

# Basin-Wide Cooperation for Drought Resilience

## Case Study:

## The Delaware River Basin

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Delaware River Basin Commission



# In this presentation , I will briefly discuss...

**The setting in Delaware River Basin**

Historic conflicts and droughts

Cooperative (and complex) management

Future challenges





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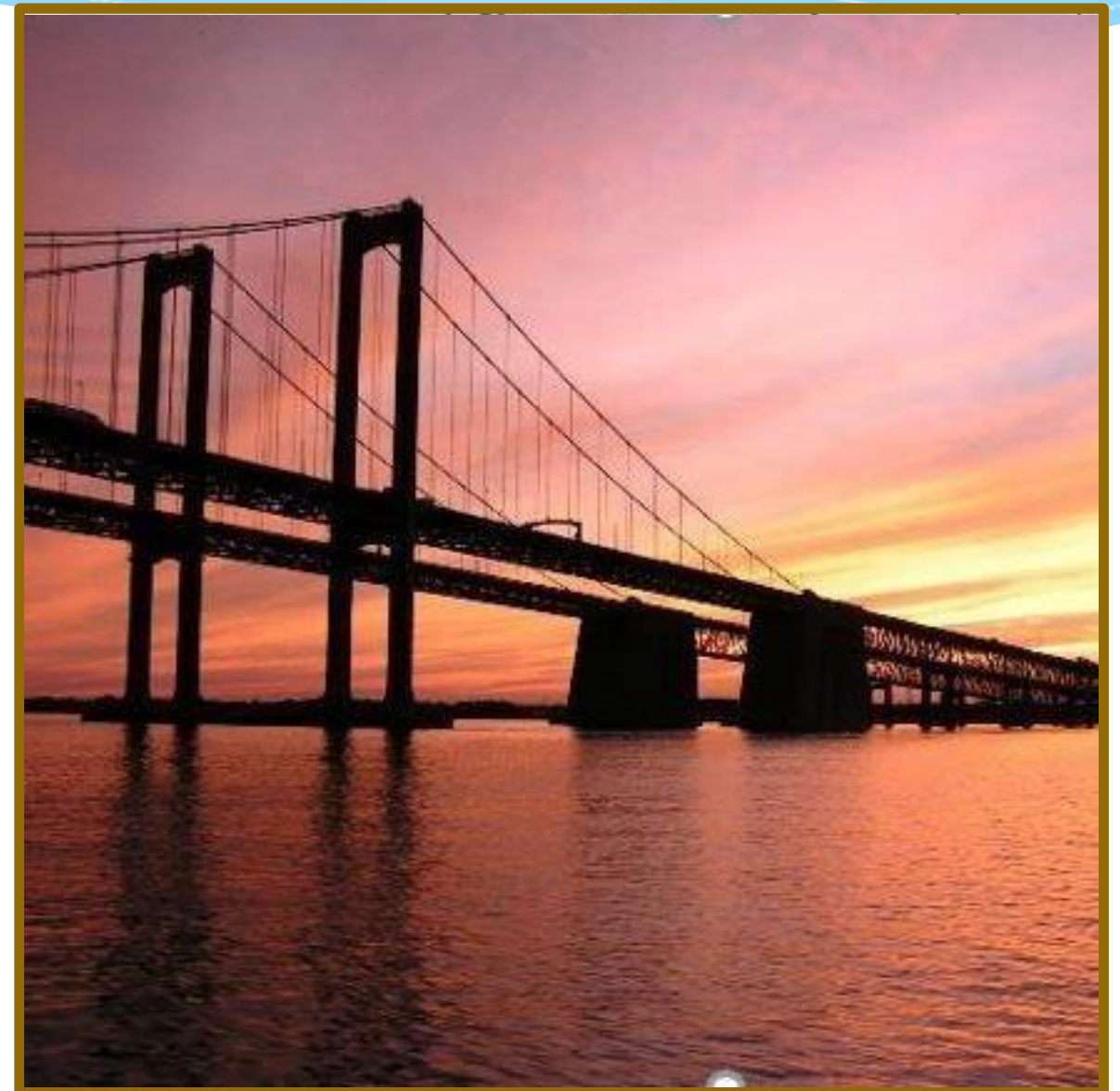
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# Setting

## The setting in Delaware River Basin

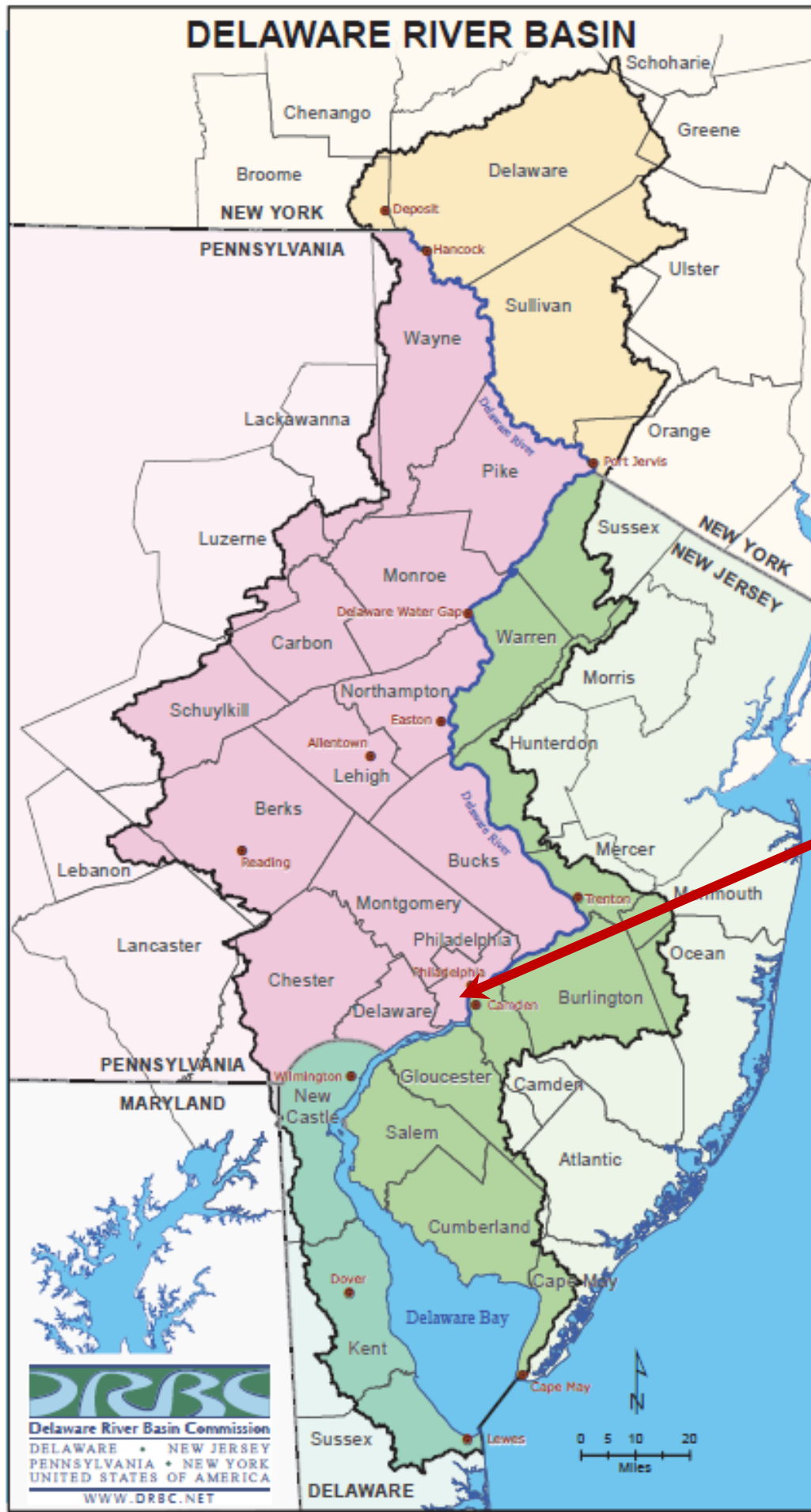
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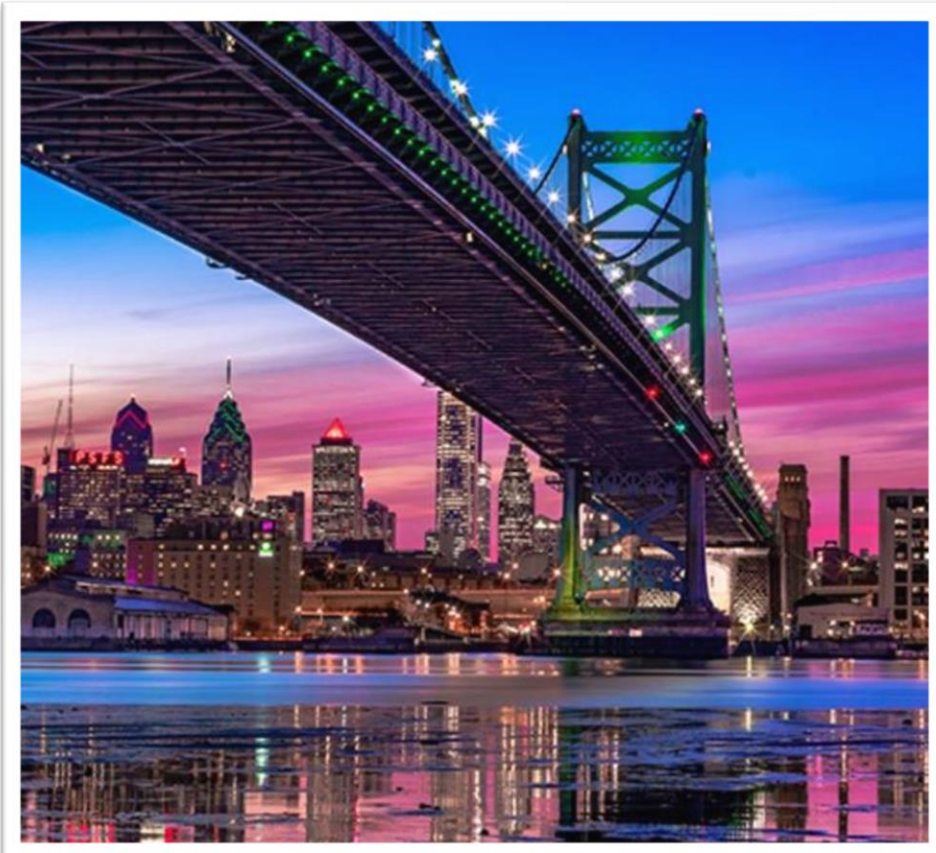
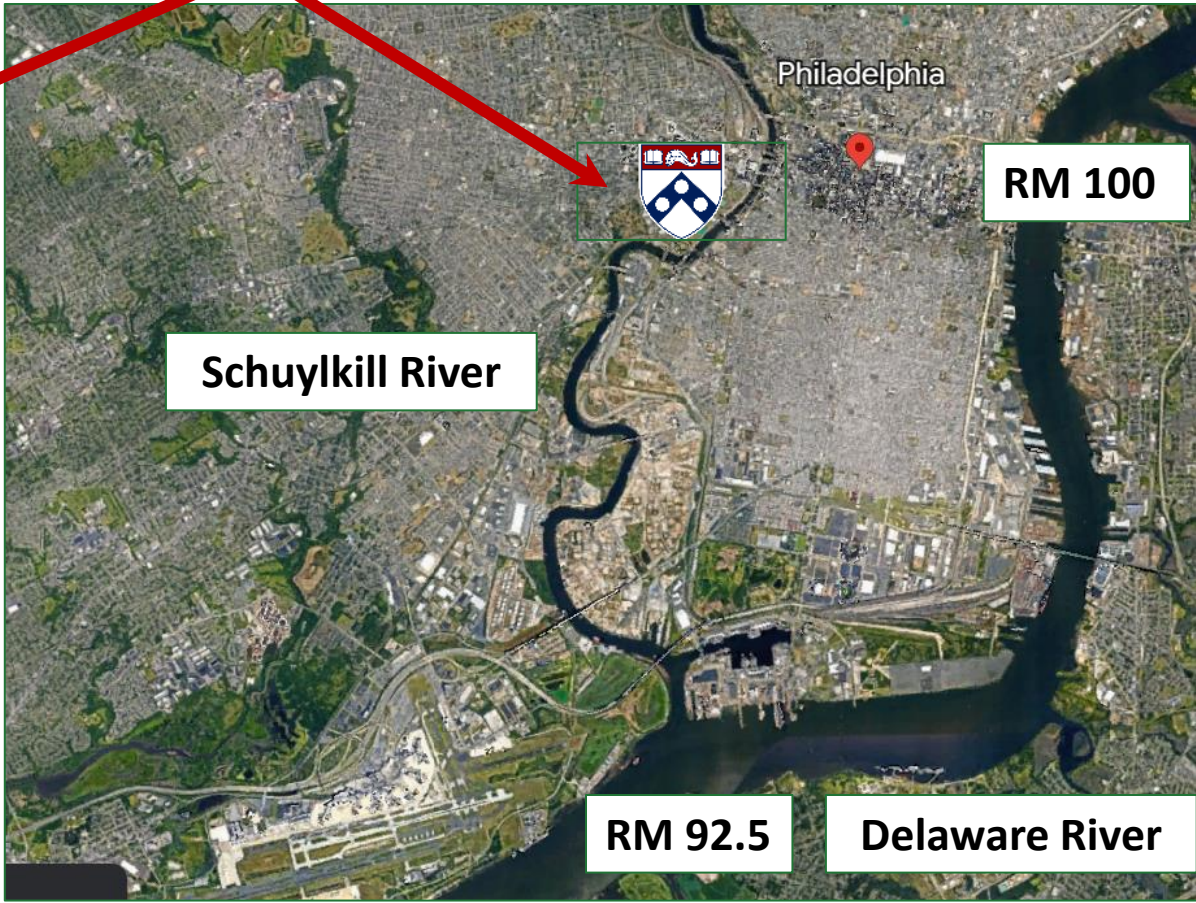
# Welcome to the Delaware River Basin!



