Delaware River Basin Commission

State of the Basin
Flow Management and Climate Change

Amy L. Shallcross, P.E.
Manager, Water Resource Operations

Water Resources Association of the Delaware River Basin
58th Annual Conference
Strategies For a Sustainable Delaware River Basin
November 6, 2019

Good

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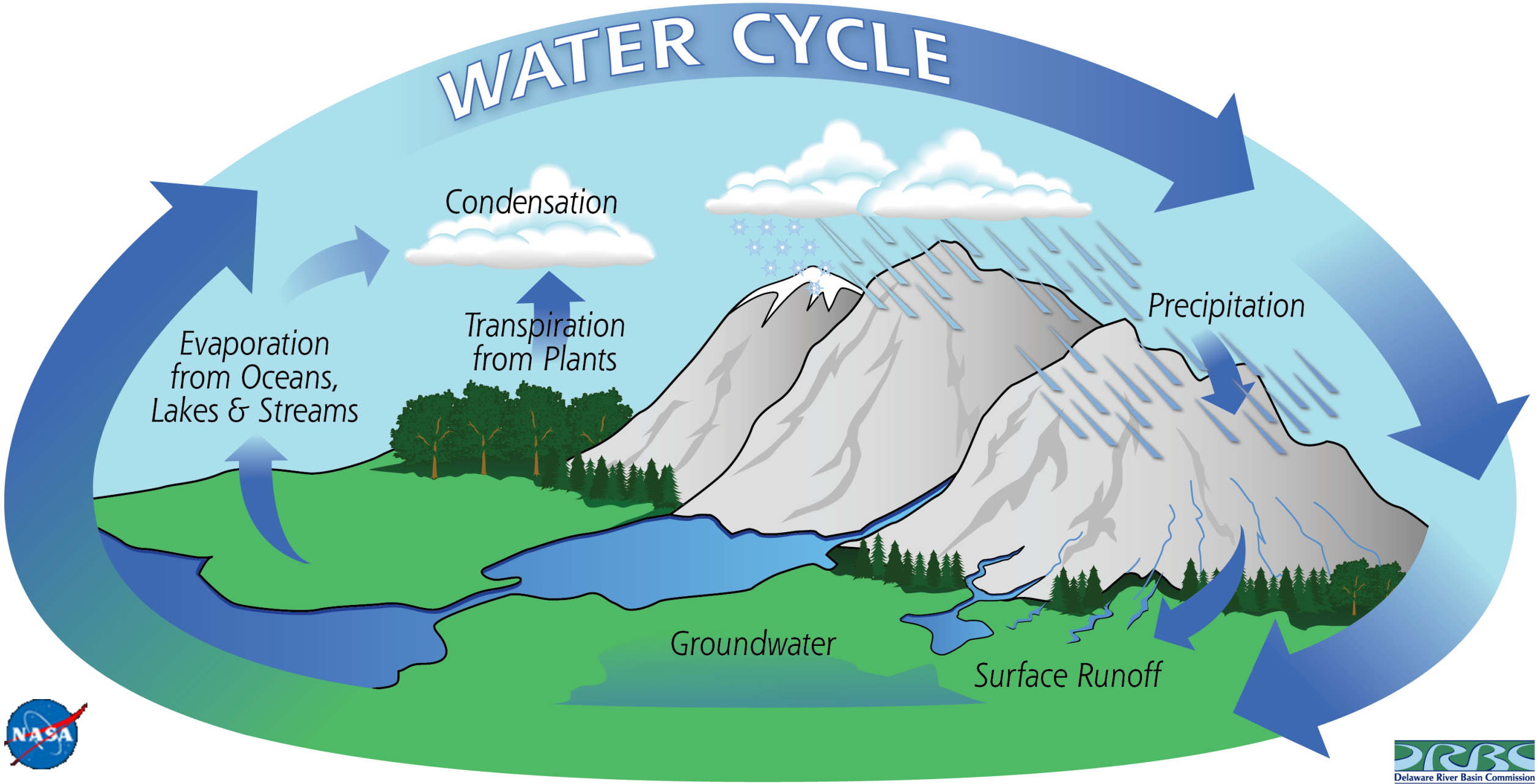

https://pmm.nasa.gov/education/water-cycle

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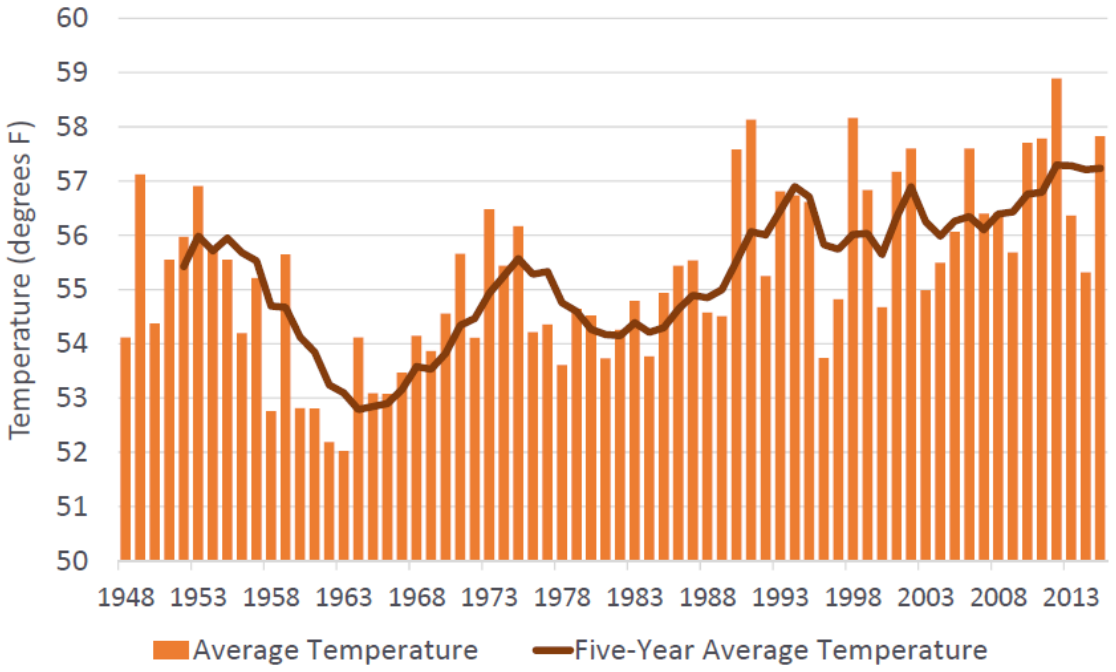
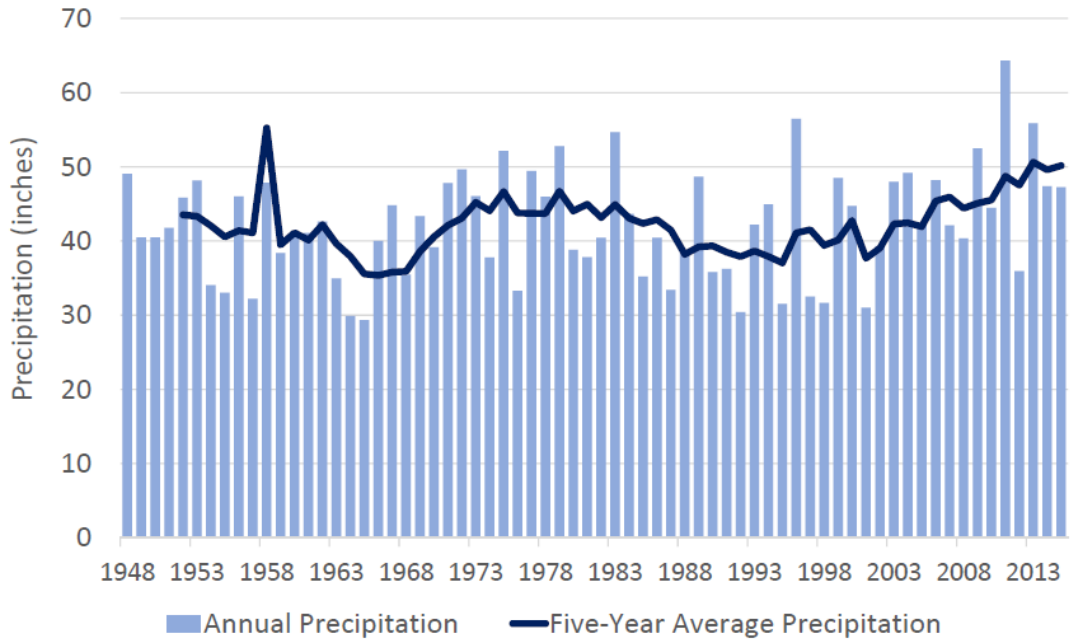
Trends in Temperature and Precipitation

