Apr.	May-Aug.	Sept-Nov.
Upstream of R.M. 92.5	2,700	2,900	2,900
Between R.M. 87.0 and R.M. 92.5	2,700	2,700	2,700
Between R.M. 82.9 and R.M. 87.0	2,500	2,500	2,500
Downstream of R.M. 82.9	2,500	2,500	2,500

The location of the salt front determines the flow objective at Trenton during **Basinwide Drought Emergency** and **ANY Lower Basin Drought Condition**

Reservoir Releases

(a.k.a. Conservation Releases for Habitat Protection)

* **Minuscule** in the beginning – 5 cfs

* D77-20 CP and Major Revisions **DRBC Rulemakings**

* Revision 1 – default program

* Revision 4

* Revision 7

* **Flexible Flow Management Plan**

* Enhanced releases for fisheries

* Thermal mitigation

* Spill mitigation

* Releases greater than D77-20 CP Rev 1

Experimental Fisheries Programs

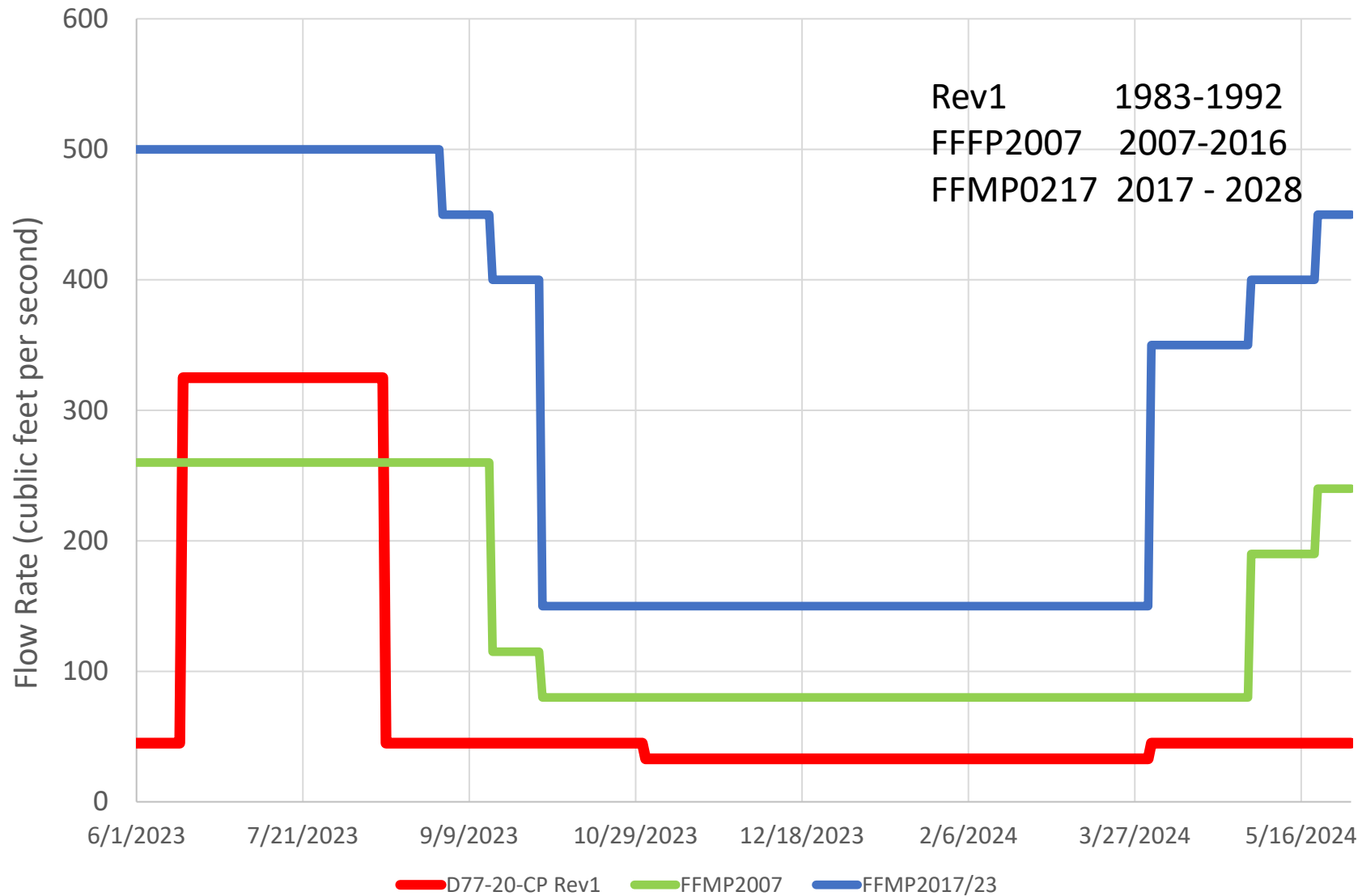
Augmented

And drought (base)