**Delaware River Basin Commission**

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

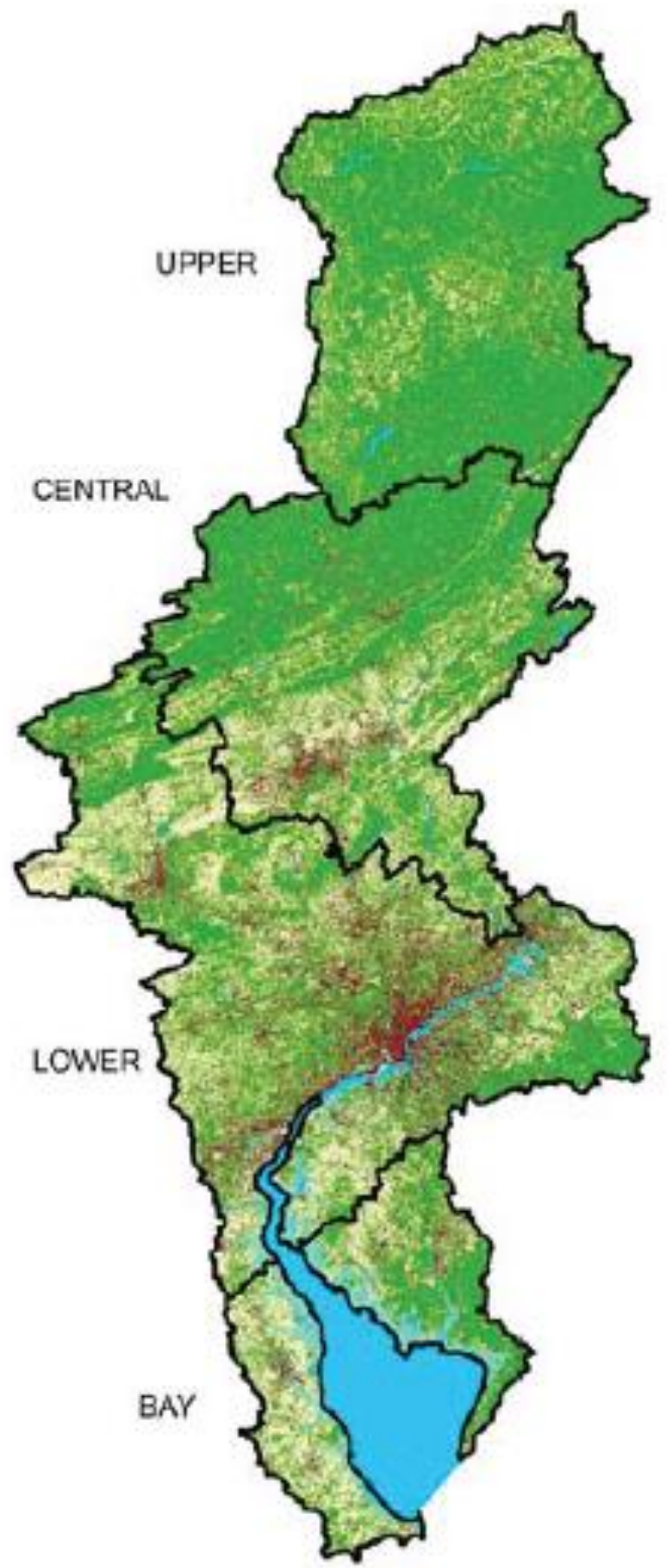
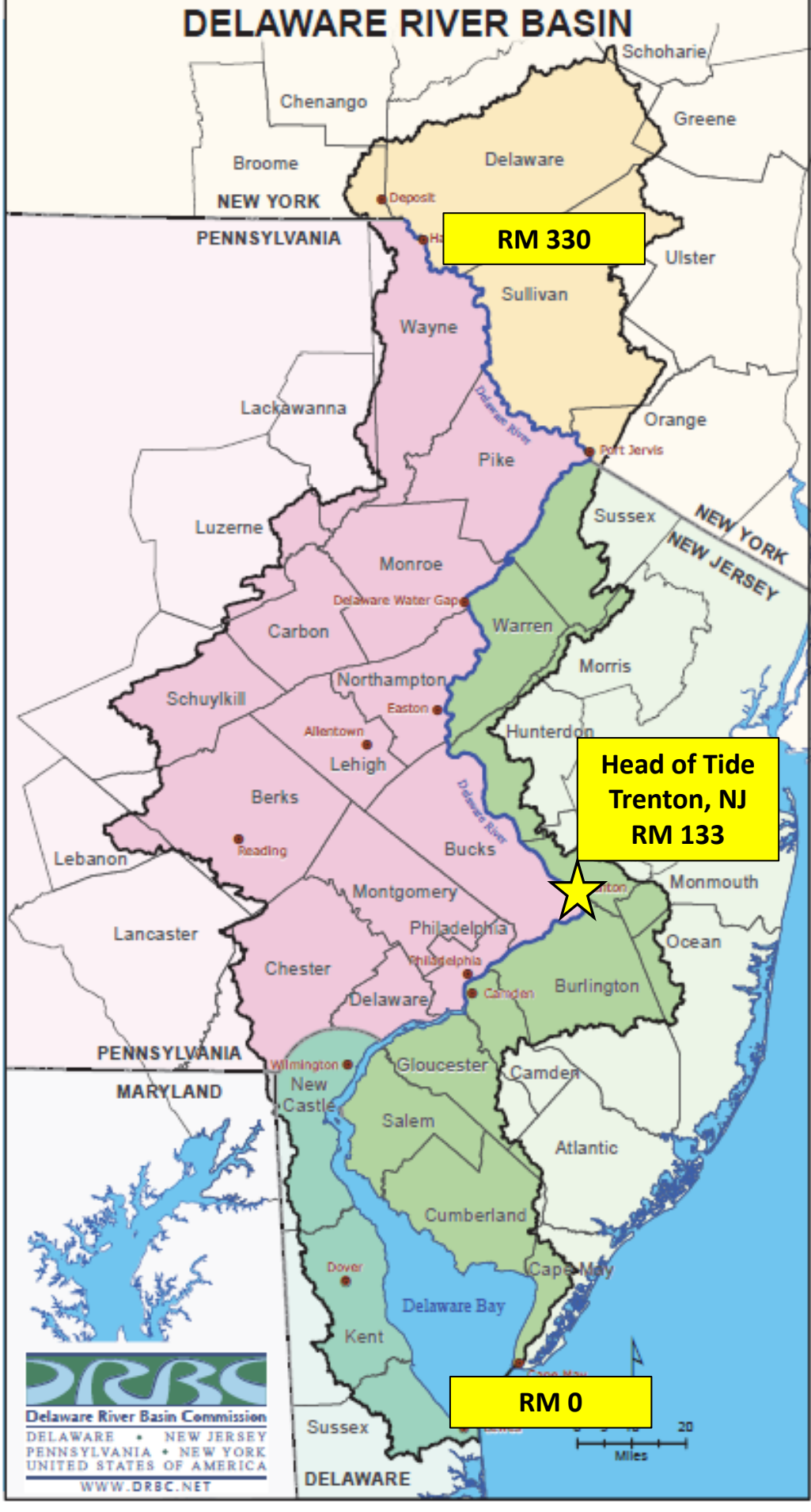
**You are Here.  
 Philadelphia, PA**



Credit: Justin Curtis

**Ben Franklin Bridge  
 River Mile (RM) 100**





Credit: Nicholas A. Tonelli



Credit: RentPhilly.com



Credit: Laura Chamberlin, WHSRN.org





CANADA

WA

MT

ND

ME

OR

ID

MN

VT

NH

WY

SD

WI

MI

MA

CT

NV

UT

CO

NE

IA

Delaware River

PA

NJ

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WV

MD

DC

DE

Pacific Ocean

Atlantic Ocean

TX

AR

AL

GA

SC

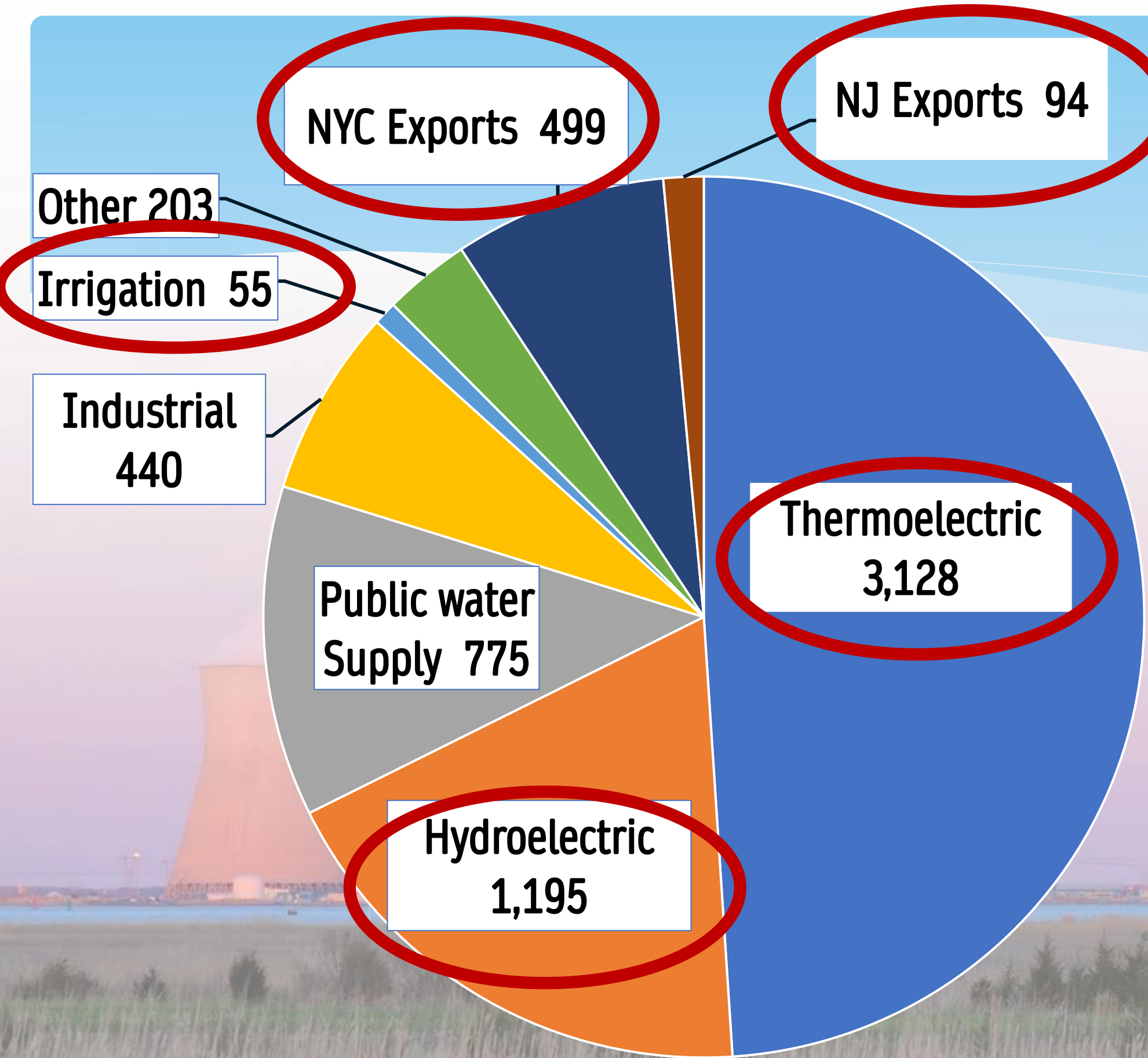
MEXICO

Gulf of Mexico

MS

FL





**The total amount of water withdrawn from the Basin in 2020 was 6,390 Million Gallons per Day (MGD) or 7.1 million acre-ft year.**



# History

The setting in Delaware River Basin

**Historic conflicts and droughts**

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NYC's growing demand for water led to interstate conflicts and court battles.