Temperature



Precipitation



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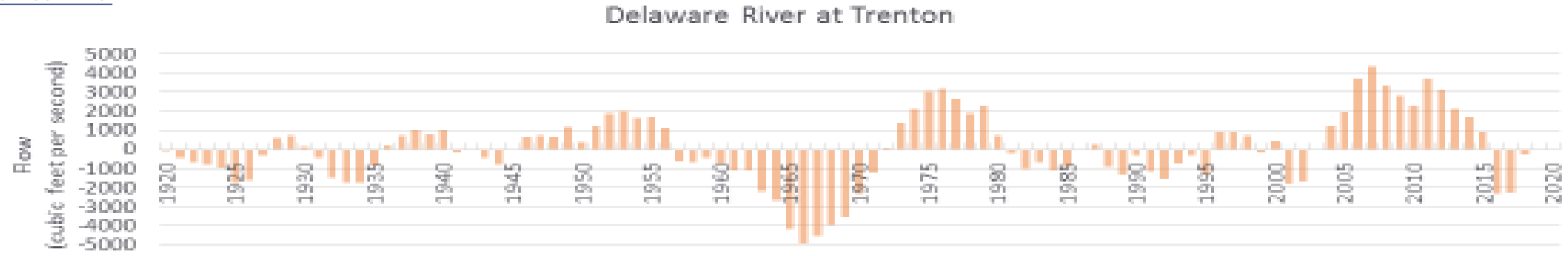
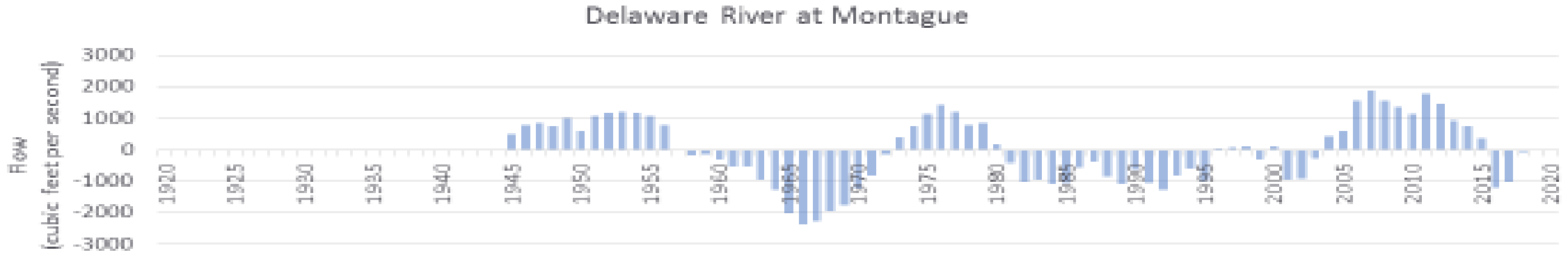
Difference Between Five Year Average Annual Flow and Annual Average Flow





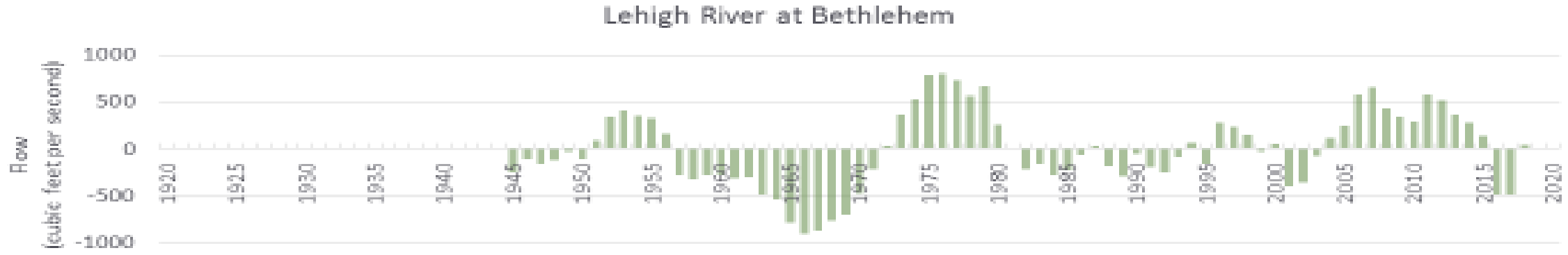


Photo: U.S. Army Corps of Engineers
Sept. 2004 Flood, Easton-Phillipsburg

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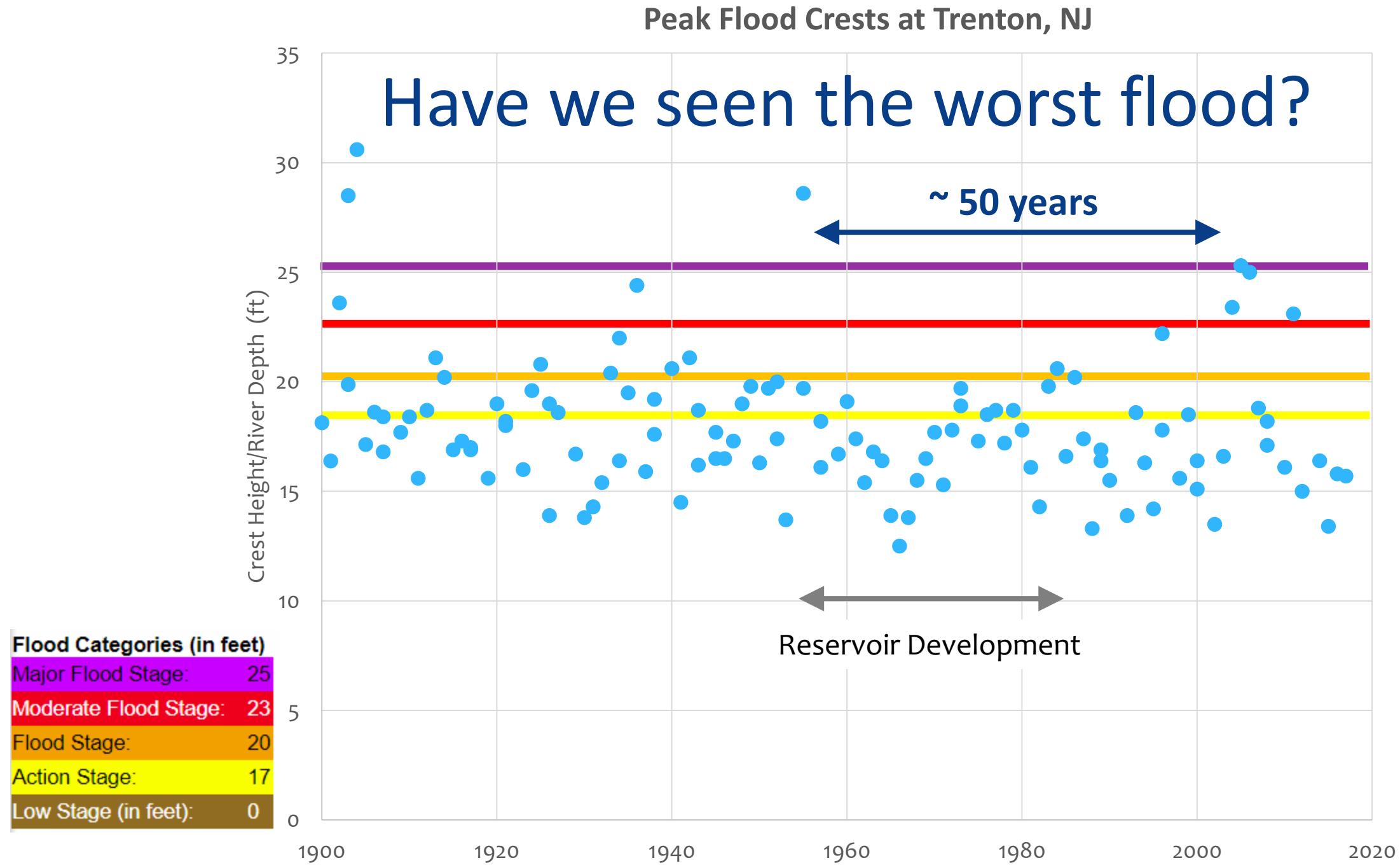

