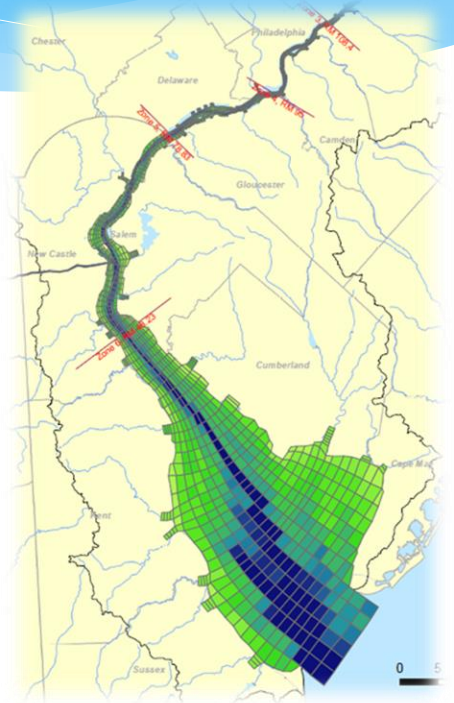
The Delaware River Basin Commission

Letting Science and Engineering Drive Water Resource Management

NJ-AWRA Annual Luncheon and Seminar

Duke Farms
Hillsborough, NJ
December 6, 2019

Photo courtesy of the U.S. Army Corps of Engineers



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Today's Water Resources Agenda

- DRBC
- Climate
- Delaware River Estuary Water Quality Improvements

Tow path at Lumberville, PA by Keith Balderston

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Science → **Policy** → **Outcomes**

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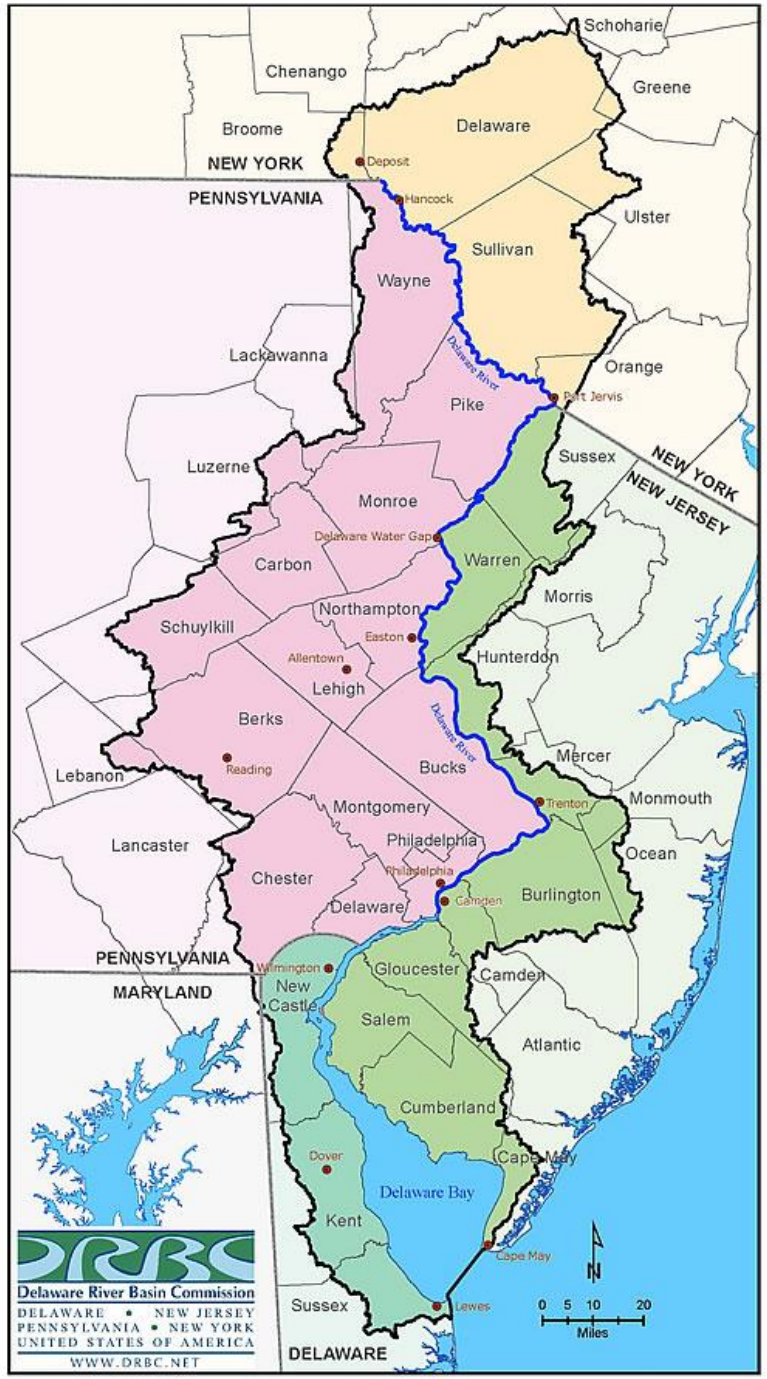

The Delaware River

- 330 miles long.
- Interstate boundary its entire length.
- Longest, un-dammed U.S. river east of the Mississippi (dams are located on tributaries, not the main stem Delaware).
- Tidal to Trenton, NJ.