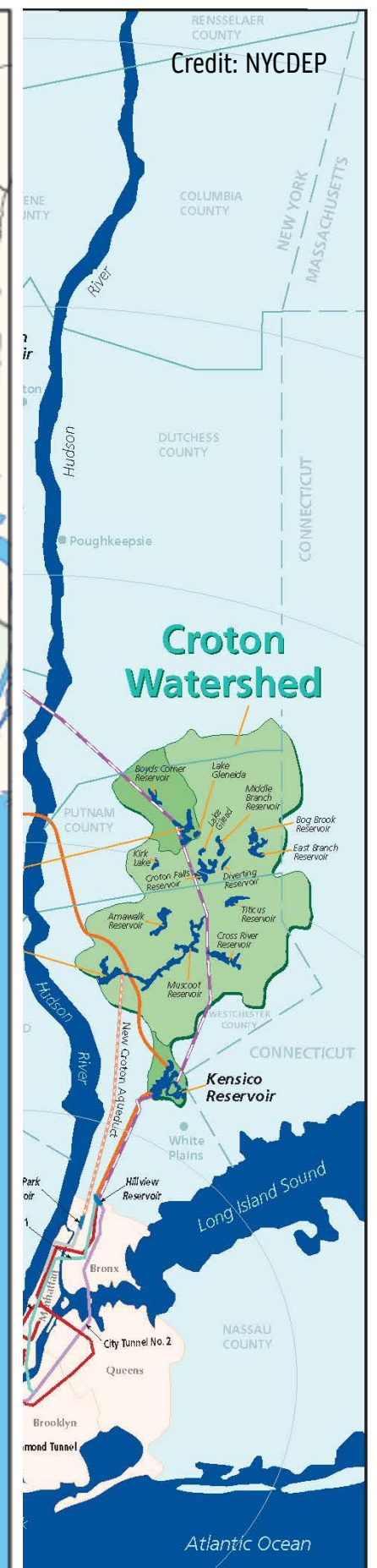
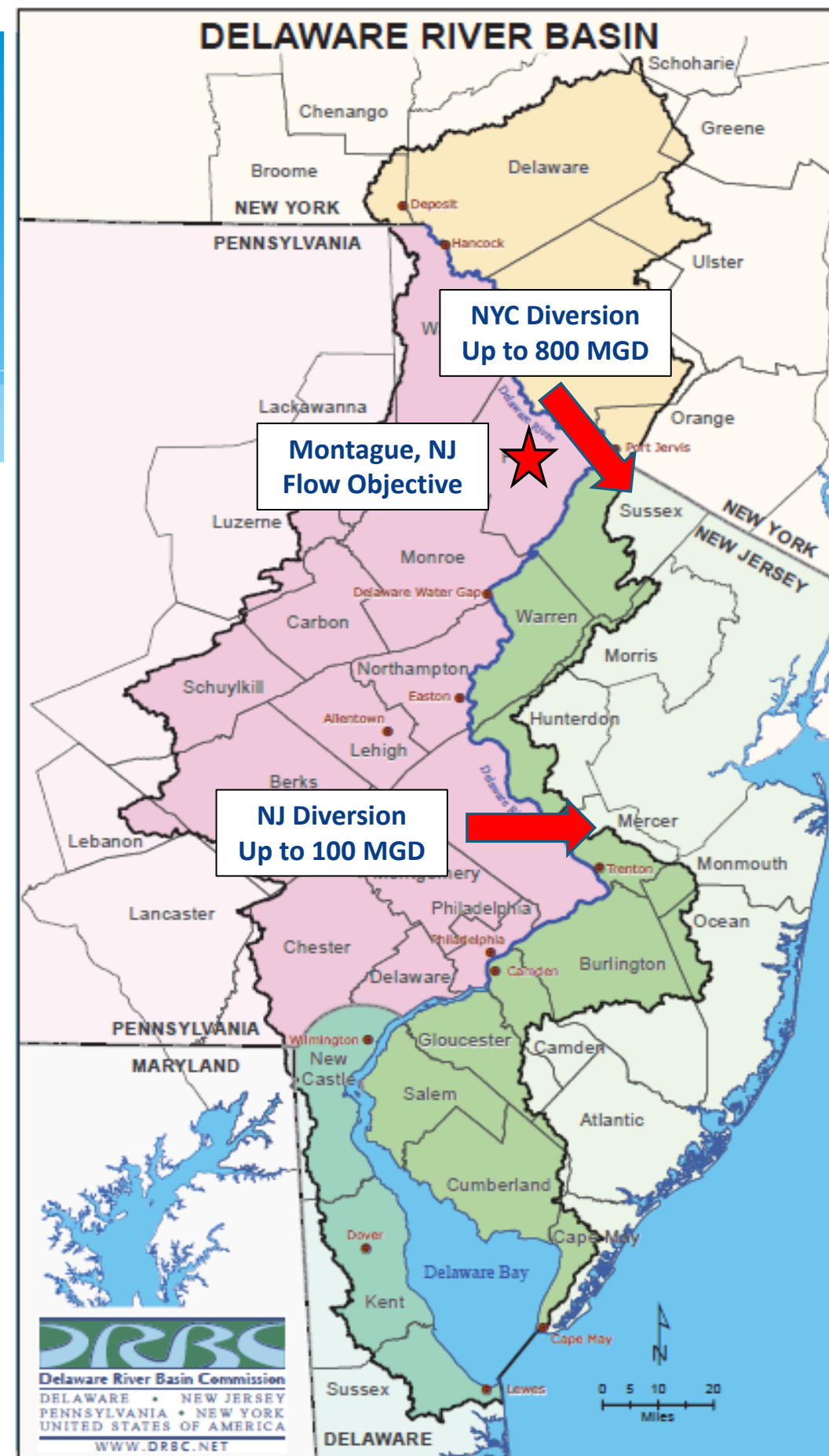
1931: State of New Jersey v. the State of New York and New York City

1954: Amended Supreme Court Decree (Pennsylvania and Delaware as intervenors)

Credit: Architect of the Capitol

A river is more than an amenity, it is a treasure. It offers a necessity of life that must be rationed among those who have power over it."

- Justice Oliver Wendell Holmes, *New Jersey v. New York*, 283 U.S. 336 (1931).





The 1954 Supreme Court Decree did not address many water management issues leaving the potential for future interstate conflicts over...

## FLOODS



Lehigh River, 1955 (CC BY-NC)

## WATER QUALITY



Philadelphia, 1929; PWD

## DROUGHTS

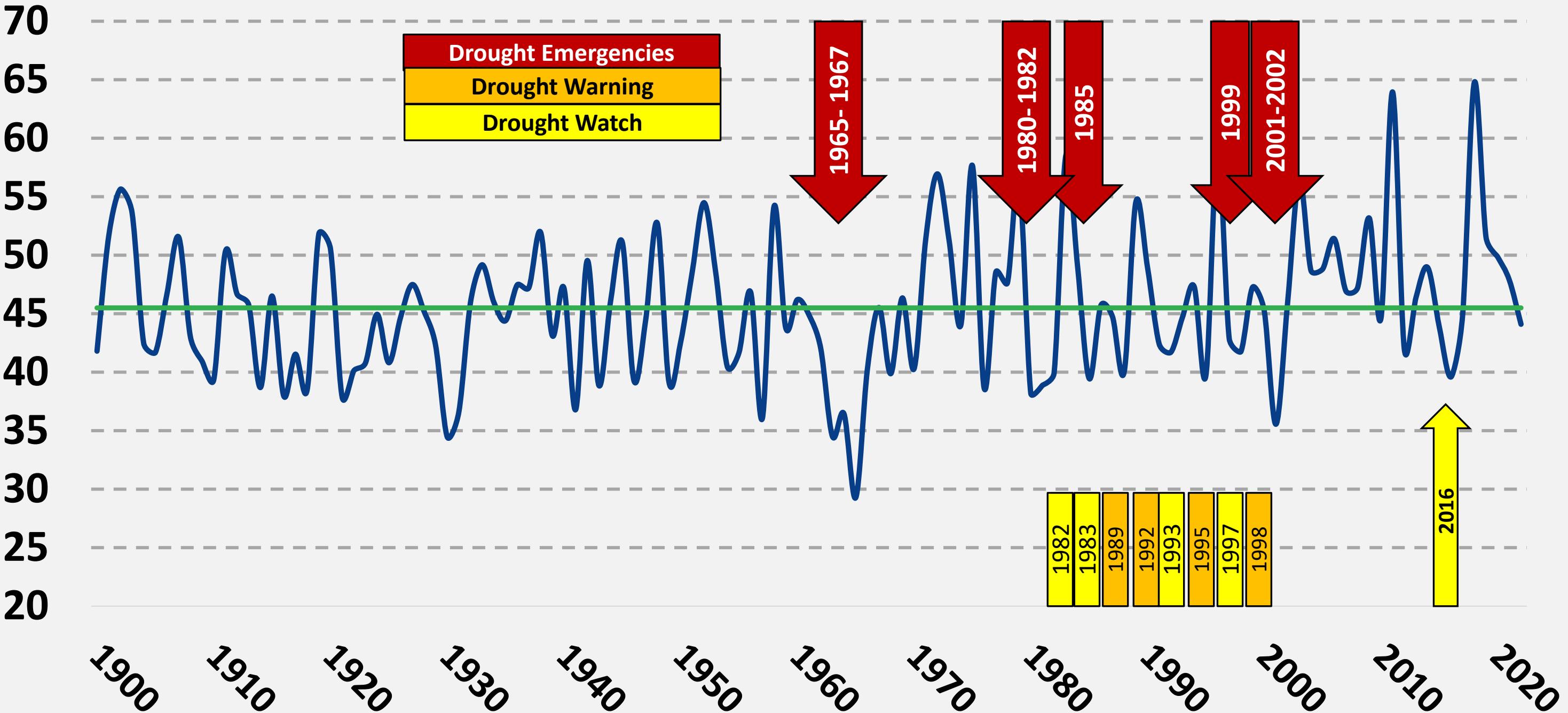


NYC Cannonsville Reservoir, 2001; NYCDEP



# The drought of record in the Delaware River Basin occurred from 1961 to 1967.

New Jersey Annual Precipitation (inches)