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August 1955

File photo courtesy of lehighvalleylive.com

Hurricane Diane: August 1955

DRB Flood of Record

Free Bridge Phillipsburg to Easton

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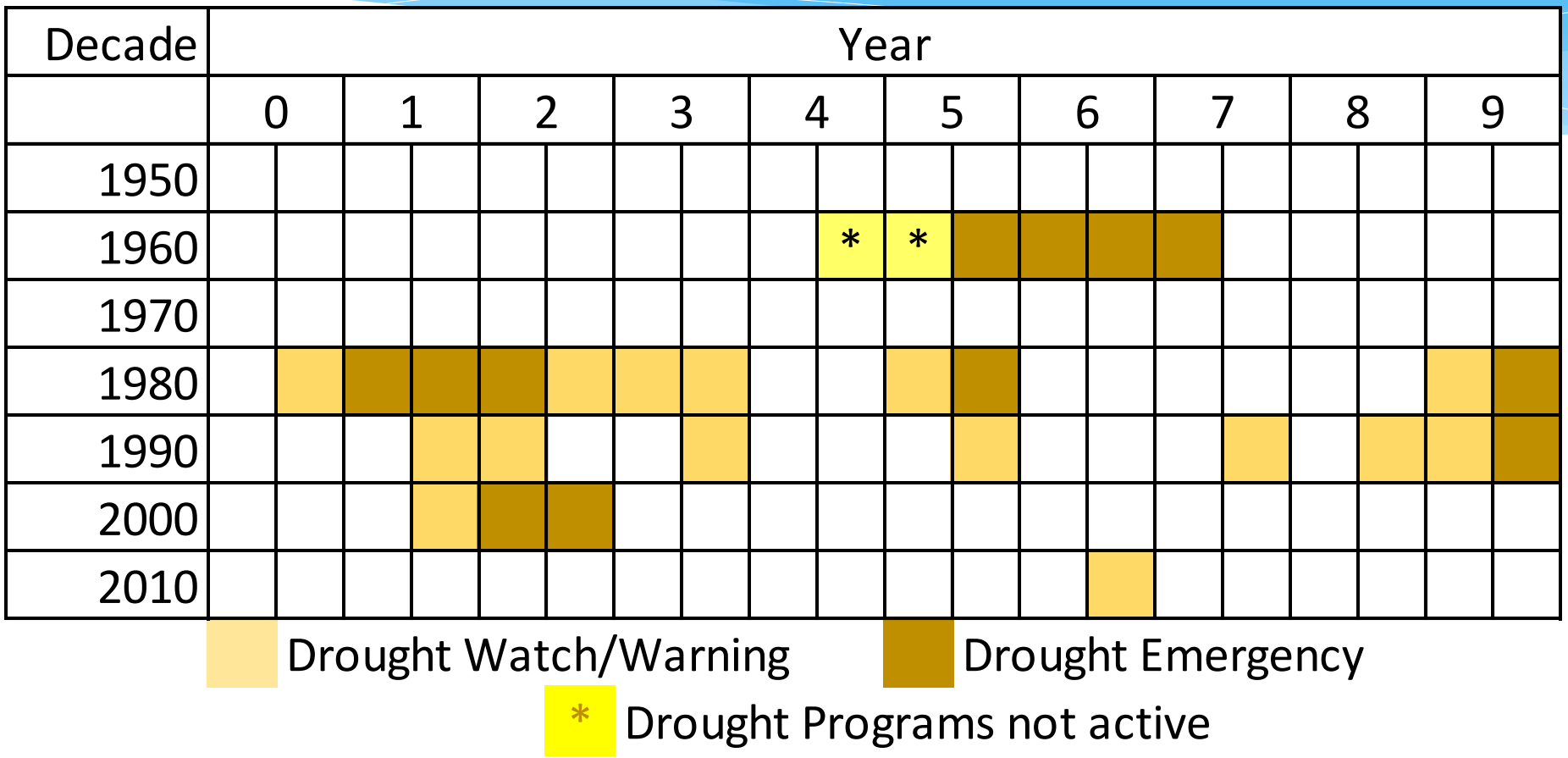
Basinwide Droughts



The Drought Management Program was not established until 1983. In the early 1980s, a provisional plan was used.

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Cannonsville Reservoir
December 2001
Photo: NYCDEP

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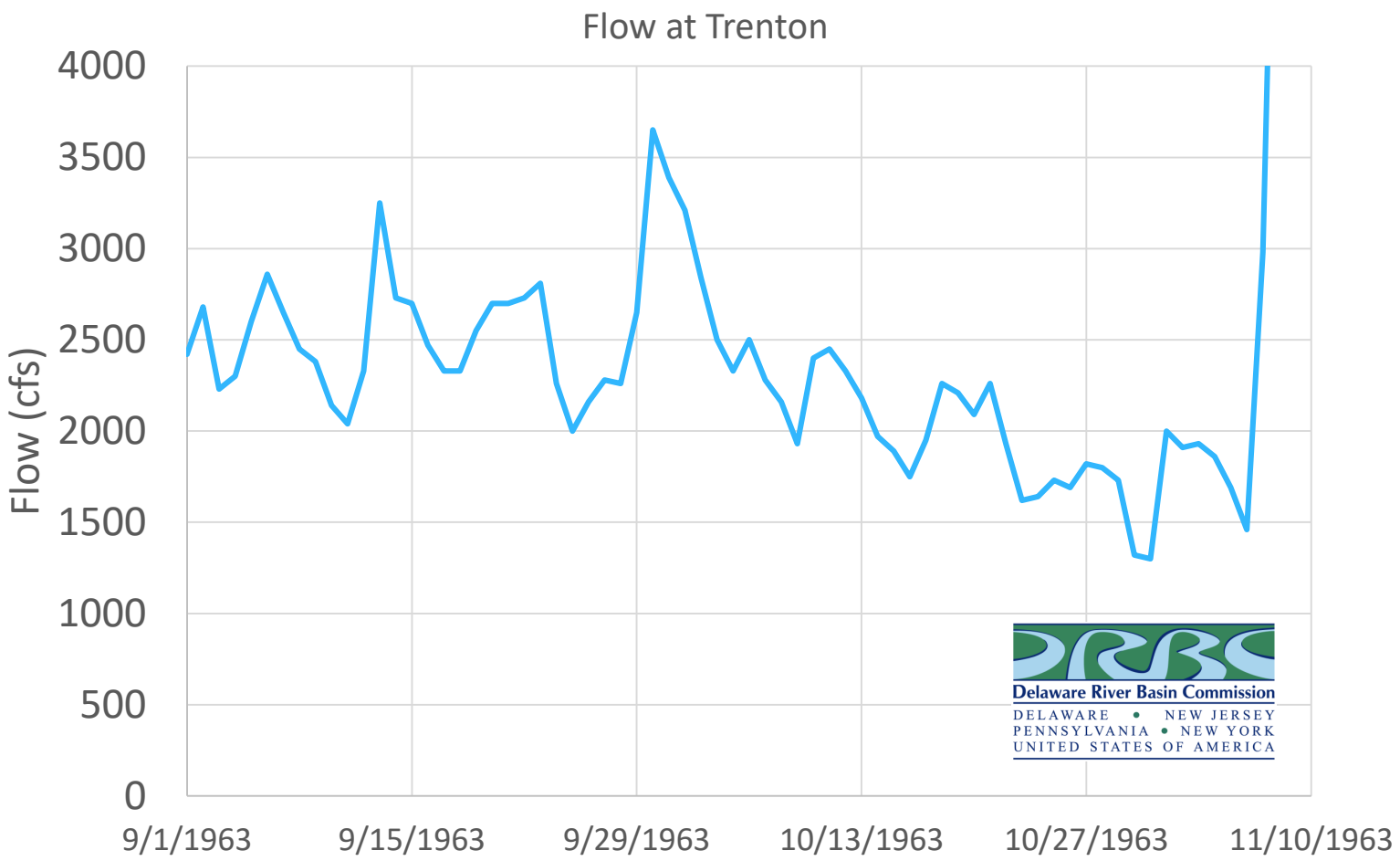
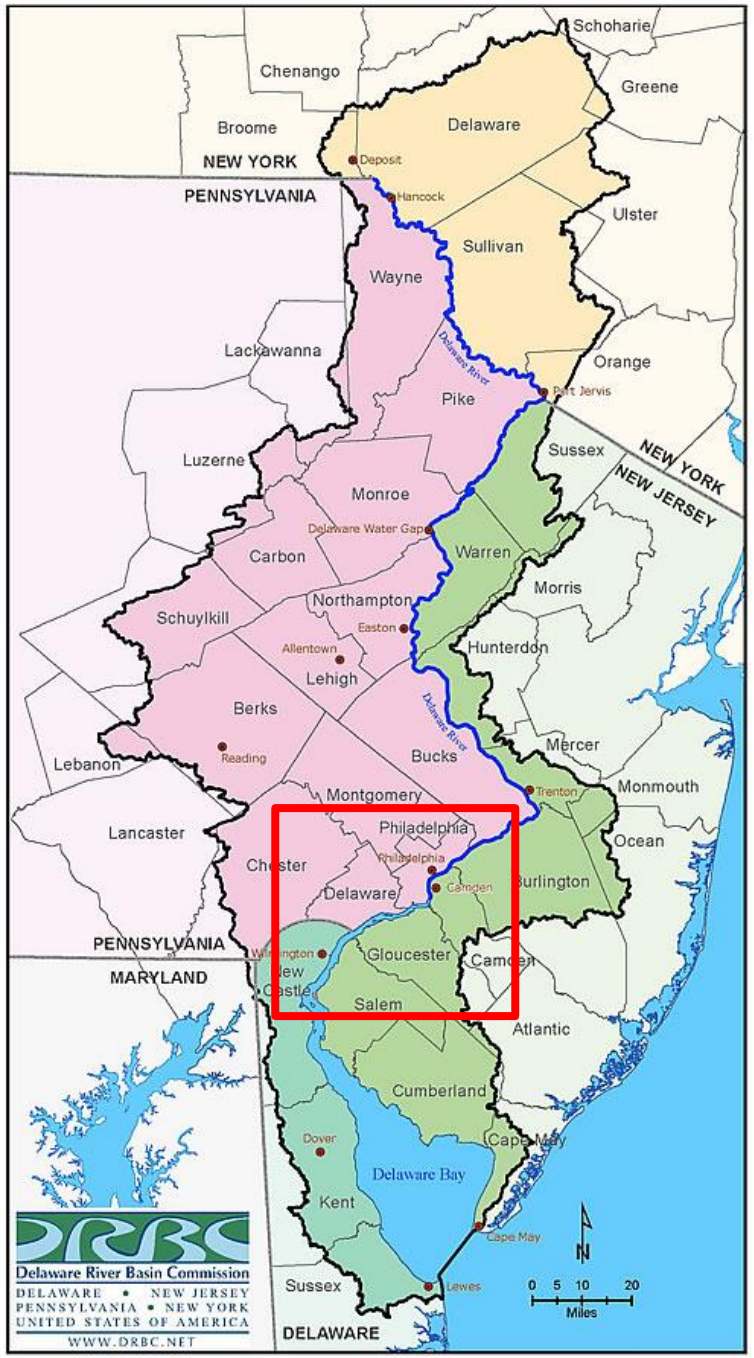
Drought of Record