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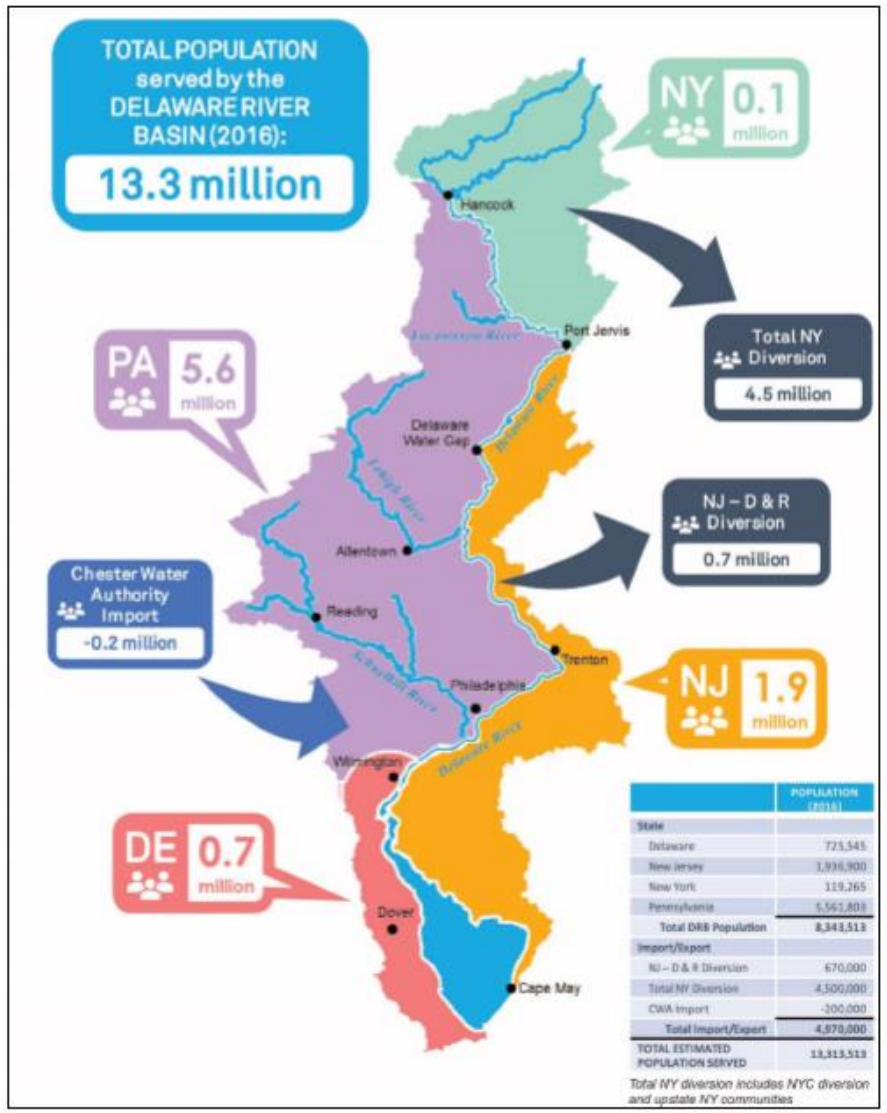
The Delaware River Basin



	POPULATION (2016)
State	
Delaware	725,545
New Jersey	1,930,900
New York	119,265
Pennsylvania	5,561,803
Total DRB Population	8,343,513
Import/Export	
NJ – D & R Diversion	670,000
Total NY Diversion	4,500,000
CWA Import	-200,000
Total Import/Export	4,970,000
TOTAL ESTIMATED POPULATION SERVED	13,313,513

- ~13 million people (about 5% of the U.S. population) rely on its waters
- Provides half the drinking water to NYC
- Drains 13,539 square miles of watershed in 4 states.
- 6.4 billion gallons are withdrawn every day
- Contributes over $21B in economic value

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Delaware River Basin Commission

- Five Equal Members:
  - Delaware 
  - New Jersey 
  - Pennsylvania 
  - New York 
  - Federal Government   

- Four Governors **are** the Commissioners
- Commissioner may select alternates
- Federal Commissioner is Commanding General, USACE, NAD
- Majority rules in most voting
- Meets quarterly

Note: New York City and Philadelphia are “advisors” and not members

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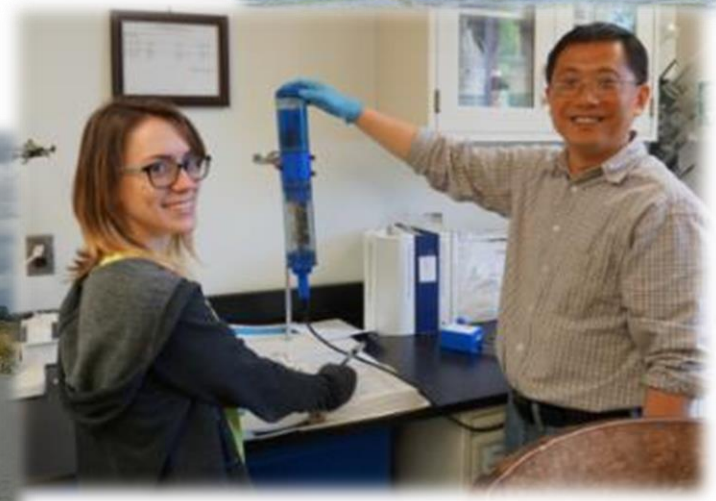
DRBC Staff and Budget