# Salinity intrusion threatened drinking water intakes in 1964.

Delaware River at Trenton, 1963

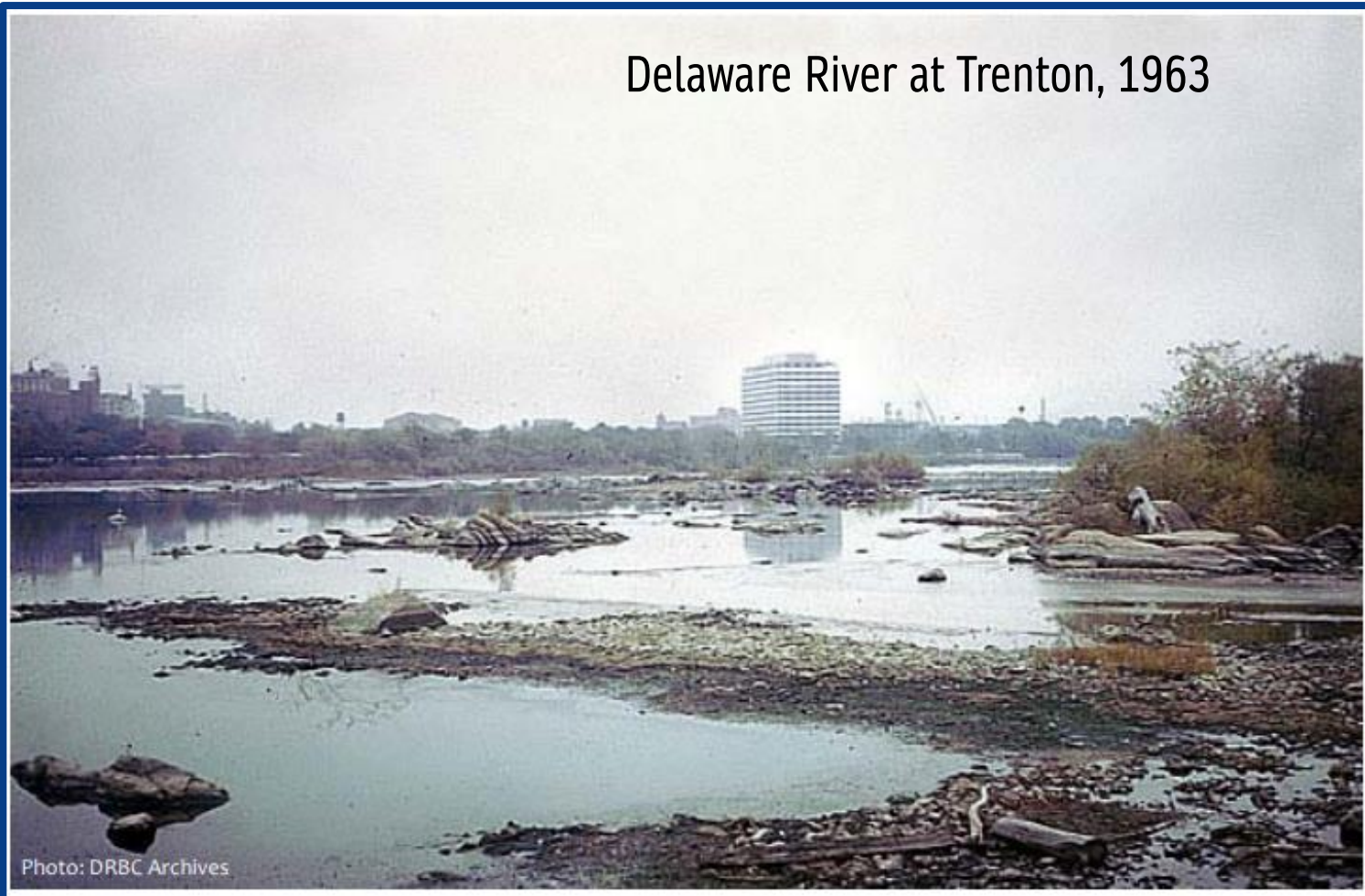
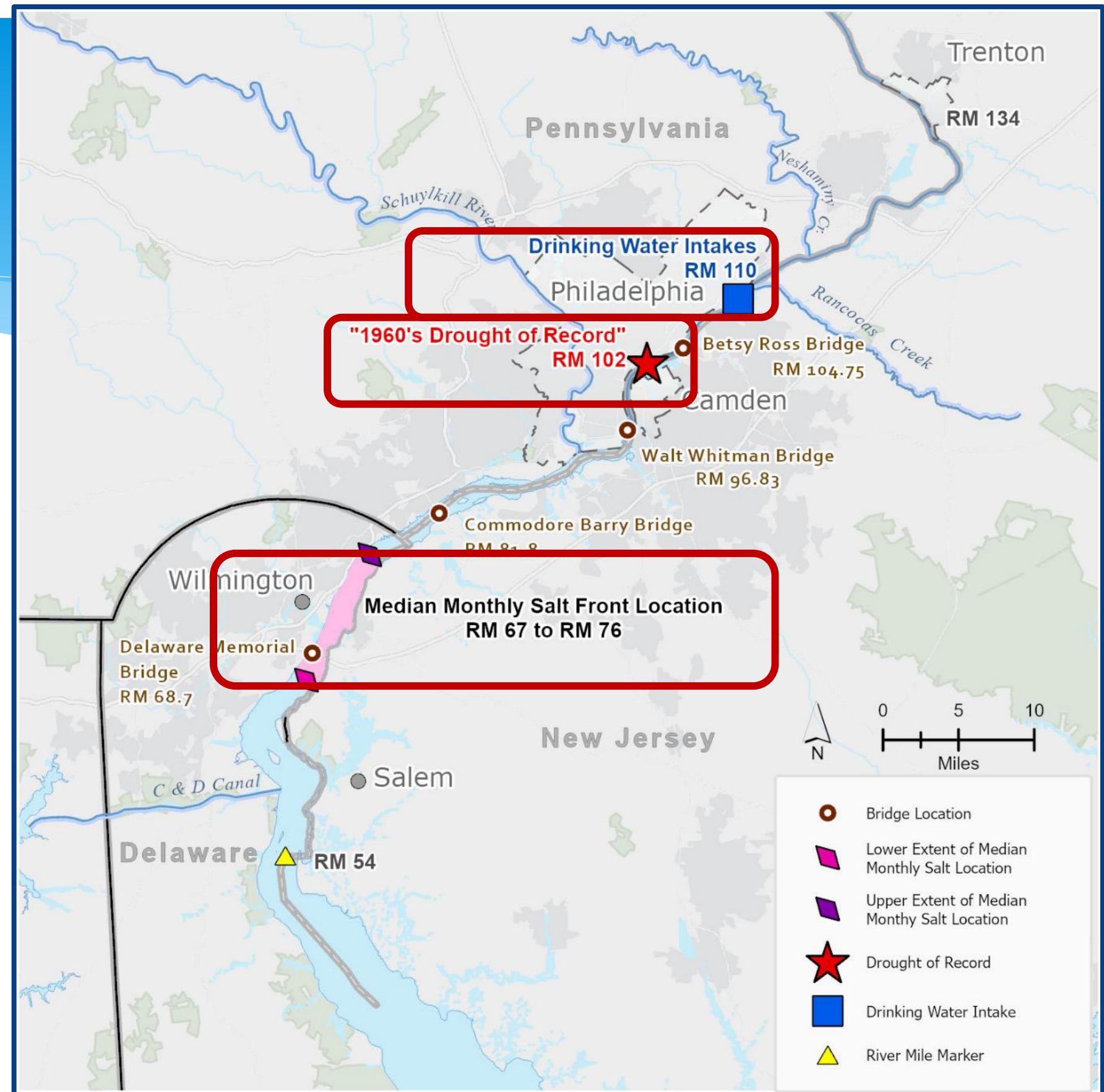


Photo: DRBC Archives



The "salt front" location represents the transition from salt water to fresh water



# Cooperative Management

The setting in Delaware River Basin

Historic conflicts and droughts

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Future challenges





# Cooperative interstate water resource management took hold when Congress and the four basin states adopted the Delaware River Basin Compact in 1961.

## FOUR STATES SIGN DELAWARE PACT

President Joins in Approving  
Vast Program for Basin  
Backed by Governors

COMMISSION IS SET UP

Developing of River Valley  
Will Use, Conserve and  
Protect Vital Supply

By **RUSSELL BAKER**  
Special to The New York Times.

New York Times Nov. 3,  
1961 headline about the  
DRBC's creation.





# The Delaware River Basin Commission was provided broad and comprehensive authority to...

...provide for the planning, conservation, utilization, development, management and control of the water resources of the basin...



Congress provided the Basin states and NYC with the tools to work together and to not to go back to the Supreme Court.



## Delaware River Basin Commission

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

## Parties to the 1954 Supreme Court Decree:

DELAWARE NEW JERSEY  
PENNSYLVANIA NEW YORK

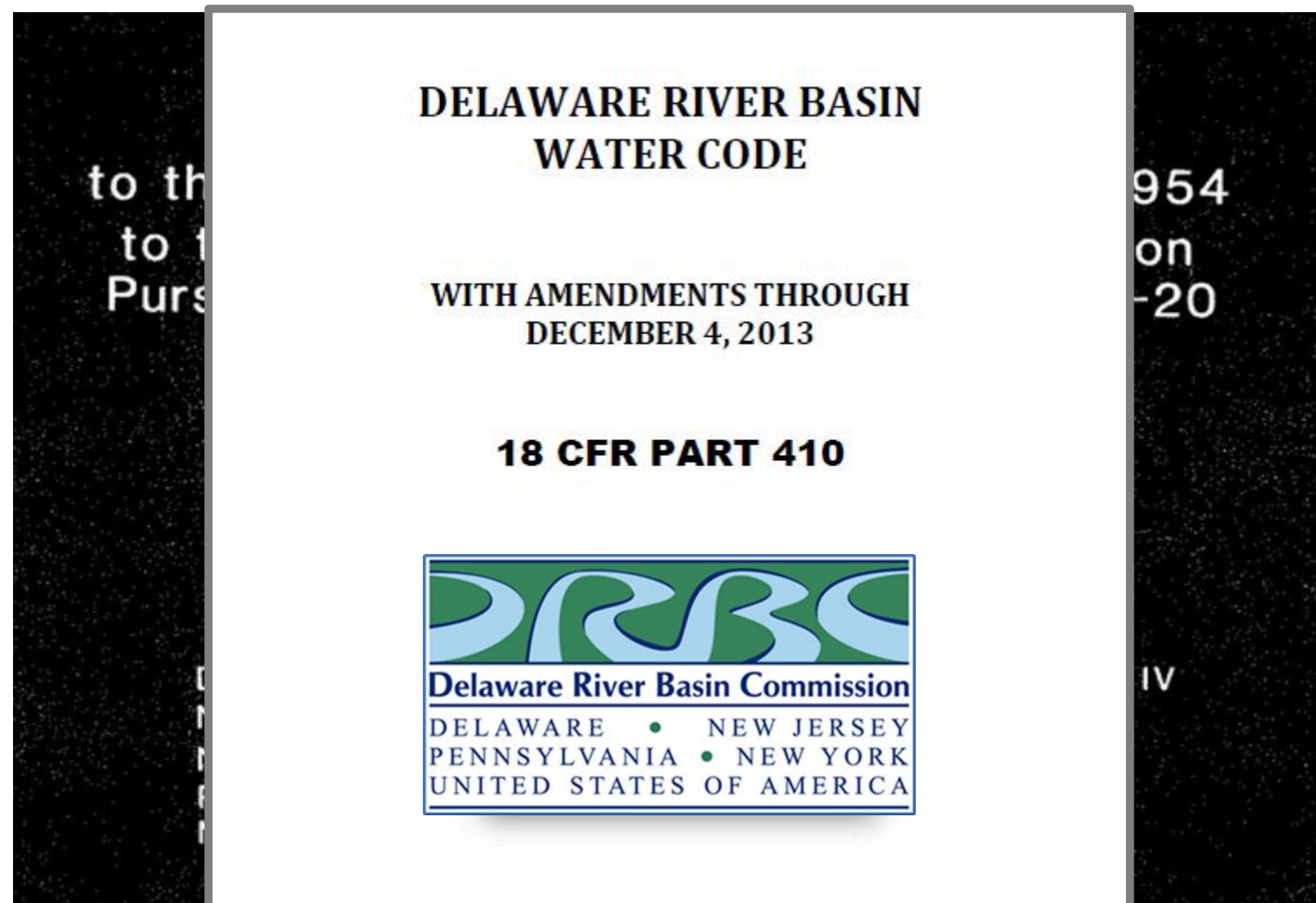
THE CITY OF NEW YORK

*The commission, without the unanimous consent of the parties to the ...[1954] Supreme Court decree...shall not...affect the...rights, conditions, obligations, and provisions...provided in said decree;*

-Delaware River Basin Compact (1961)



The basin states, the federal government, DRBC staff, and New York City have a long and successful history of interstate cooperative, collective, and adaptive management to address drought resilience.



## Drought Management Plan

Flow Objective at Trenton (head of tide)