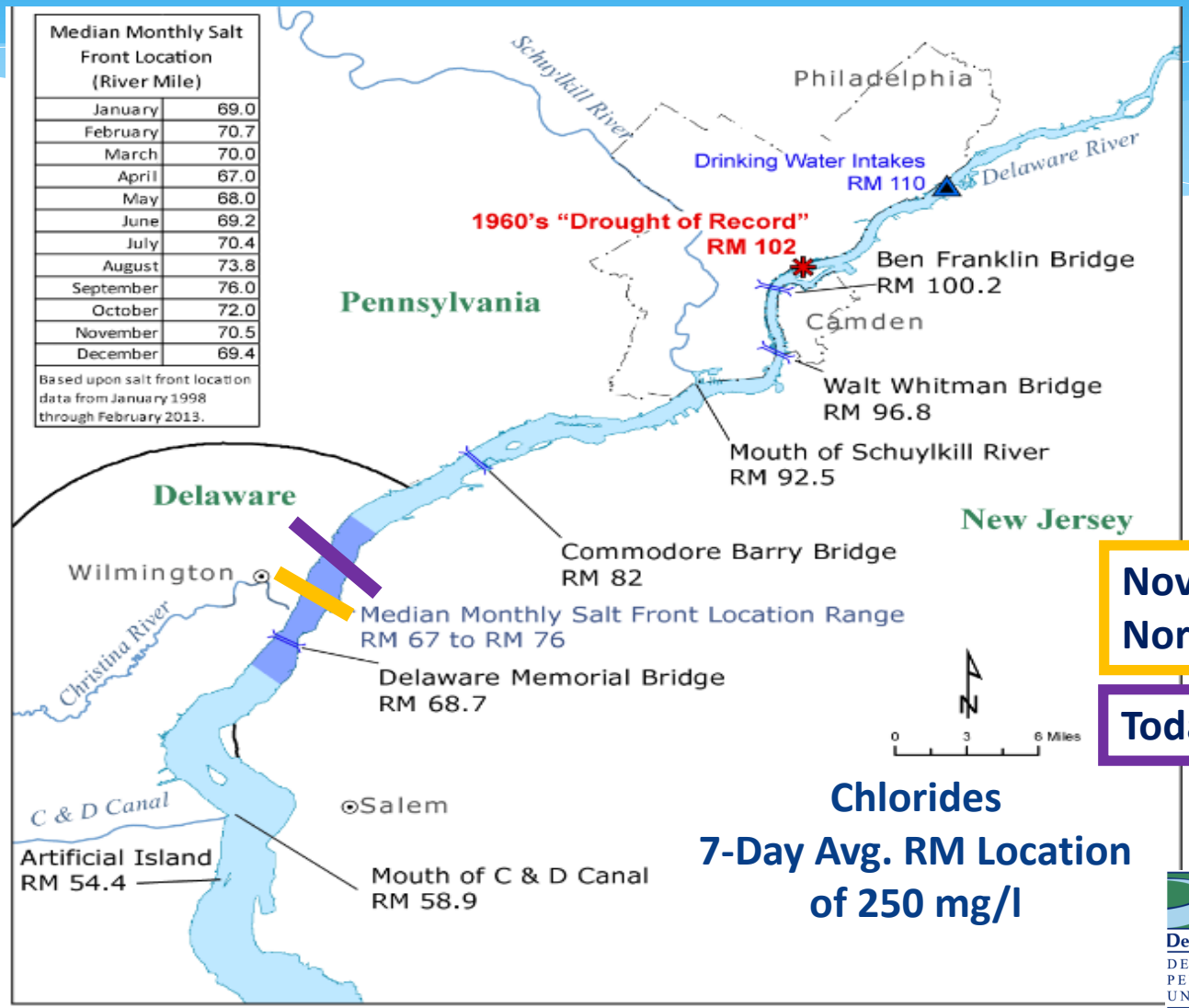


Salt Front



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.



November Normal R.M. 70

Today R.M. 72

Chlorides
7-Day Avg. RM Location of 250 mg/l

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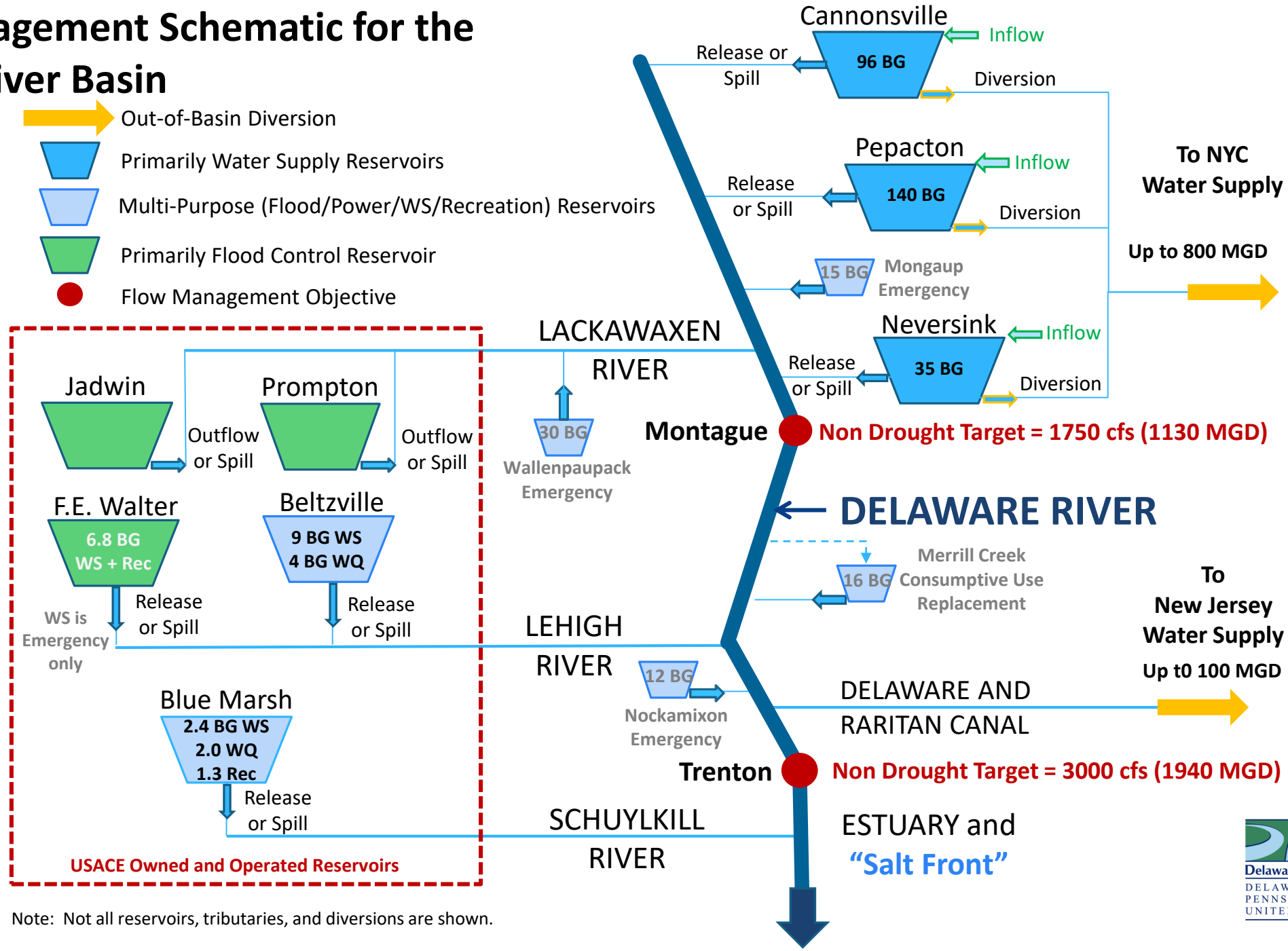
Sources of Water