- Professional Planners, Engineers and Scientists
- 39 Budgeted Staff (12% Vacancy Rate)
- FY2020 Budget = $6.8 million
- Funding from “Signatory Members” = $1.7 M (27%)
- Located in West Trenton, NJ since 1974



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Delaware River Basin Compact

- Recognizes DRB as a regional asset with local, state and national interests
- Management and control of water resources under a **Comprehensive Plan** will bring benefits and is in the public welfare.
- The Commission shall develop and effectuate **plans, policies and projects** relating to the water resources of the Basin

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DRB Compact Basic "Charges" From the Preamble

A **Comprehensive Plan** administered by a basin wide agency will provide:

- **flood damage** reduction;
- conservation and **development of ground and surface water supply**…;
- development of **recreational facilities**;
- **propagation of fish and game**;
- promotion of related…**watershed projects**;
- **protection to fisheries**…;
- development of **hydroelectric power**;
- **control of movement salt water**;
- **abatement and control of stream pollution**;
- **and regulation towards the attainment of these goals.**

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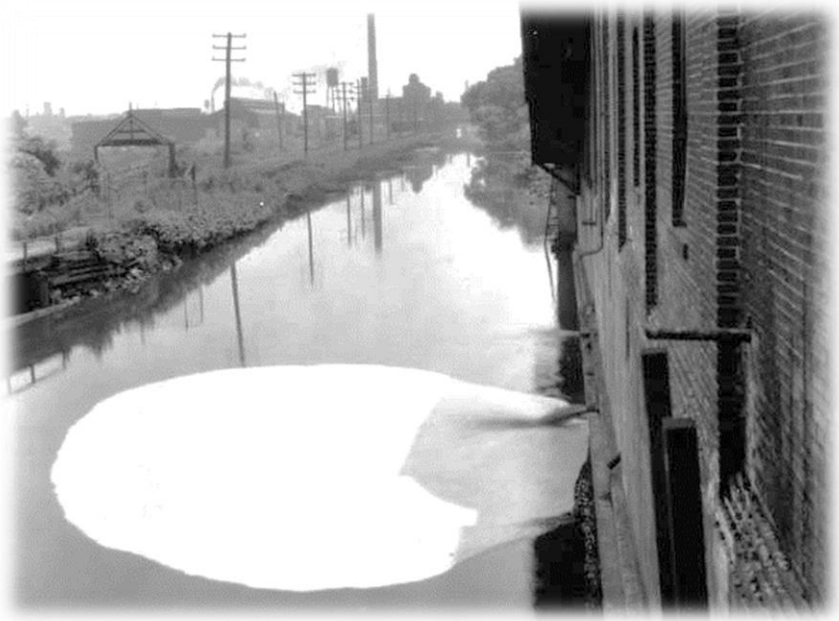
DRBC Water Resource Management Programs

Planning	Operations	Regulation	Science
Sustainable Water Availability	Flow / reservoir management	Water withdrawals	Water quality Assessments
Future water use	Drought management	Wastewater discharges	Water quality Monitoring
Consumptive water use	Salinity control	Special protection waters	Emerging contaminants
Water efficiency	Decree parties	Groundwater special protection	Toxic pollutants
Water audits	Hydrologic models	Water quality standards - Interstate Waters	Fish consumption
Climate Change	Water charges	Flood protection	Reduction of legacy pollutants - PCBs

State of the Basin…Then



Slaughterhouses discharging in 1928
(courtesy of the Phila. Water Dept. Historic Collection)

Delaware River at Trenton in 1965
(DRBC photo)

Fish kill on the Delaware from oil spill in 1929
(courtesy of Temple University Archives)

The Delaware River Today

Photo: Greg Breese, USFWS

Photo: Justin Curtis

Photo: Delaware River Sojourn

Photo: https://camdenwd.weebly.com/

DRBC Core Responsibilities

- **FLOW** - An adequate and sustainable supply of water.
- **QUALITY** - Clean and heathy water resources.

View from Bowman's Hill Tower by Linda Park

Partnering to achieve for the Basin what individual members could not accomplish alone.