Phased Flow Objectives and Diversions

Reservoir Storage / Flow Augmentation

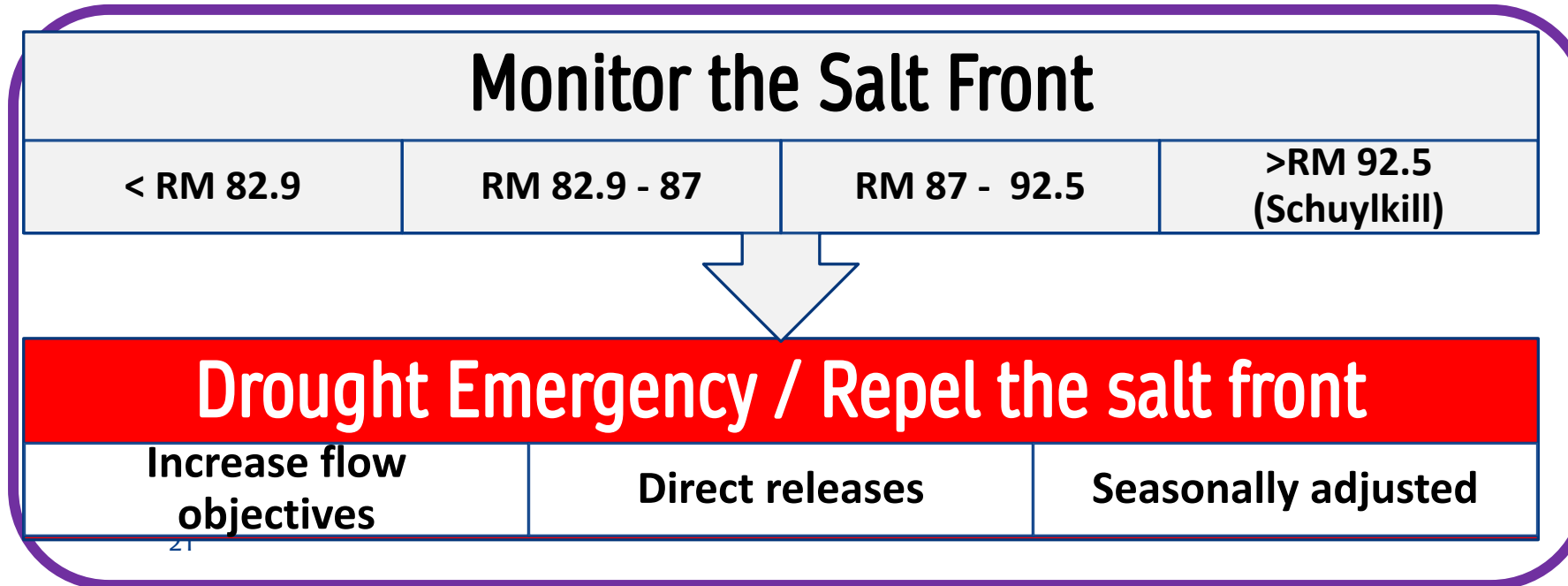
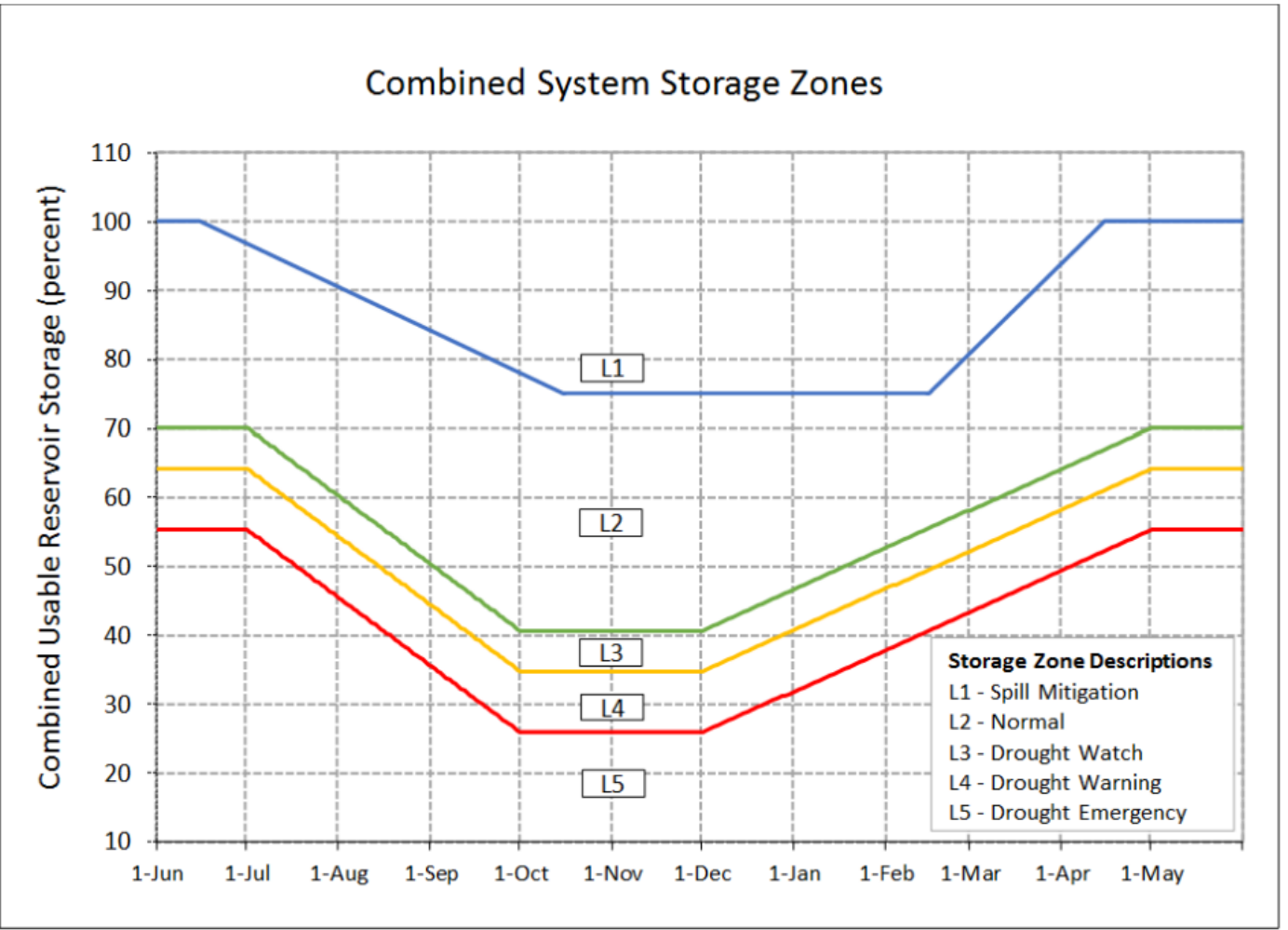
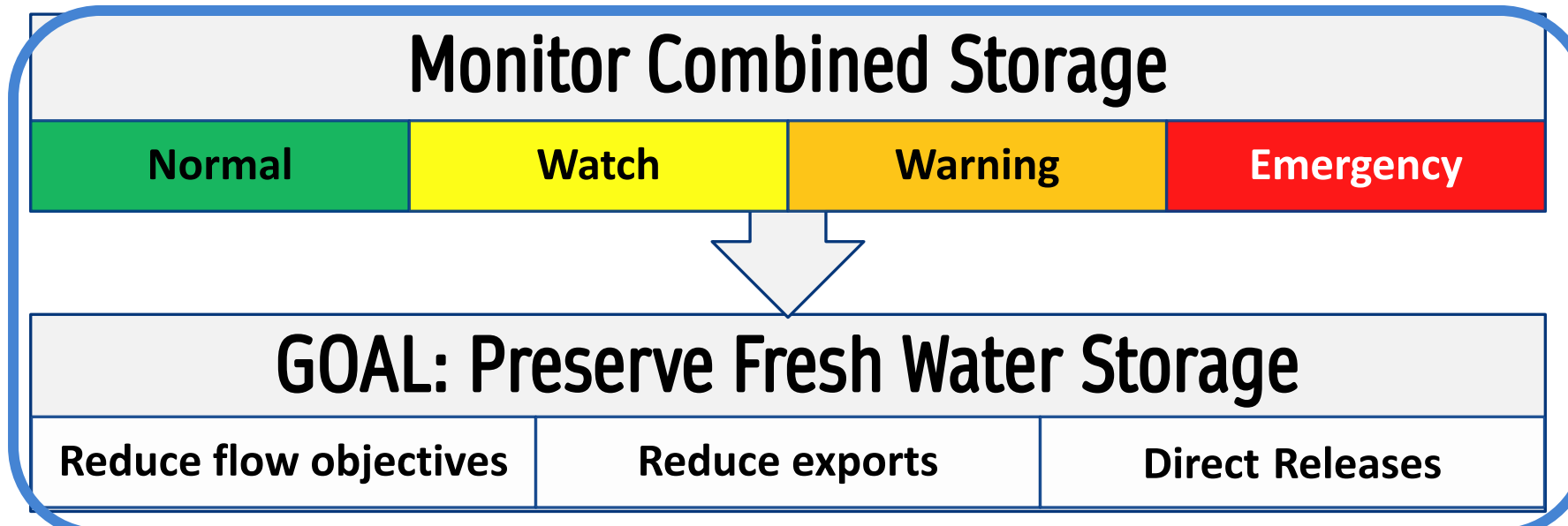
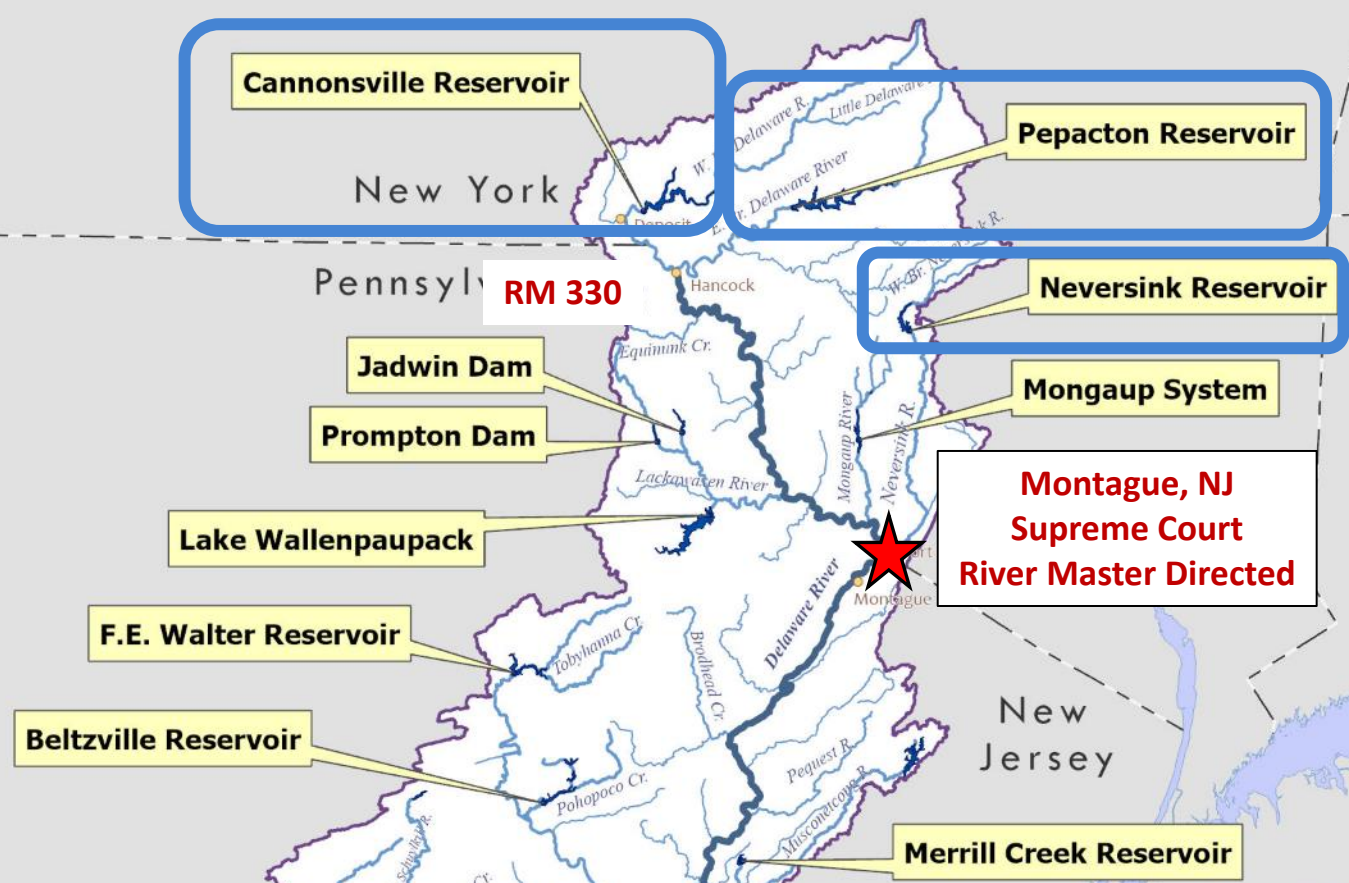
Regulation of Consumptive Uses