- NYC Reservoirs - instream flow support - Montague)
- USACE Reservoirs (Flood and Recreation; DRBC - instream flow support – Trenton)
- Emergency (Private, PA)
- Consumptive Use Replacement (Thermoelectric)
- Dockets
- Others not shown

Flow at Montague and Trenton can be 60 percent or more from reservoir releases in dry periods

Water Management Schematic for the Delaware River Basin



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

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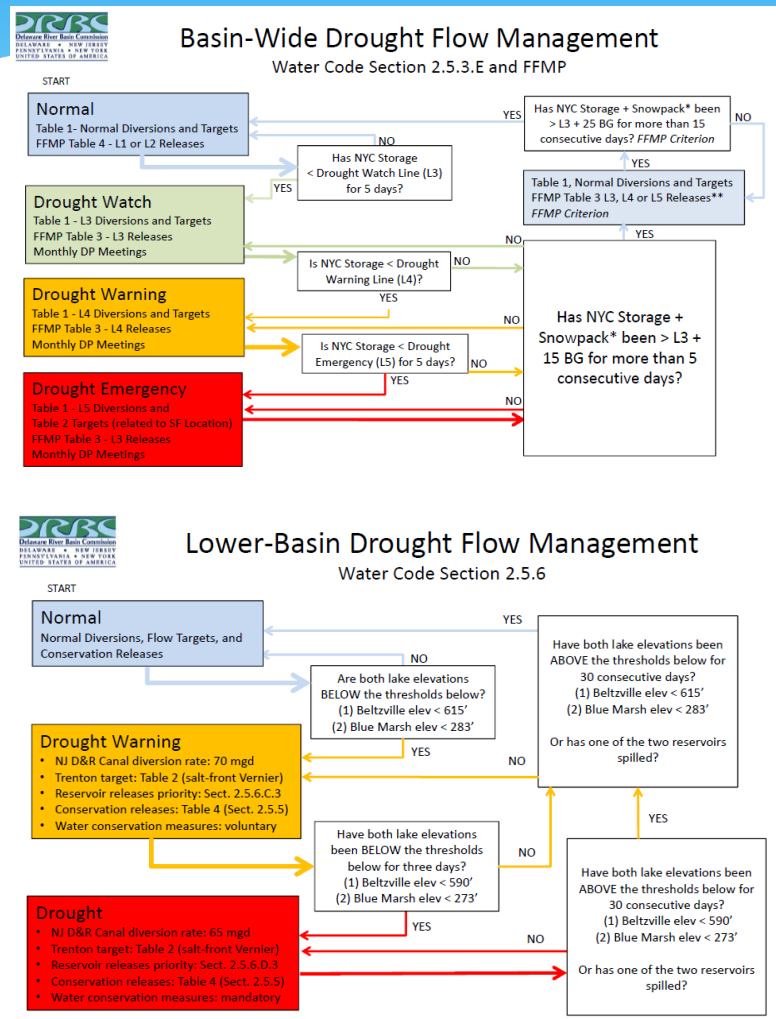
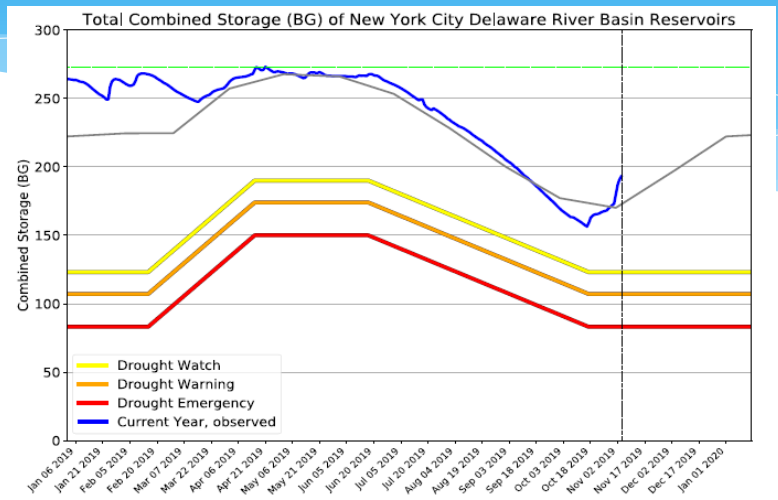
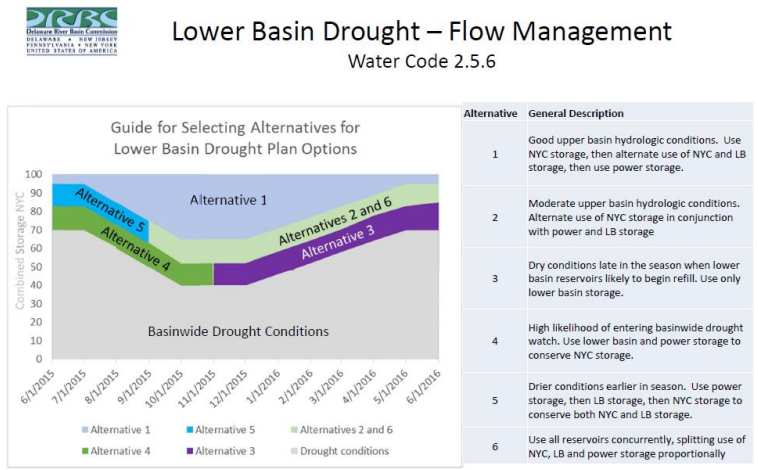
DRBC Drought Management Plans

Based on Storage and Salt Front Location







PHASED REDUCTIONS

Drought Status	Diversions NYC	Diversions NJ
Normal	800	100
Watch	680	100
Warning	560	90
Emergency	520	80

Drought Status	Flow Objectives Montague	Flow Objectives Trenton
Normal	1,750	3,000
Watch	1,650	2,700
Warning	1,550	2,700
Emergency	SF: 1,100 - 1,650	SF: 2,500 - 2,900

Basinwide plan is based on combined NYC storage. Lower Basin plan based on elevations in BZ and BM.

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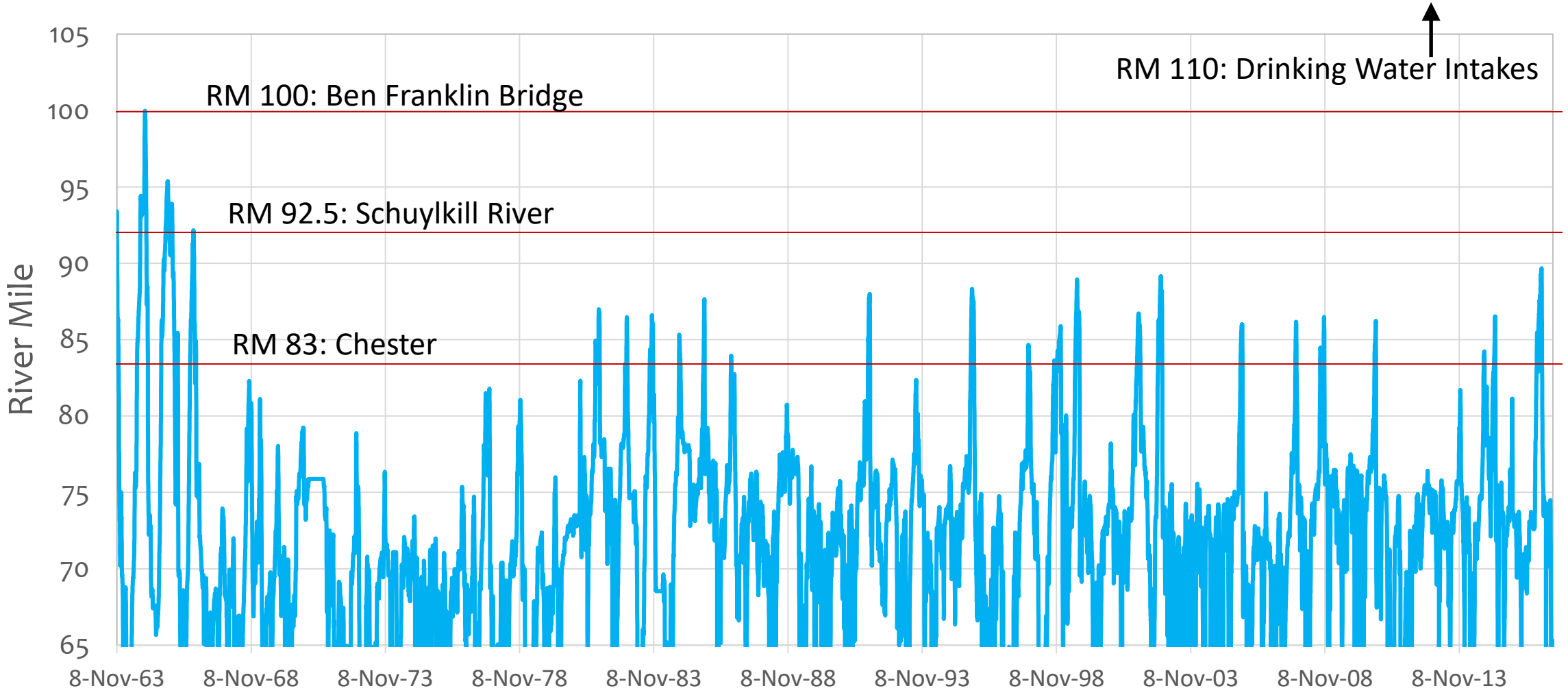
Salt Front River Mile Location 1963 - 2016
7-day average 250 mg/l isochlor