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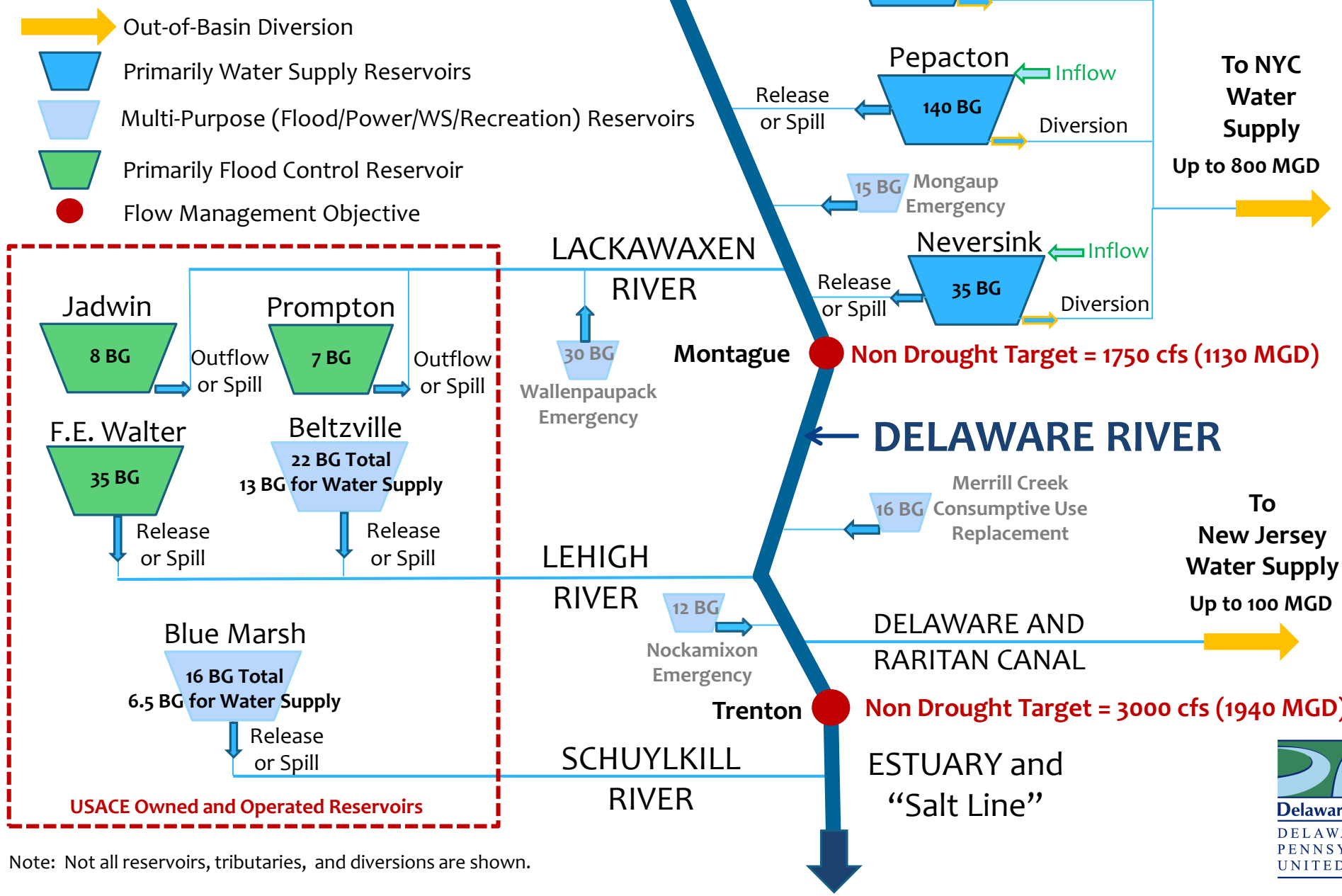
Photo: Nicholas A. Tonelli