Water Conservation

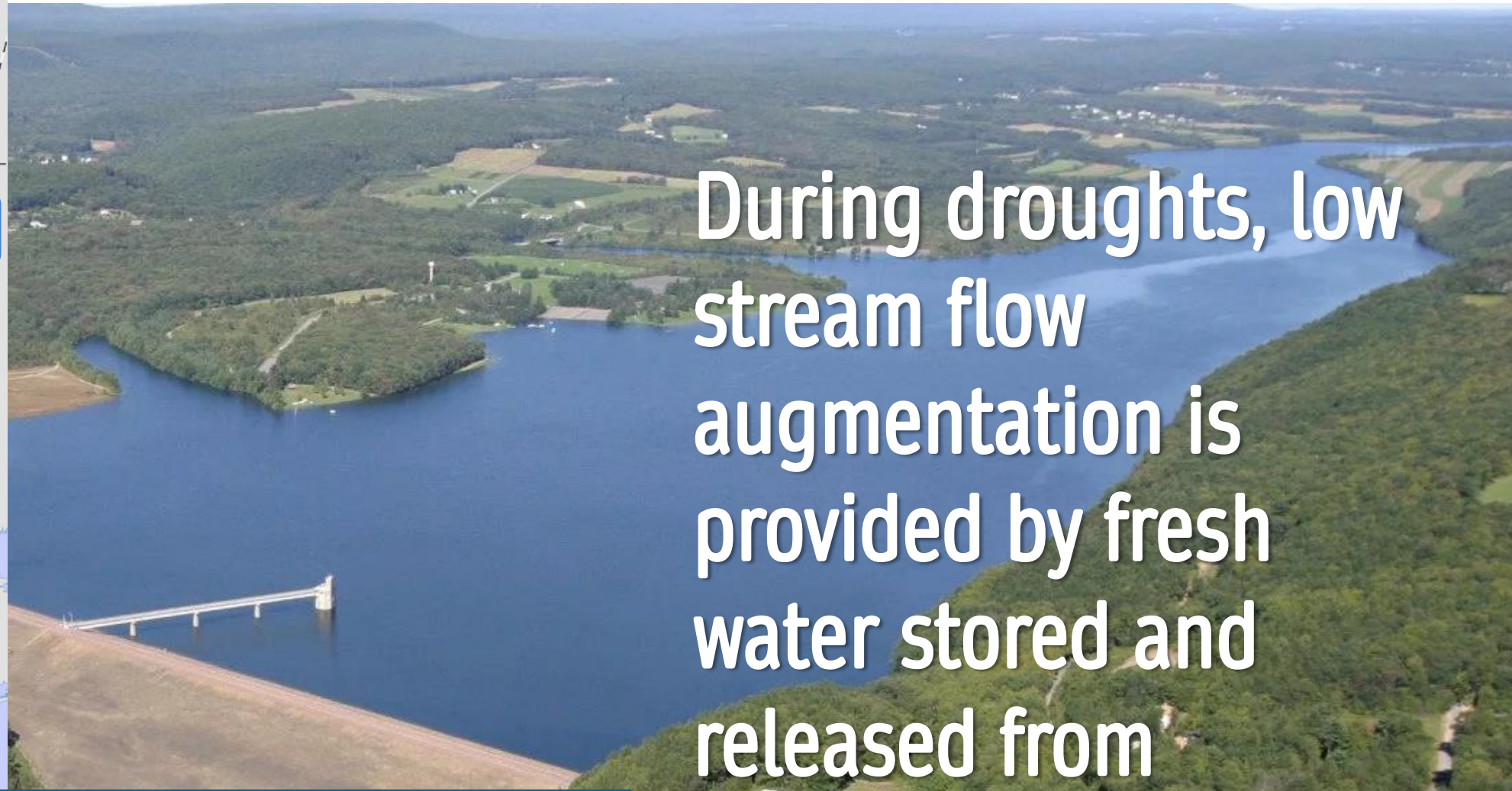
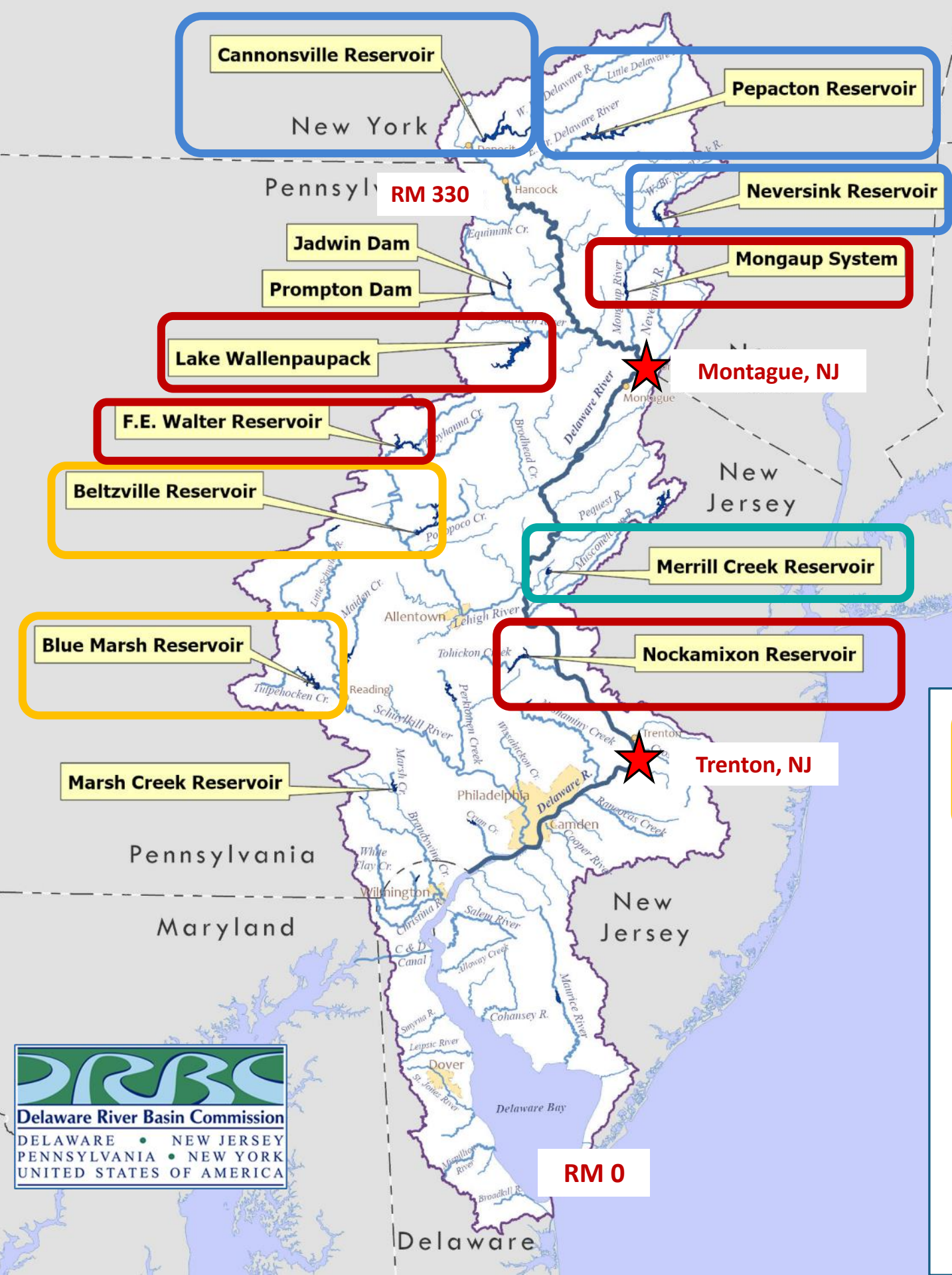
1960s drought as the planning standard



# Flow objectives and out of basin diversions (exports) are revised and phased based upon the combined volume in the three NYC reservoirs







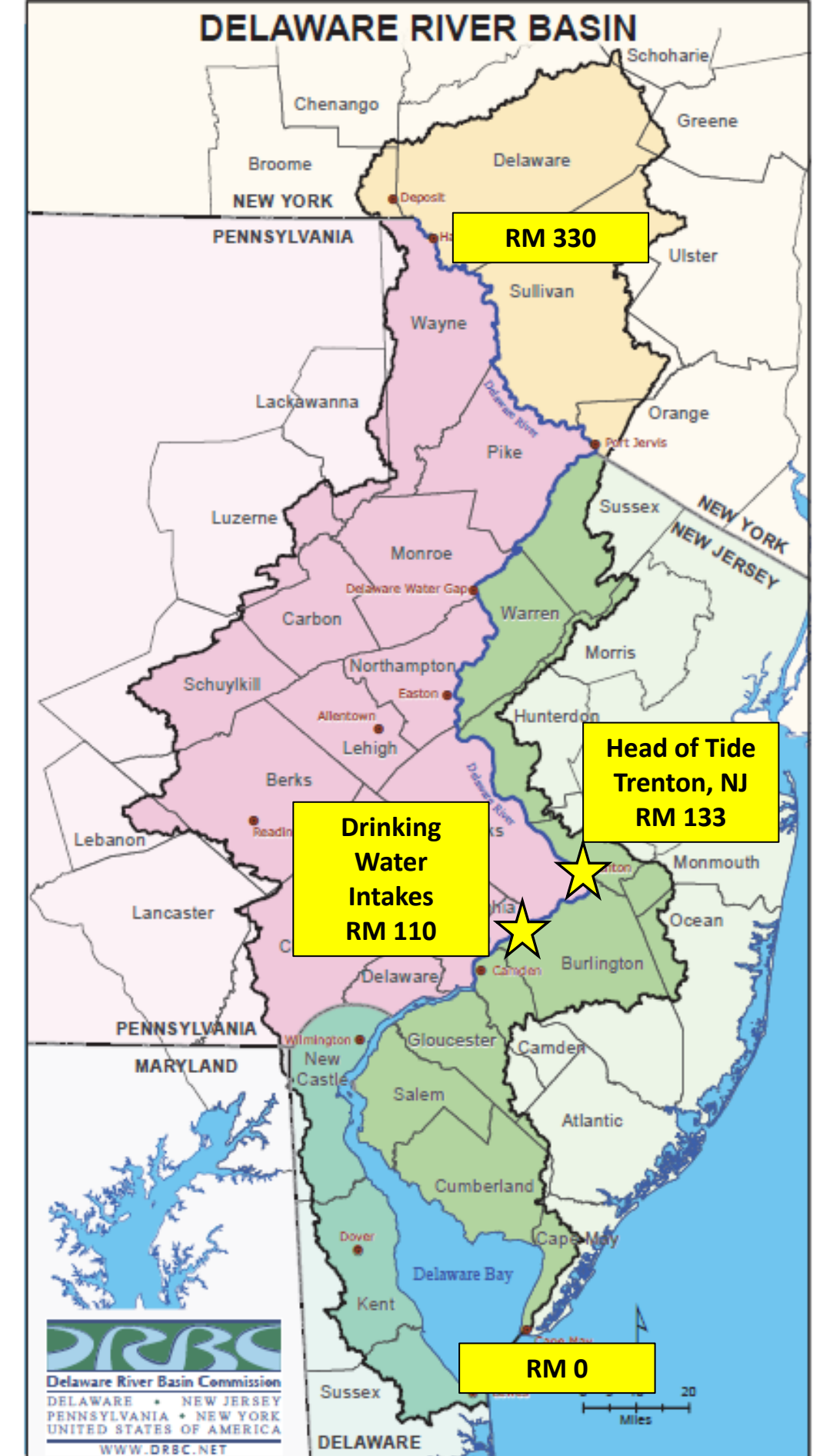
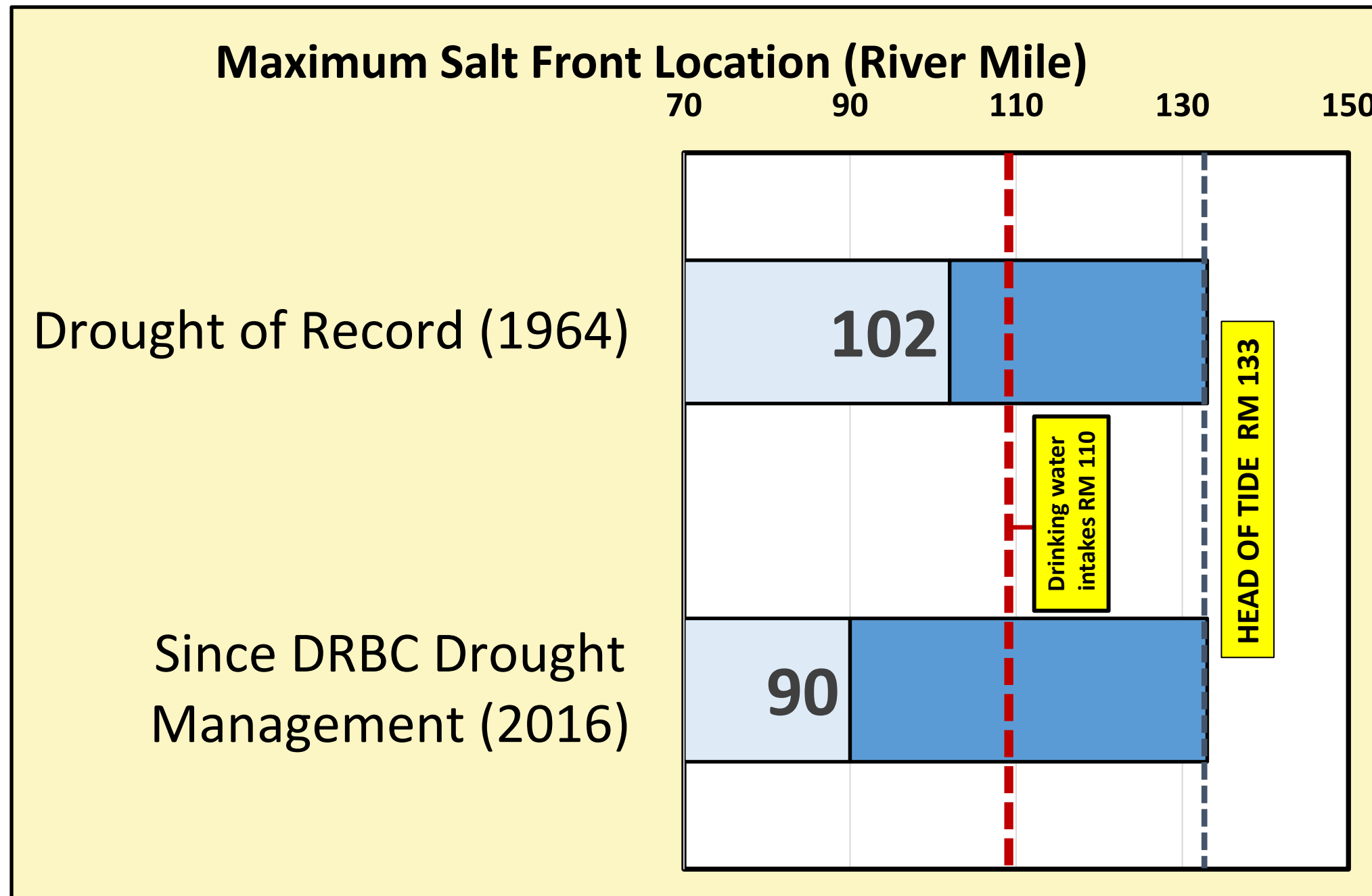
During droughts, low stream flow augmentation is provided by fresh water stored and released from reservoirs throughout the Basin.

- USACE Multi-purpose Reservoirs**
- Drought Emergency Reservoirs**
- NYC Delaware System Water Supply Reservoirs**
- Power Consumptive Use Replacement Reservoir**

Beltzville Reservoir, Carbon County, PA  
 Photo Credit: U.S. Army Corps of Engineers



# Cooperative planning and policy has worked to control salinity intrusion during droughts.





# Cooperative and adaptive management is a continuous process and has been supported by a Flexible Flow Management Program (FFMP)

Refines of out of basin diversion and flow objectives.

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Enhances conservation releases from NYC Reservoir to support cold water fisheries and **local habitat protection**.

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Provides a **flood discharge mitigation** program

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Creates “**water banks**” for specific needs.

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Provides Decree Parties and DRBC with direction for studies of future adaptive management needs.