Adaptive Management Program

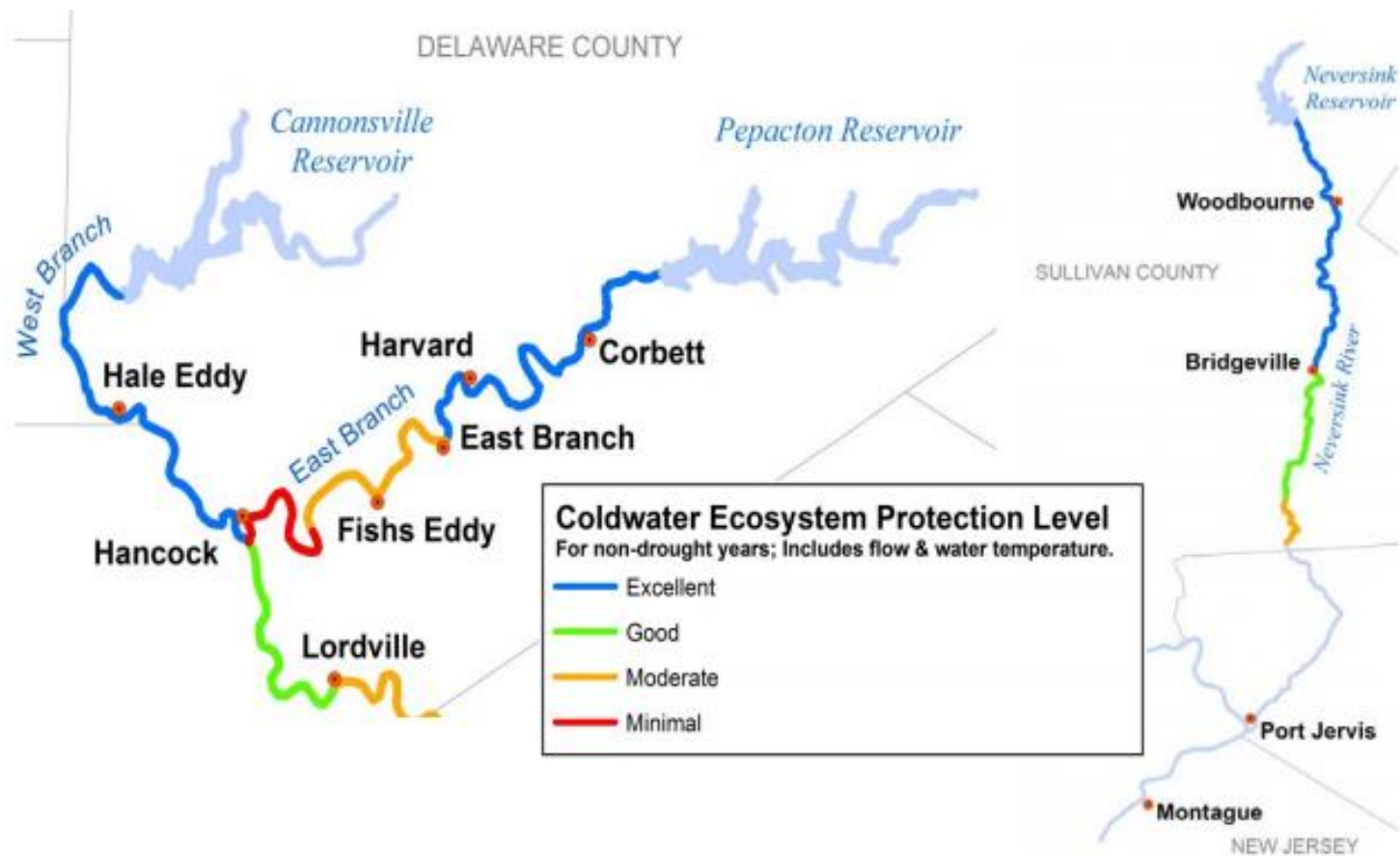
“Converts potentially spilled water
into managed water”

Changes to Release Rates for Cannonsville Reservoir



Habitat Protection

(Flow and Temperature)



Goals for Excellent Habitat:

- * Summer Temperature typically less than 20°C
- * Rare Exceedances greater than 24°C

What is "Forecast Available Water?"