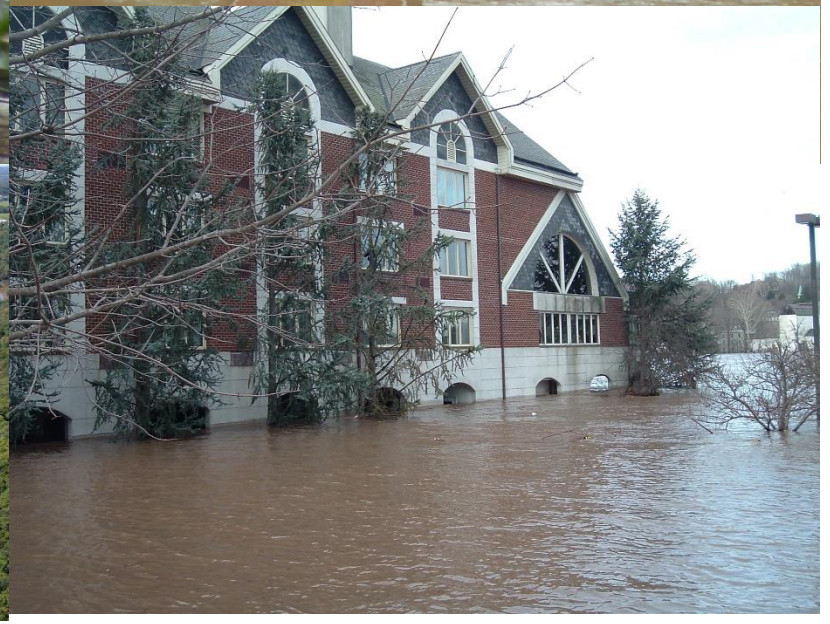


Future – Climate Change

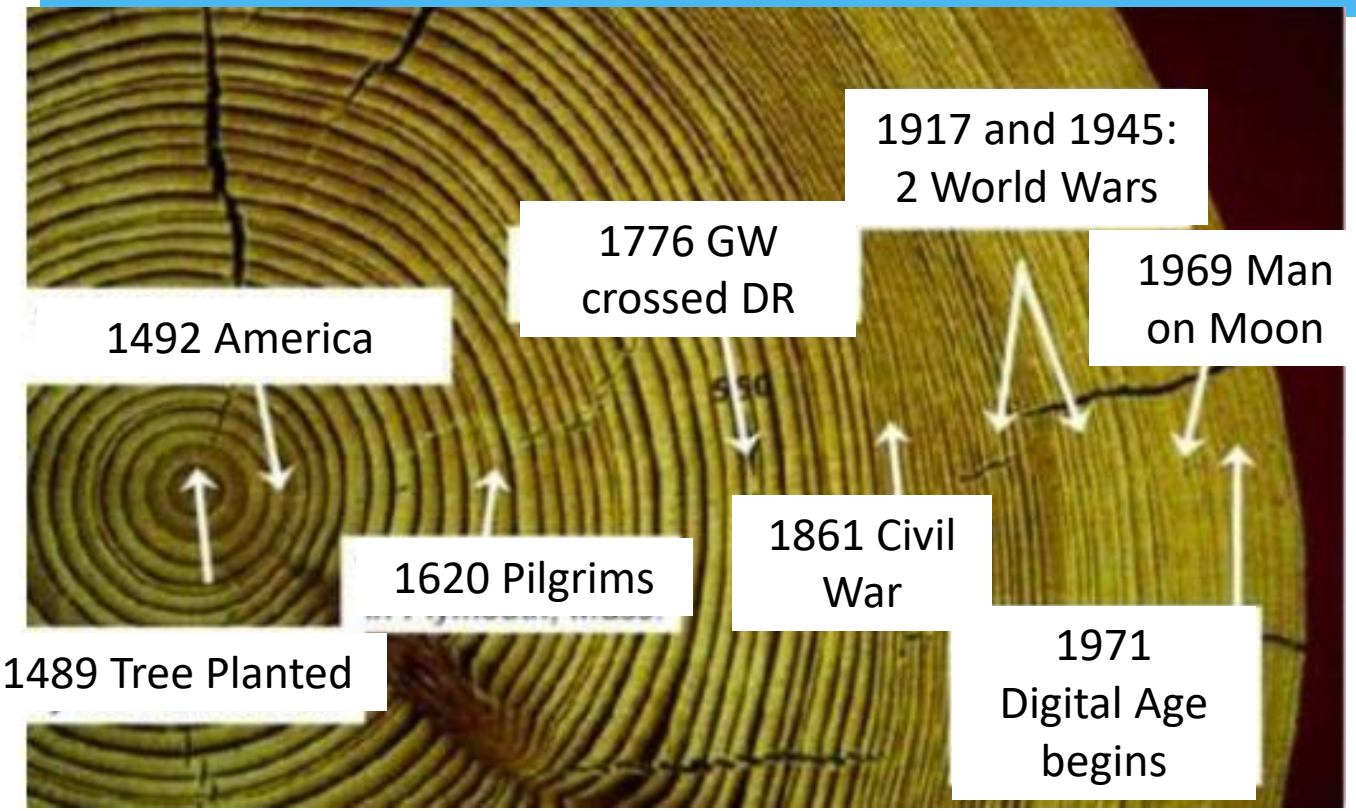

Photo: U.S. Army Corps of Engineers


Photo: NYCDEP


Photo: U.S. Army Corps of Engineers

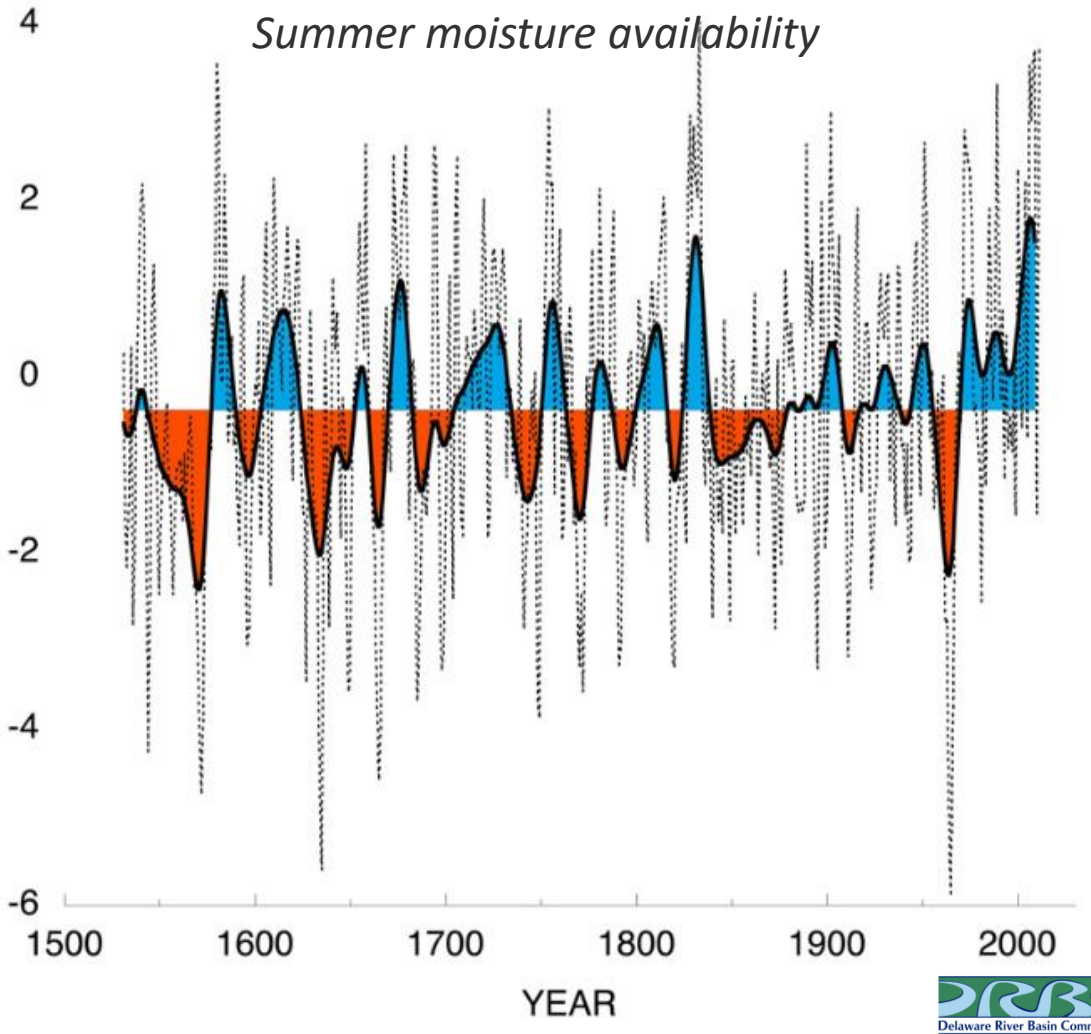


Have we seen the Drought of Record?



https://www.pinterest.com/pin/360780620131619426

Tree Rings can be used to estimate the amount of available water.



Pederson, et.al. Journal of Climate, Feb 2013

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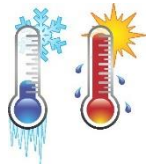
Models

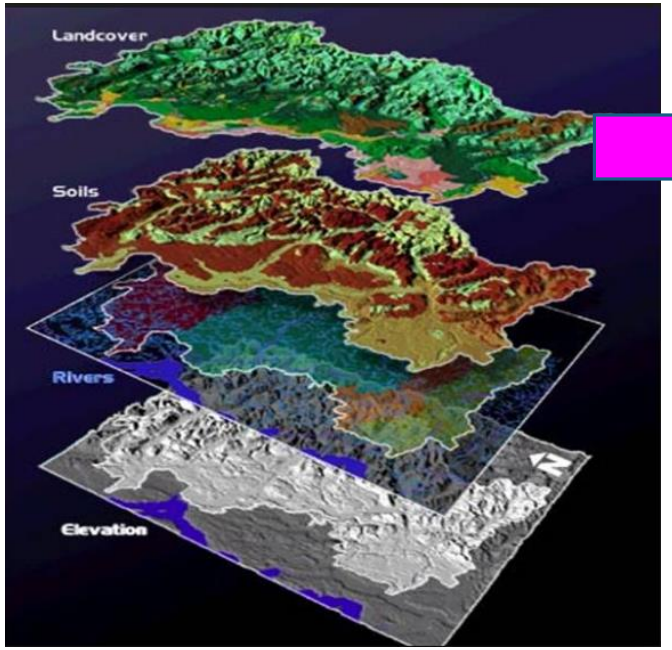
GCMs and RCPs

GFDL
GISS
NCAR
CanES

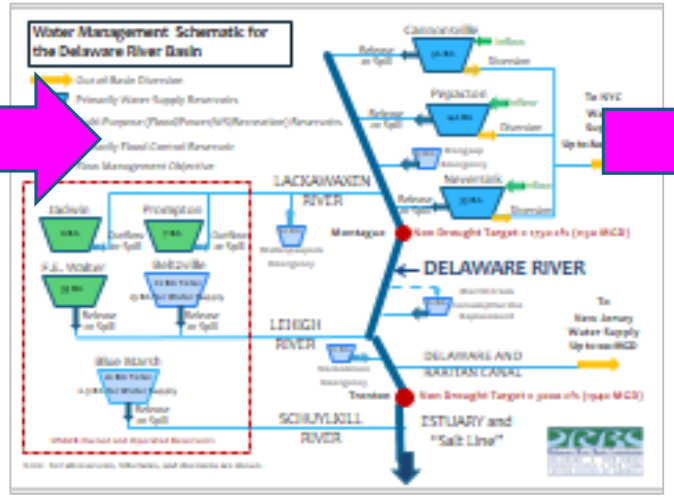


RCP2.6
RCP4.5
RCP6.0
RCP8.5

Hydrologic Model (WATER)