Water Management Schematic for the Delaware River Basin



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

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Climate Change

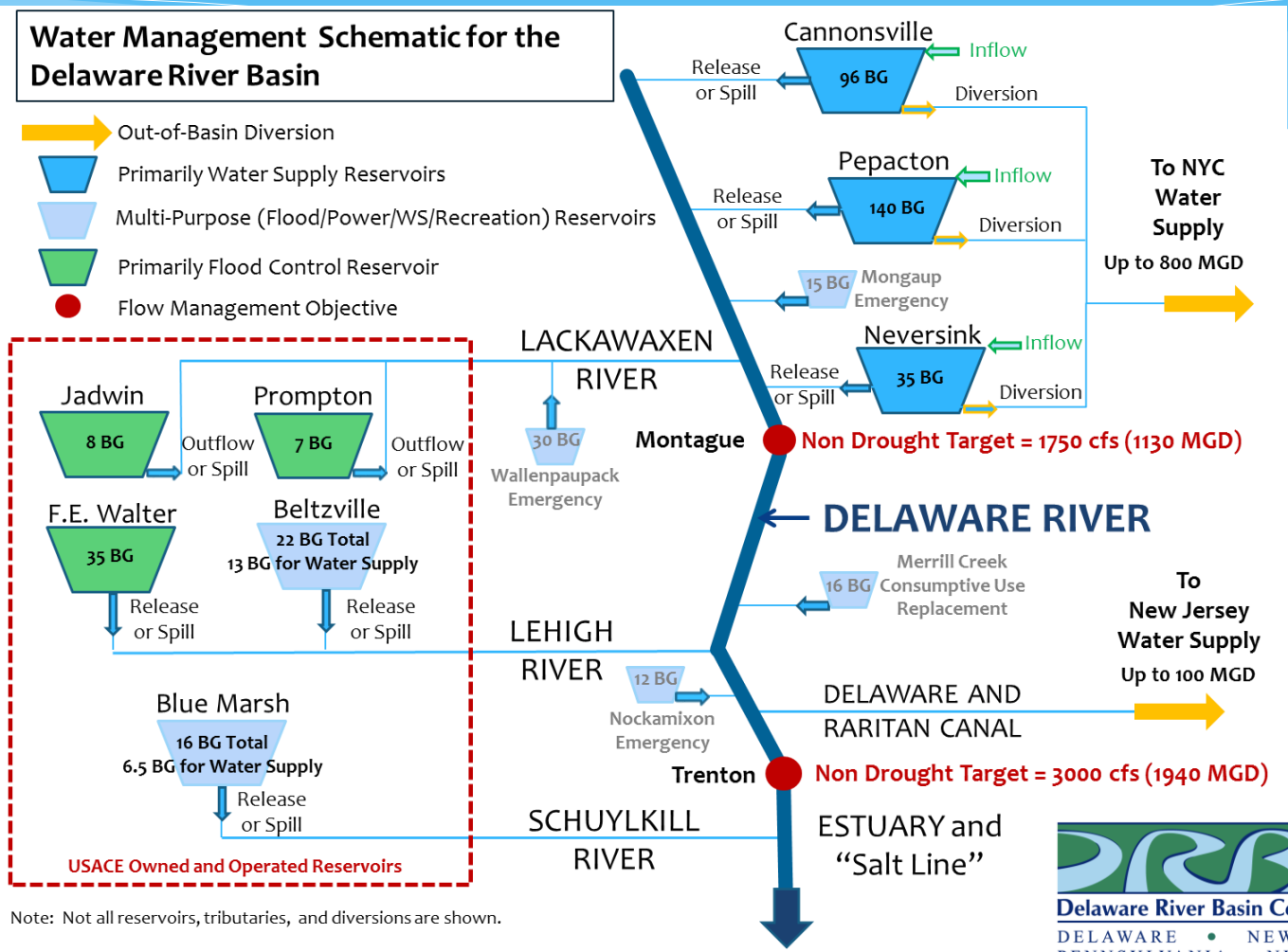
RUTGERS
Climate Institute

- More warm extremes and fewer cold extremes
- Heavy rains become more intense
- More frequent dry spells
- Rising sea level with increased frequency and intensity of coastal flooding

*From RCI Co-Director **Tony Broccoli** featured at September 27, 2017 statewide conference Climate Change Policy in New Jersey: Advancing Opportunities to make New Jersey Safer, Greener, Healthier and More Prosperous , sponsored by the New Jersey Climate Adaptation Alliance.*

Planning Questions - Water Availability

- Adequacy of available storage?
- Adequacy of emergency storage?
- Number of "drought days"?
- Adequacy of flow objectives to control salinity in the Estuary?



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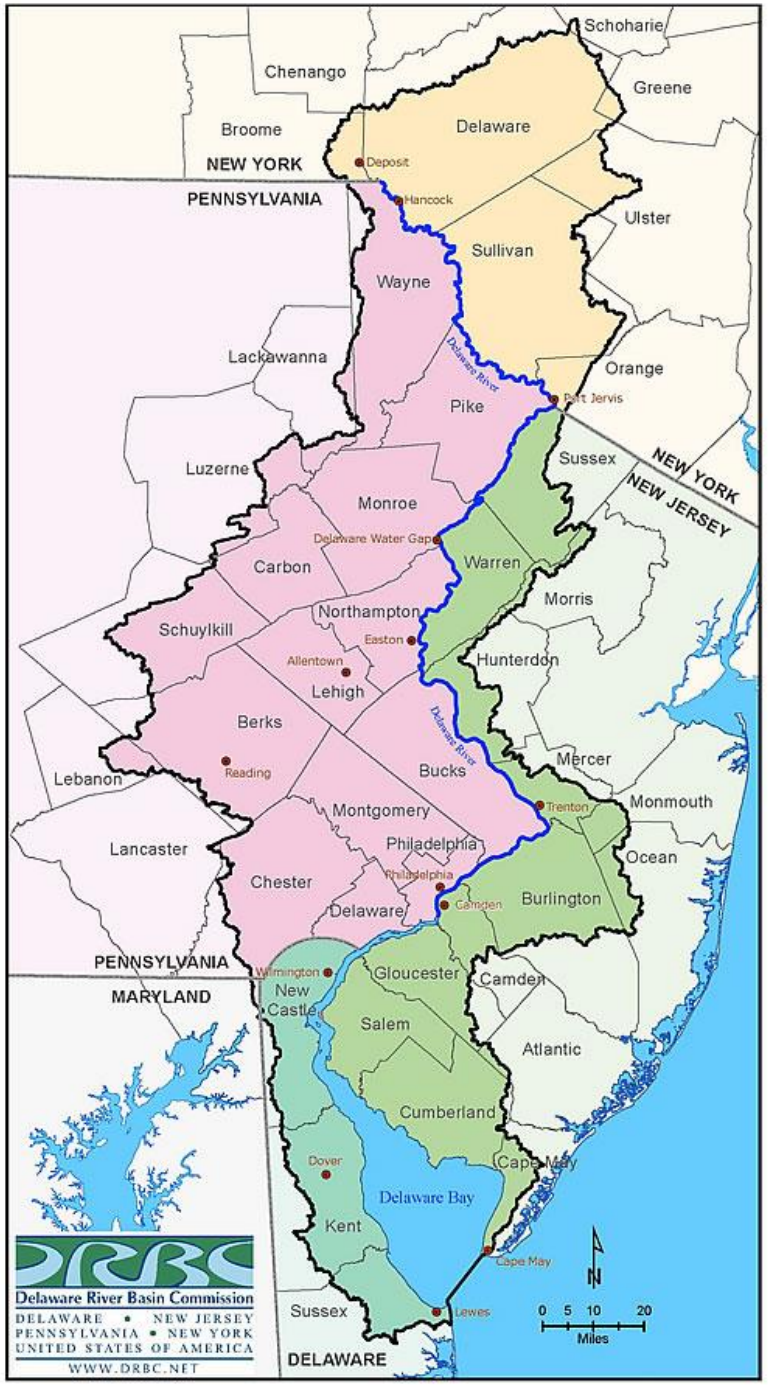