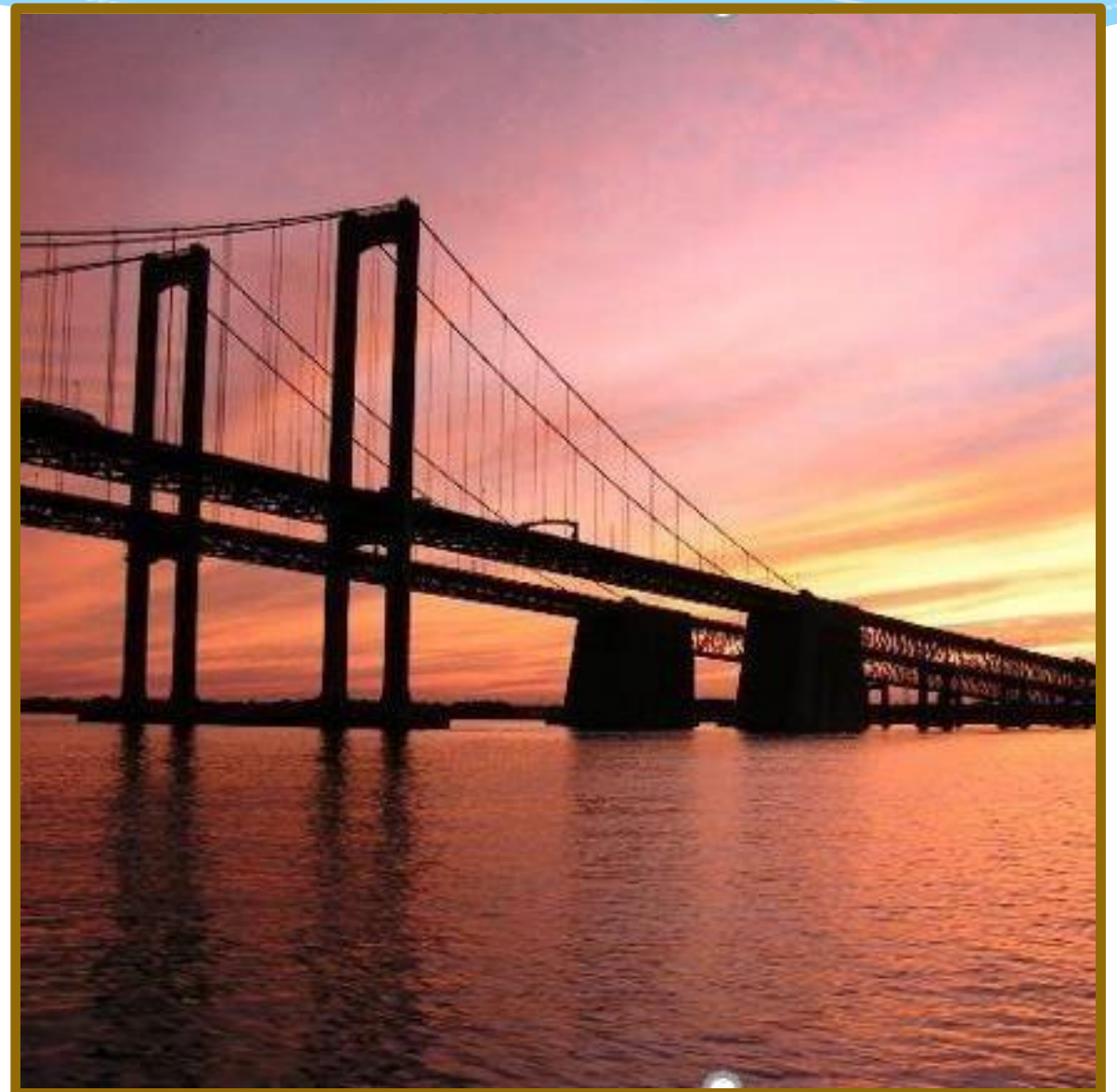
# Future Challenges

The setting in Delaware River Basin

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# Climate change will impact both non-tidal and tidal river reaches.