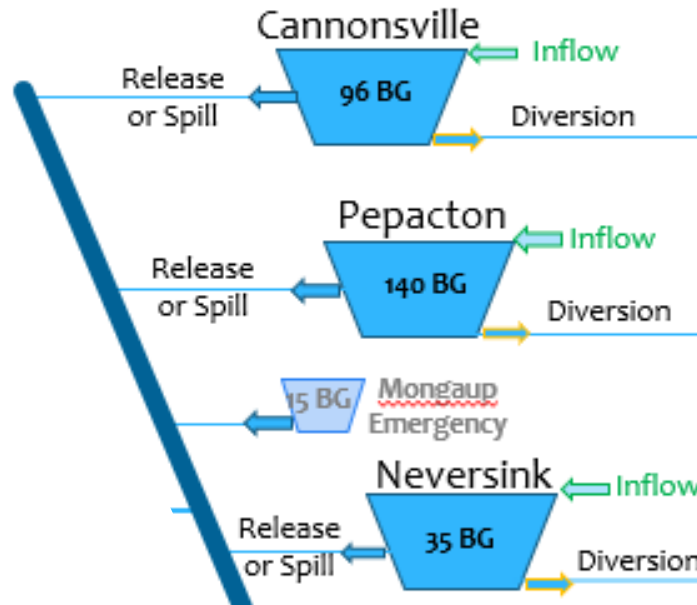
NOAA and NWS provide seasonal forecasts of weather, streamflow, and snowmelt to NYCDEP



NYC estimates water demands and uses a sophisticated model to determine an amount water that can be used for releases without impacting water supply (one goal is to be full in May/June prior to increase in water use)



Photo: DRBC



Water Supply

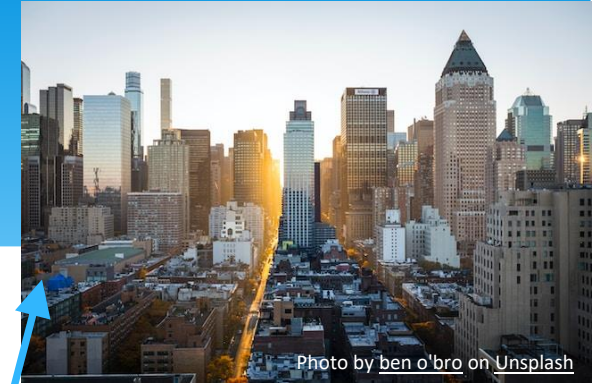


Photo by ben o'bro on Unsplash

Healthy Habitat



<https://rsmflyfishingdelaware.blogspot.com/2010/10/delaware-river-fly-fishing.html>