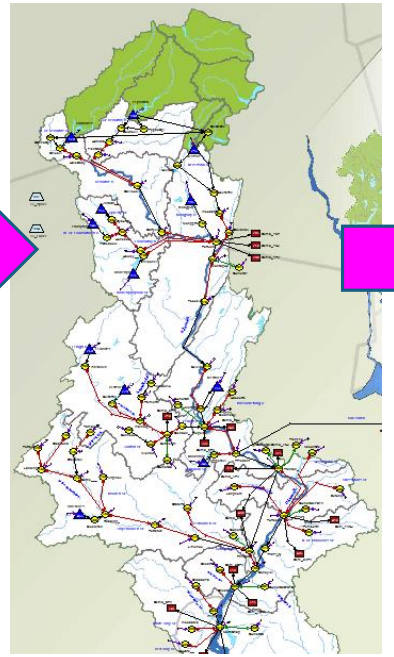


Flow Management Rules



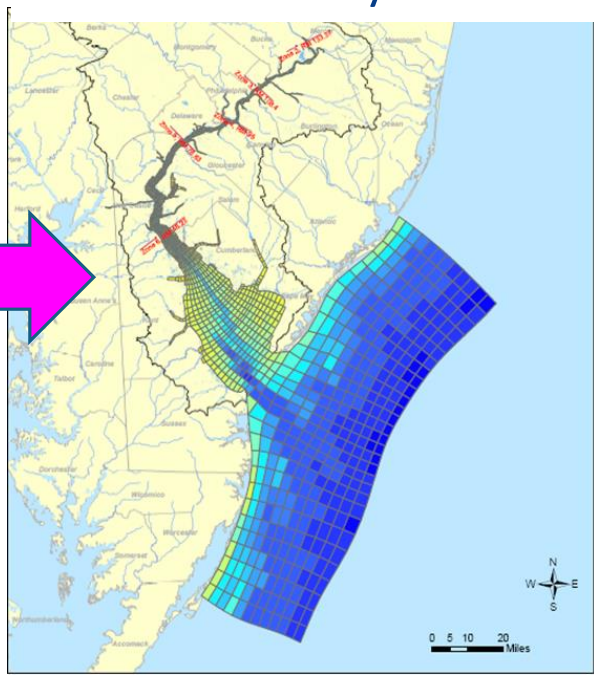
Water Code, FFMP, Dockets

Operations



DRB-Planning Support Tool

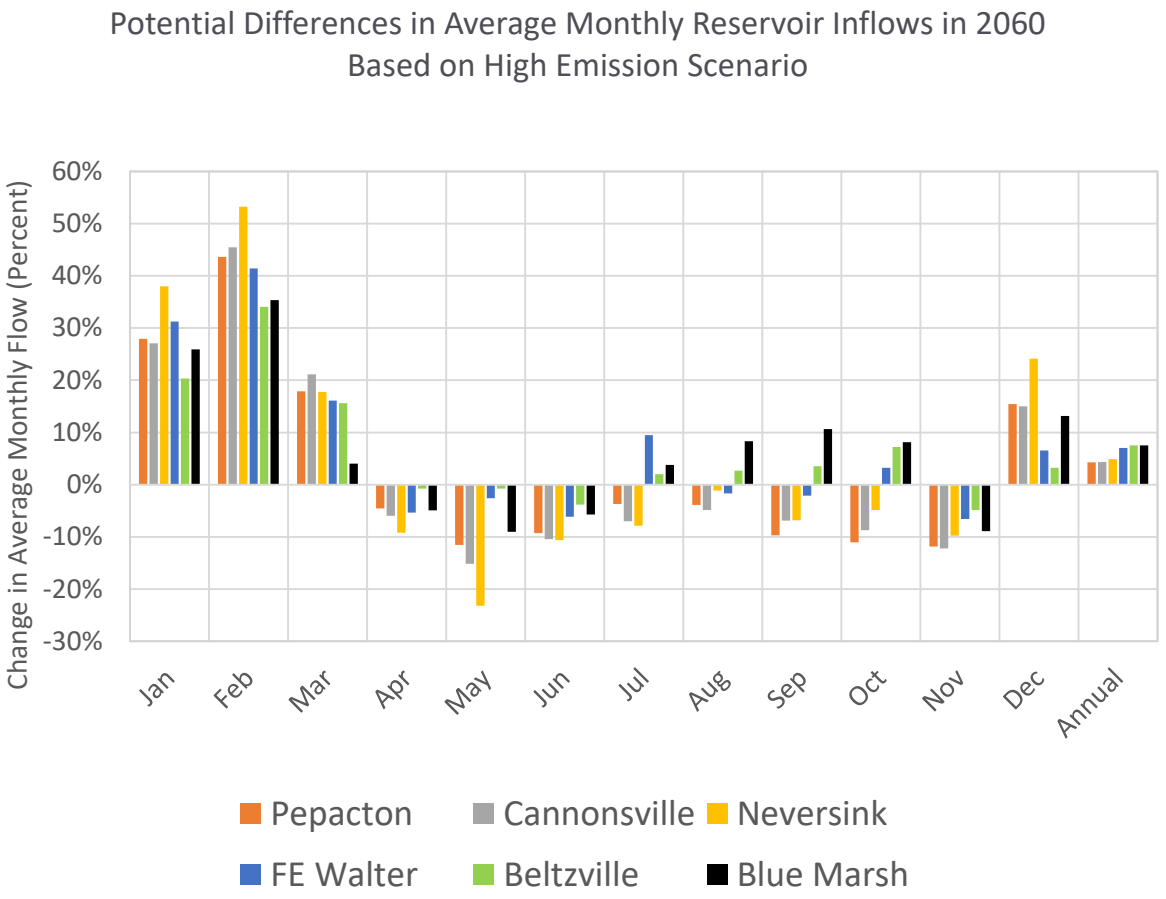
Salinity



EFDC – Designated Use

GCM: Global Circulation Model

Climate Change



- Flows modestly increase
- Seasonality changes
- Higher temps means less snow
- Less snow means less snowmelt
- Increased evapotranspiration offsets increased precipitation

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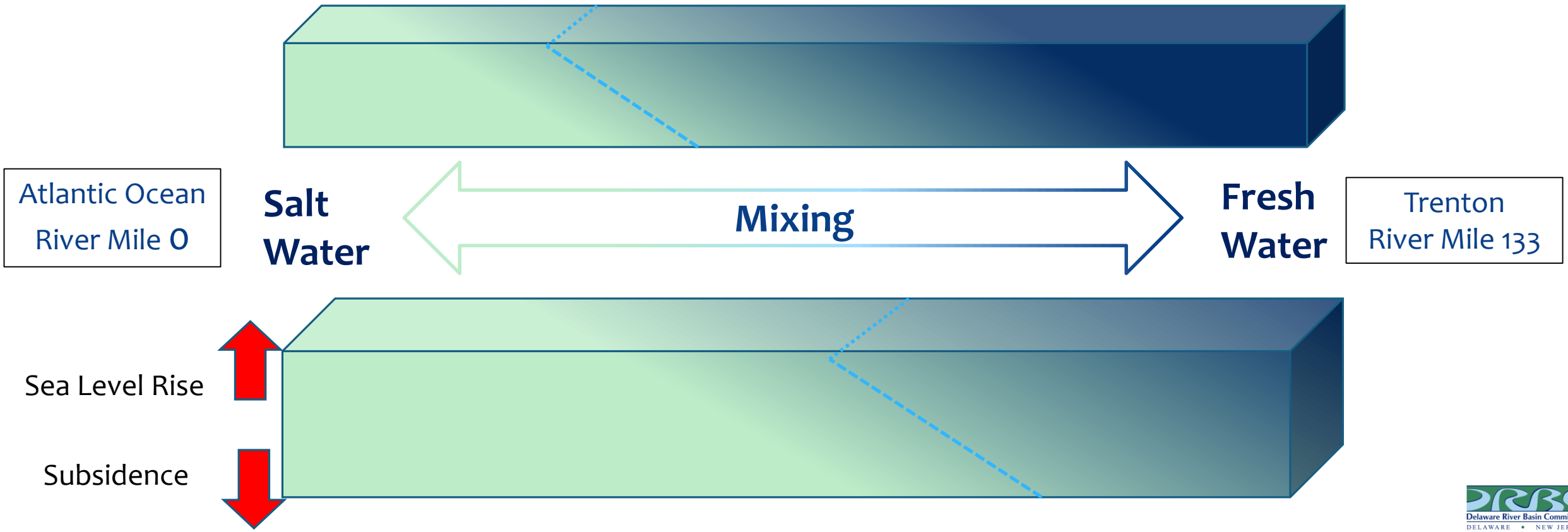
Sea Level Rise



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Possible Sea Level Rise Impacts on Salt Front

Median Monthly Salt Front Location (River Mile)	
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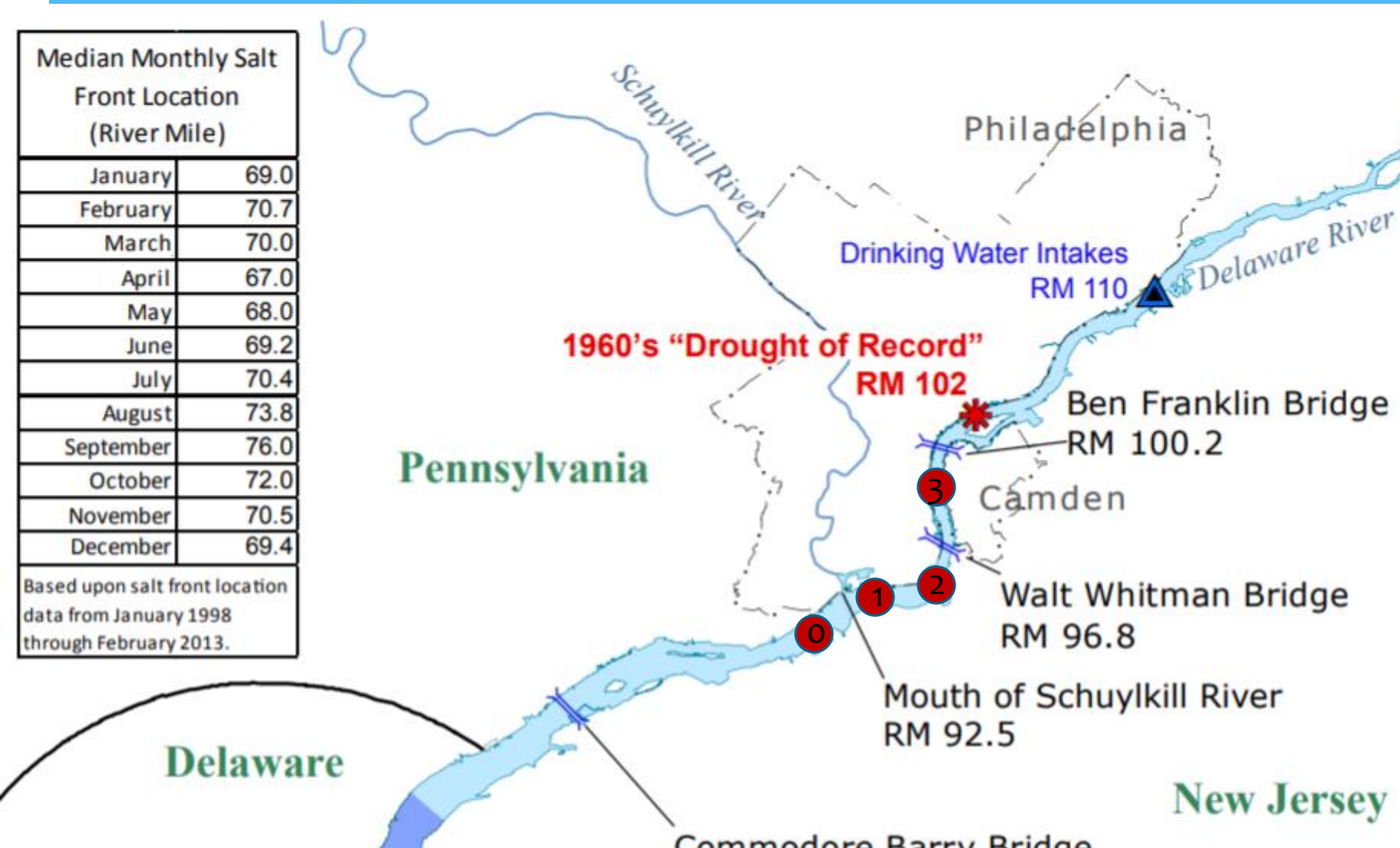

Sea Level Rise (ft)	River Mile
0	90
1	93
2	95
3	98

USACE Model Results 2010

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Summary - Hydrology

- Basin is vulnerable to floods and droughts
- Reservoirs were constructed on tributaries for flood damage reduction
- Extensive studies and analyses were conducted after the drought of record to build resiliency (salinity repulsion)
- DRBC implements both basinwide and lower basin drought management plans (as well as water conservation, allocations, water audits, etc.)
- Uncertainty about climate change related factors warrants a new assessment of basin resources and flow/drought management

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Go with the Flow

Photo: Tom Amidon

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Managing, Protecting and Improving the Basin's Water Resources since 1961

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