NON-TIDAL

Head of Tide  
Trenton, NJ RM 133

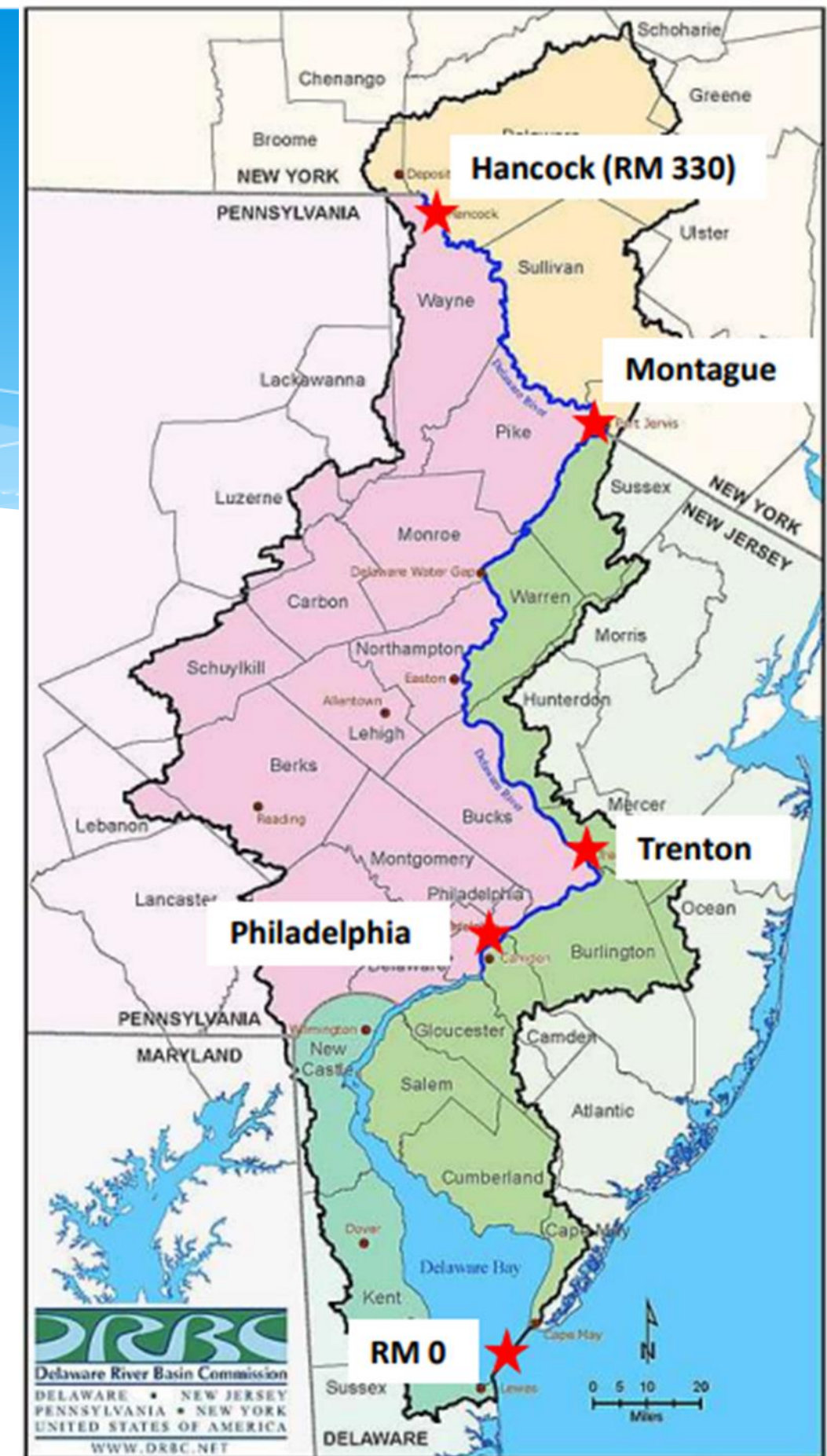
TIDAL

## Temperature and Precipitation

- Streamflow/ Reservoir inflow
- Evapotranspiration
- Snowpack

## Sea Level Rise

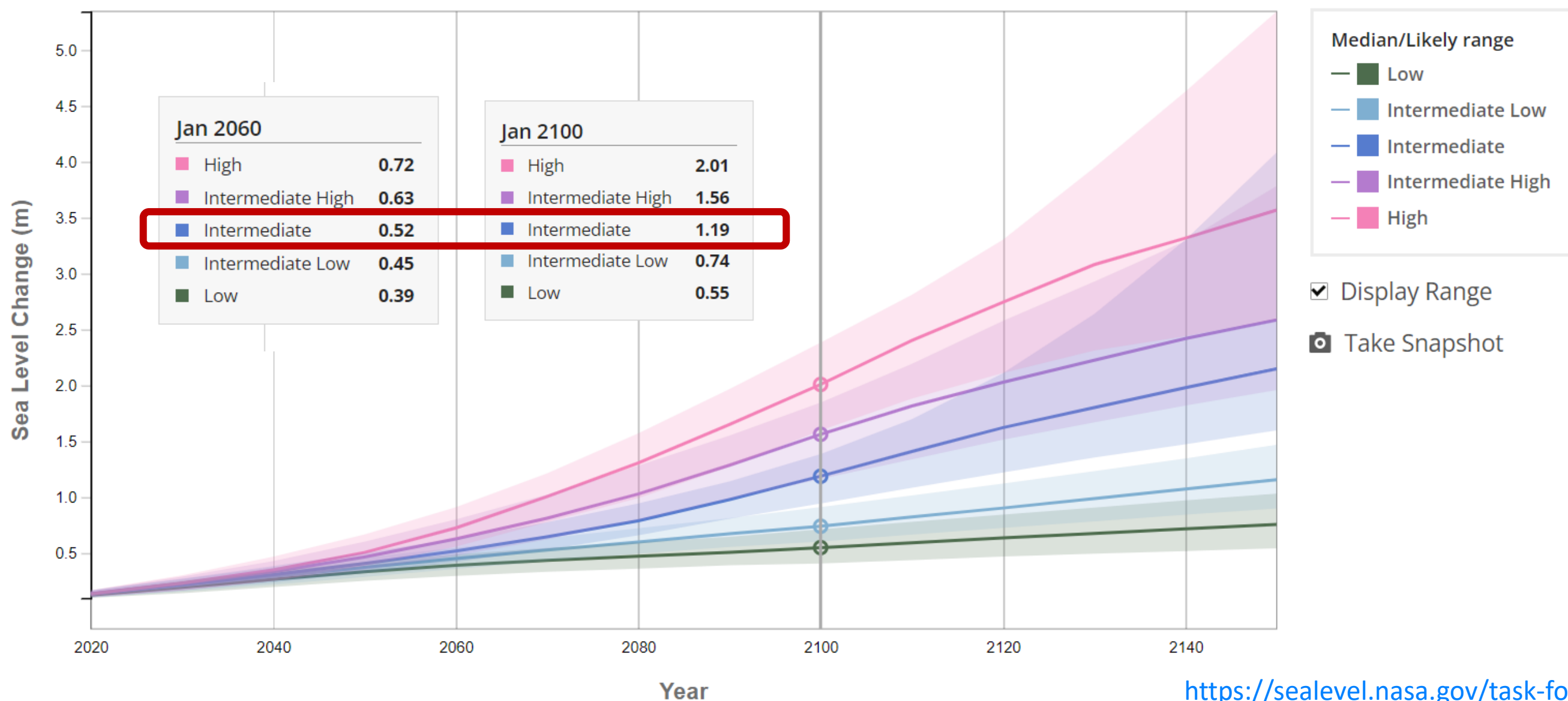
- Salinity Intrusion
- Tides and waves



← RETURN TO MAP

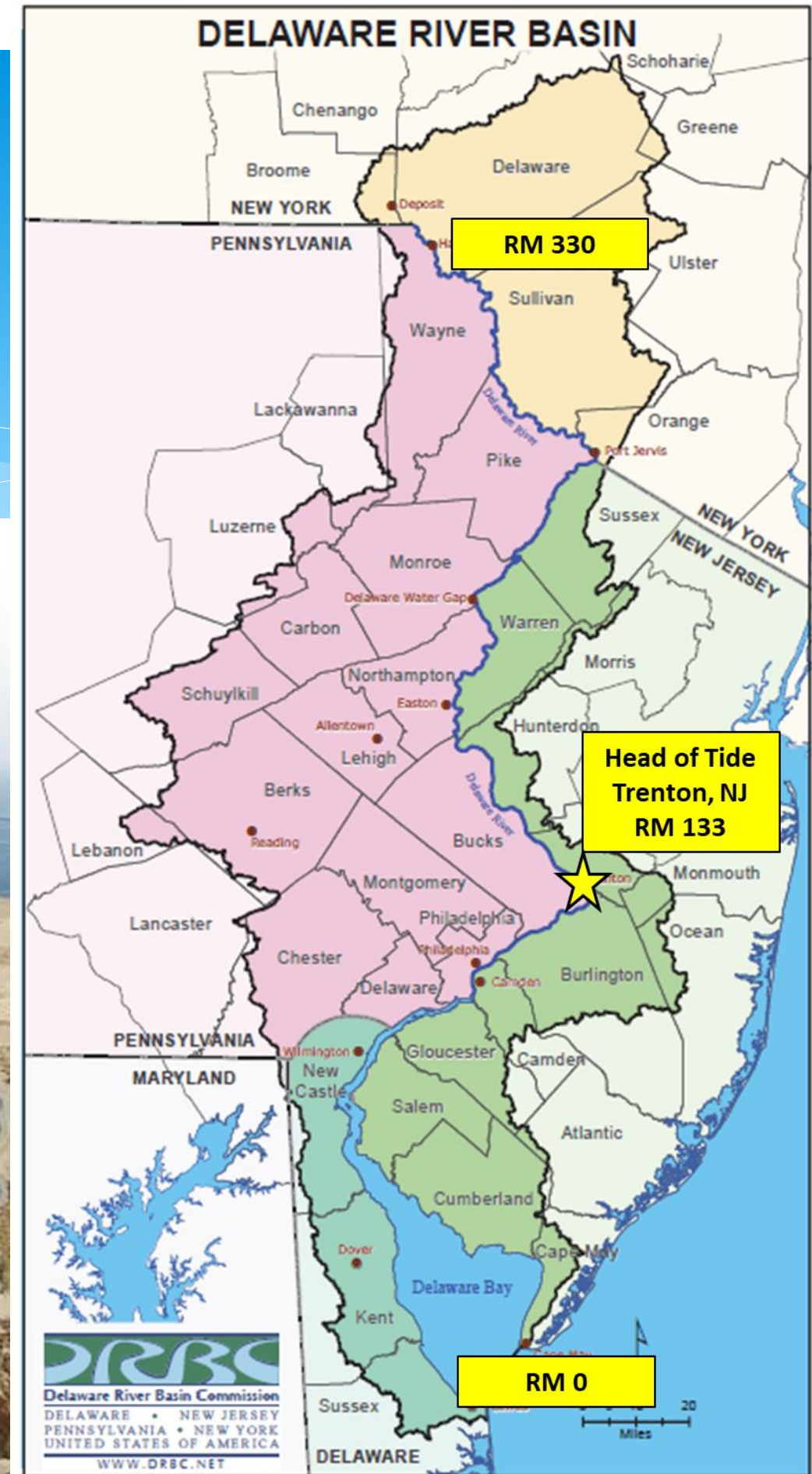
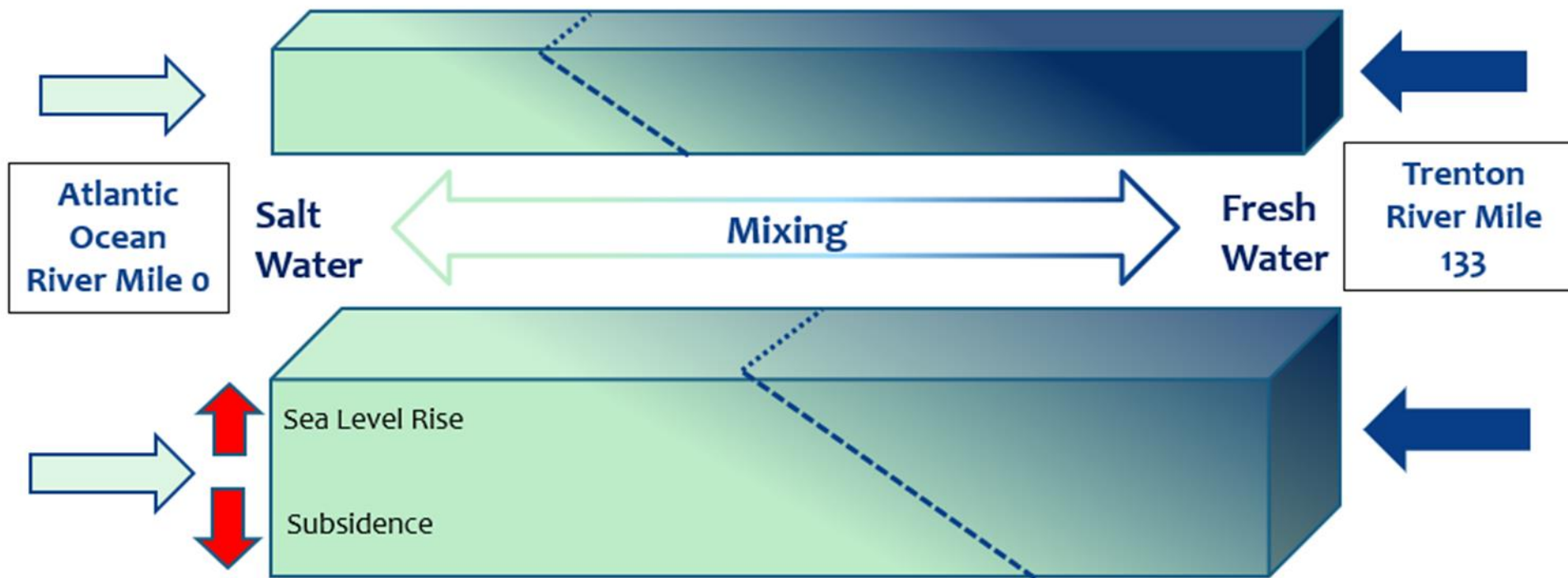
# PHILADELPHIA (PIER 9N)

NASA interagency team projects **0.52 m** SLR by **2060** and **1.19 m** by **2100** using “Intermediate” emissions scenario – Delaware River / Philadelphia



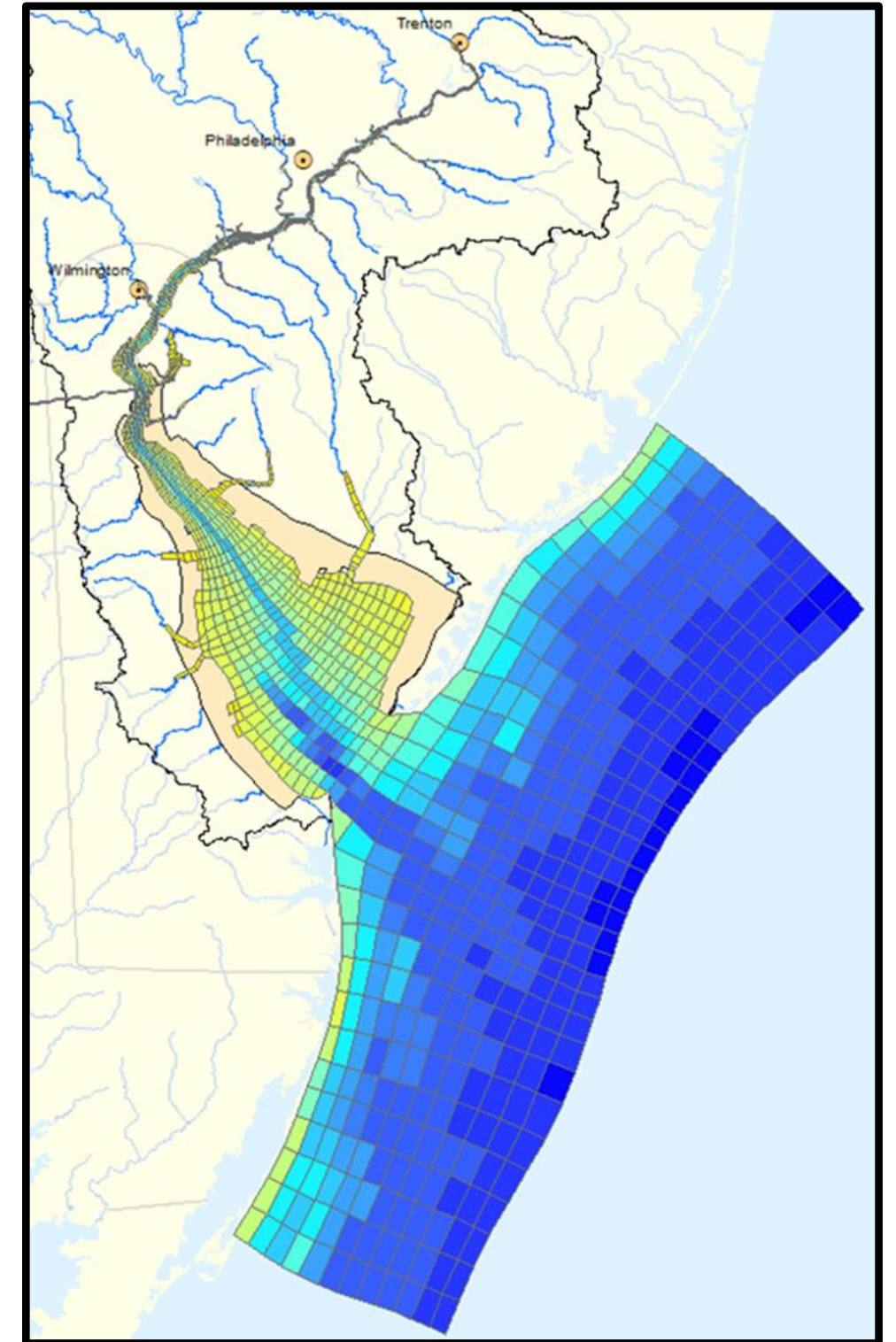
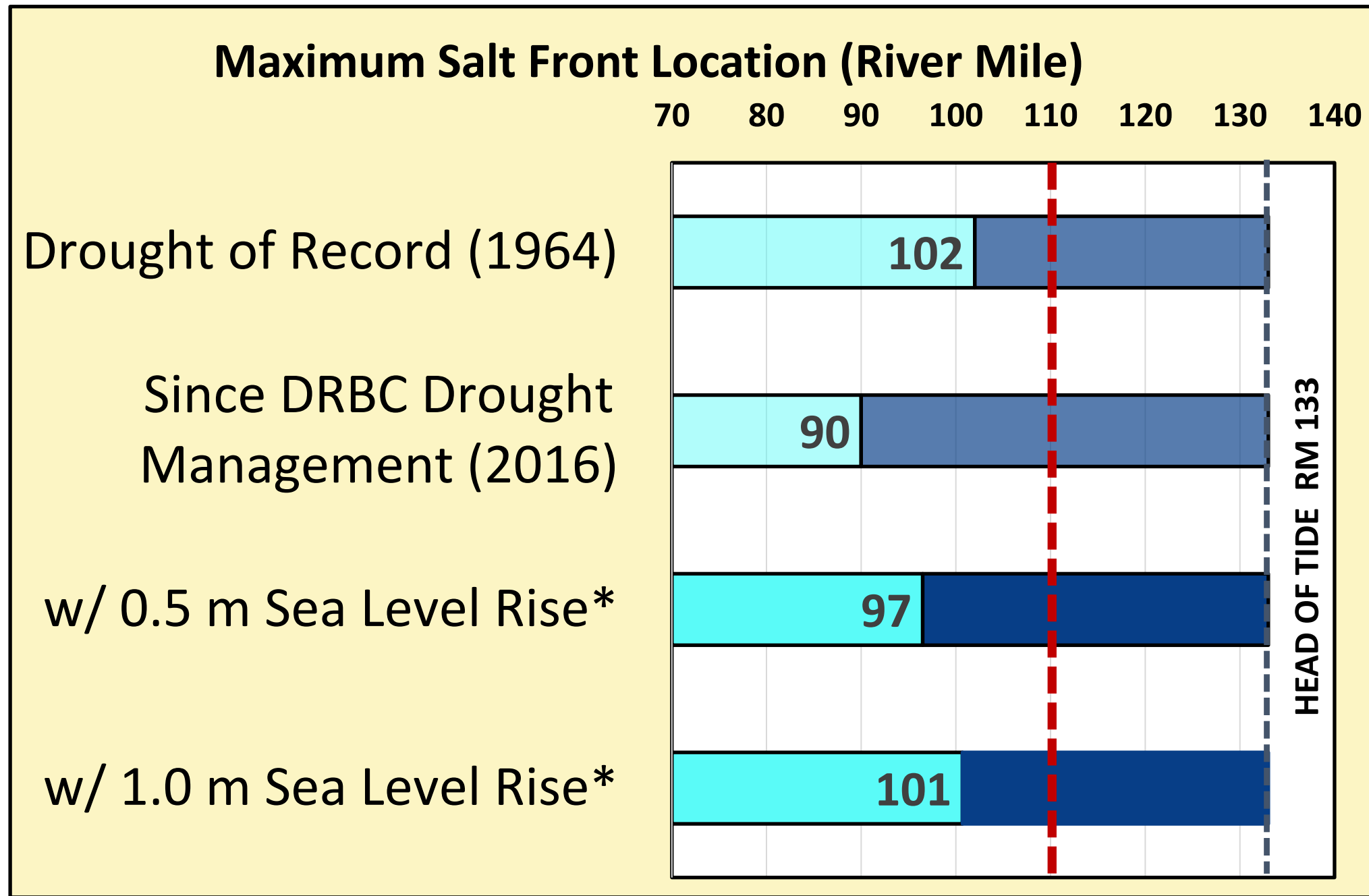


With SLR and more force from the ocean, the salt front is expected to be pushed farther upstream more frequently.





# Models estimate that salinity intrusion protection in the Delaware River Estuary is being adversely impacted by SLR.



\* Preliminary Draft Model Results by DRBC



The DRBC's Advisory Committee on Climate Change (ACCC) expands the cooperative approach to several government, business, academic, and non-government organizations.



**NEW JERSEY  
DEPARTMENT OF  
ENVIRONMENTAL  
PROTECTION**



**pennsylvania**  
DEPARTMENT OF ENVIRONMENTAL  
PROTECTION



**NYC**  
Environmental  
Protection

**PHILADELPHIA  
WATER  
DEPARTMENT**



 **COLUMBIA WATER CENTER**  
THE EARTH INSTITUTE AT COLUMBIA UNIVERSITY

 **The Water Center**  
UNIVERSITY OF PENNSYLVANIA

**RUTGERS**  
Climate Institute



**When the well's dry, we all know the value of water.**

*- Benjamin Franklin*