Freshwater Hydrologic Climate Considerations:

- Precipitation
  - Flow
- Temperature
  - Evapotranspiration
  - Snowpack

Salt Water Climate Considerations:

- Sea Level Rise
- There is no dam on the Delaware River

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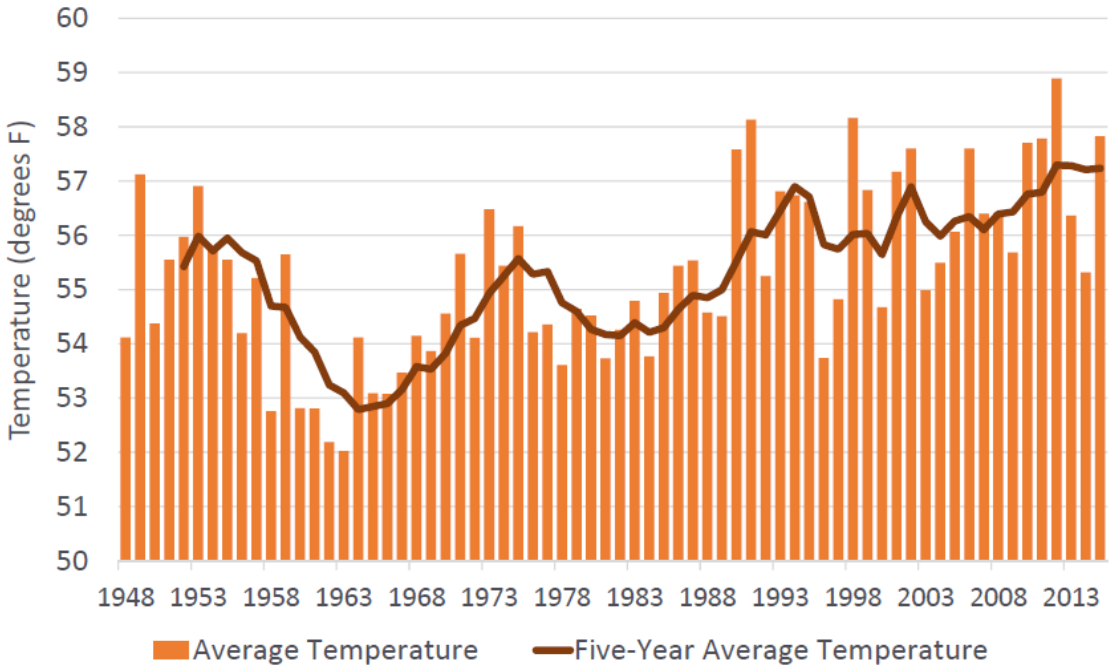
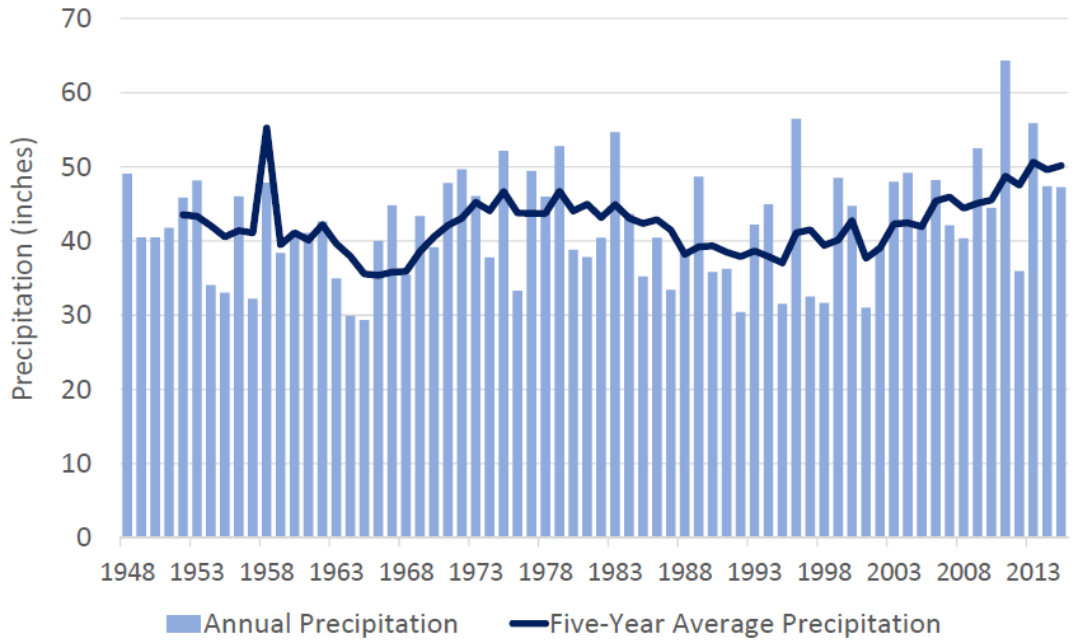
Trends in Temperature and Precipitation (since 1948)