Spills are a waste of water



Photo: NYCDEP

Spill Mitigation



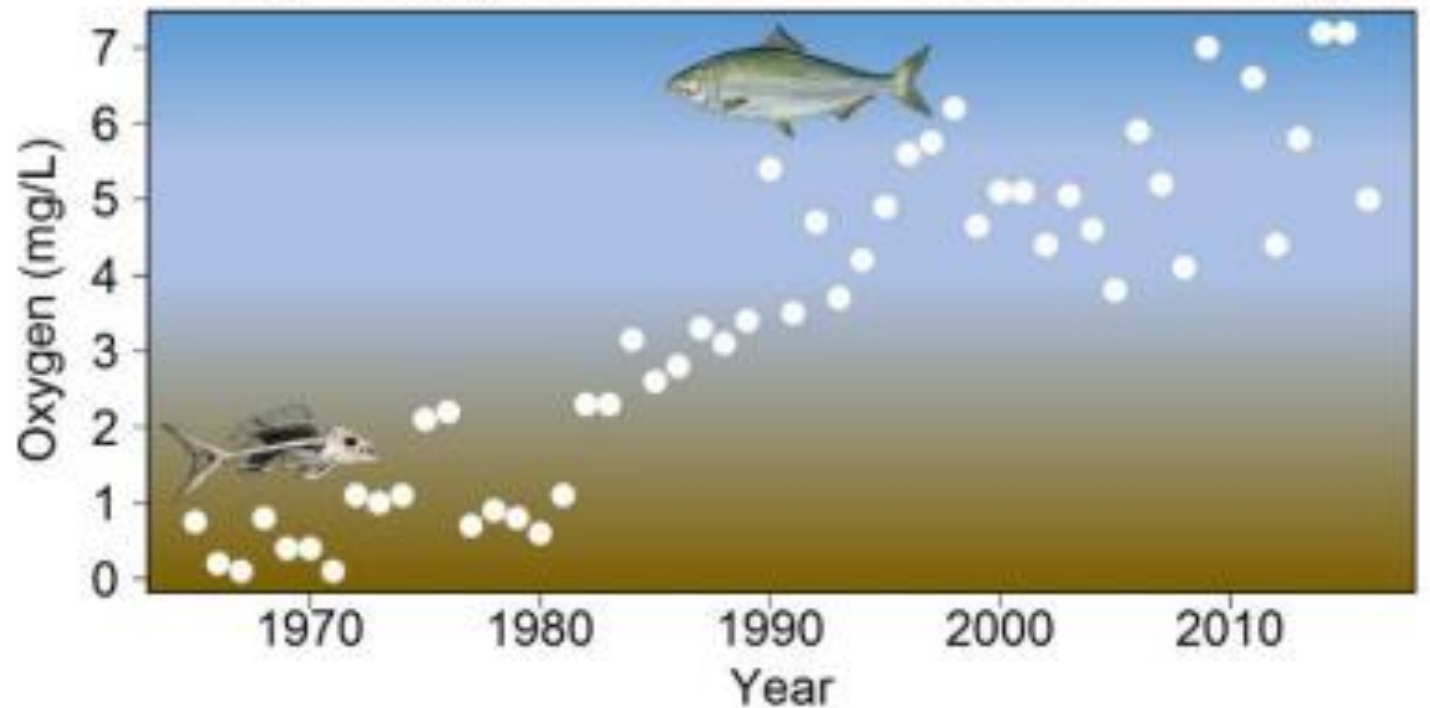
Photo: DRBC

- * Maintain “space” in the reservoirs to delay flood waters
- * Not their purpose, BUT ...
 - * Outflow is limited by the capacity of the reservoir
 - * Water backs up behind the spillway (e.g., reservoir more than 100 % full)
 - * Extent/amount depends on many factors – rain (intensity, track, location), prior conditions (wet/dry, snowpack)

Water Quality

- * More Water in the River helps with improve water quality
- * Permits (Dockets) for wastewater releases
- * Deeper water = larger mixing zone
- * Reduces concentrations

July Oxygen at Ben Franklin Bridge



How does the FFMP impact you?



Photo: DRBC

- * More water in the river is better for fish, recreation, and water quality
- * When water is abundant, more water is released
- * Avoiding spills “helps” with flood mitigation
- * Drought management programs protect water supplies along the entire mainstem of the Delaware River (including those for Philadelphia and Central/SW New Jersey)
- * Flow Objectives have protected lower basin drinking water supplies from salt water

Your Role in the FFMP and River Management

- * Sign up for [DRBC list-serves](#)
- * Get involved – volunteer to follow [DRBC Advisory Committee Meetings](#) and report to your organization
- * Be informed - Request additional information sessions
- * Review and comment on studies underway to inform the next FFMP



Photo: DRBC

Additional Resources

(too much information)

- * FFMP 101 FAQs – coming soon from CDRW!
- * Amy.Shallcross@drbc.gov, DRBC.gov, [Interest List-Serves](#)
- * [River Management in the DRB \(a.k.a.\) flow management](#)
- * [Drought Management and Information](#)
- * [NYC Water Supply and Watershed Management](#)
- * [Evolution of Releases for Fish and Wildlife](#)
- * [Good Faith Agreement](#)
- * [FFMP \(see 2018 Appendix A Final for details on reservoirs\)](#)
- * [Office of the Delaware River Master](#)