Temperature



Precipitation



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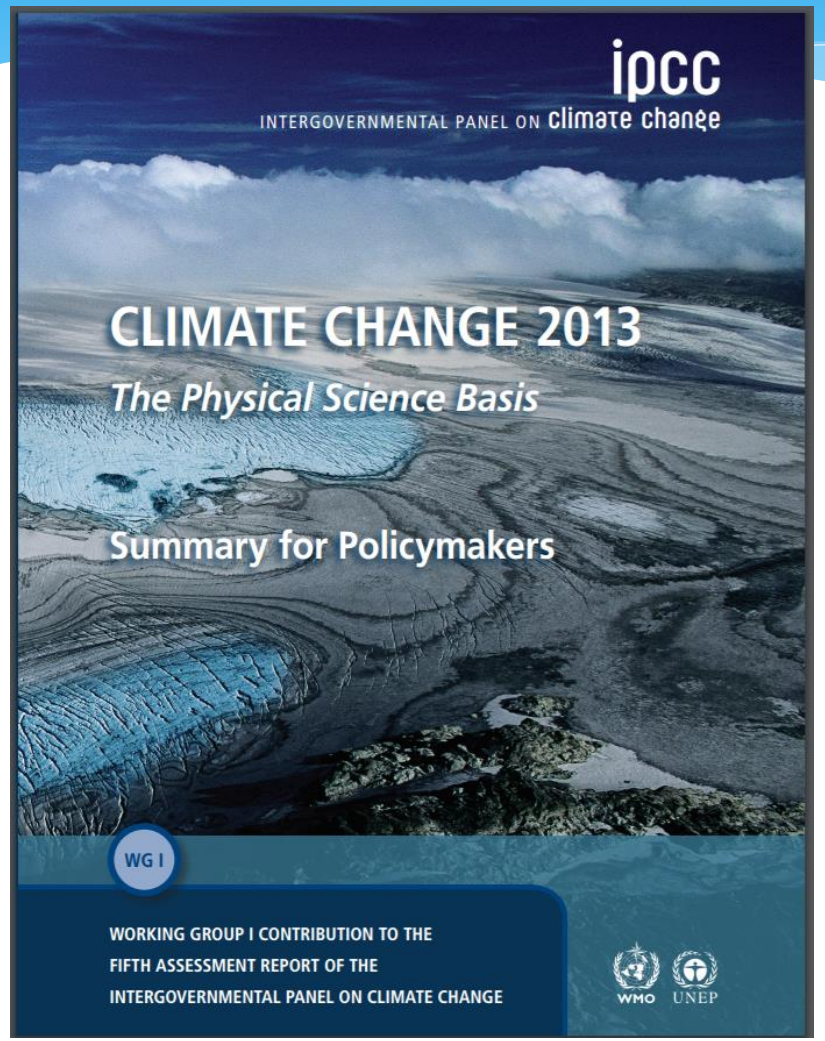
IPCC 2013 Summary for Policymakers



Water Cycle:

"Changes in the global water cycle in response to the warming over the 21st century will not be uniform. The **contrast in precipitation** between wet and dry regions and **between wet and dry seasons will increase, although there may be regional exceptions."**

IPCC = Intergovernmental Panel on Climate Change

Climate Scenarios
Temperature and Precipitation

IPCC Emissions
- RCP 2.6
- RCP 4.5
- RCP 6.0
- RCP 8.5

USGS Hydrology
- Precipitation
- Temperature
- Land Use
- Runoff

DRBC Modeling
- Future Water Demands
- Water Availability
- Drought Resiliency

IPCC = Intergovernmental Panel on Climate Change

RCP = Representative Concentration Pathways
(Carbon Dioxide Emissions)

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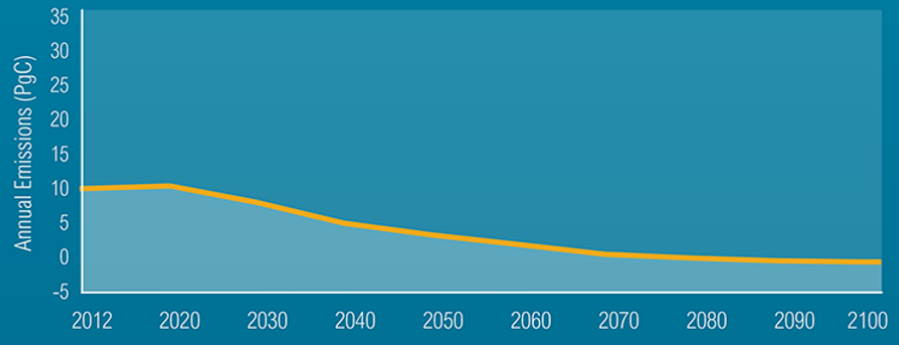
Representative Concentration Pathways (RCPs)

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

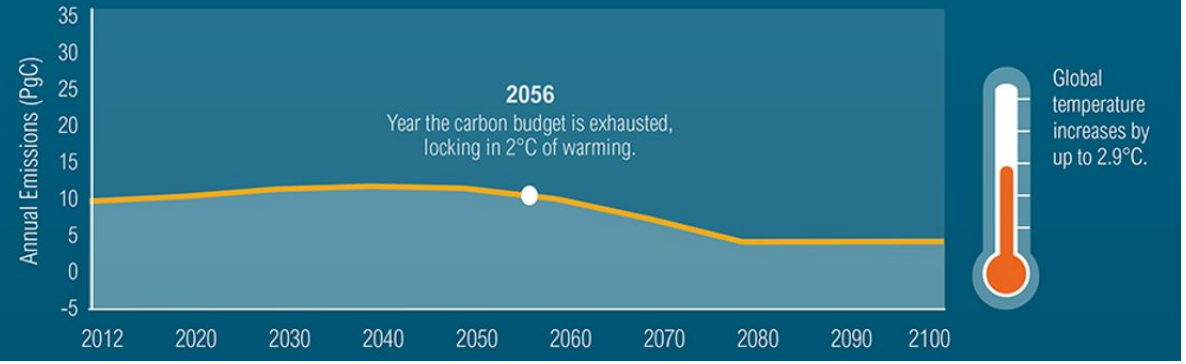
LOW EMISSIONS PATHWAY RCP 2.6

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.



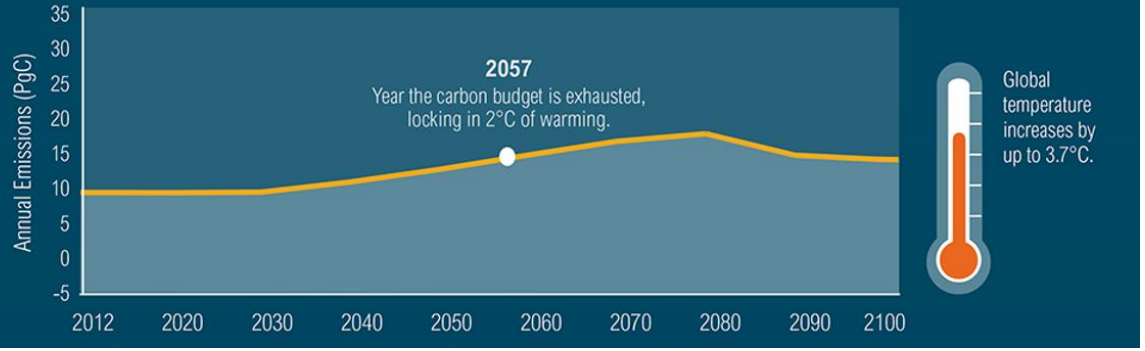
MEDIUM EMISSIONS PATHWAY RCP 4.5

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



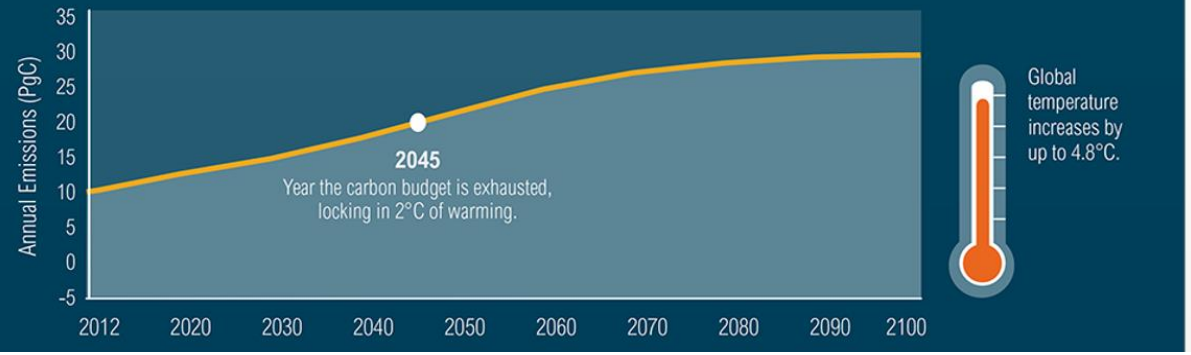
HIGH EMISSIONS PATHWAY RCP 6.0

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.



Models

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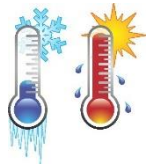
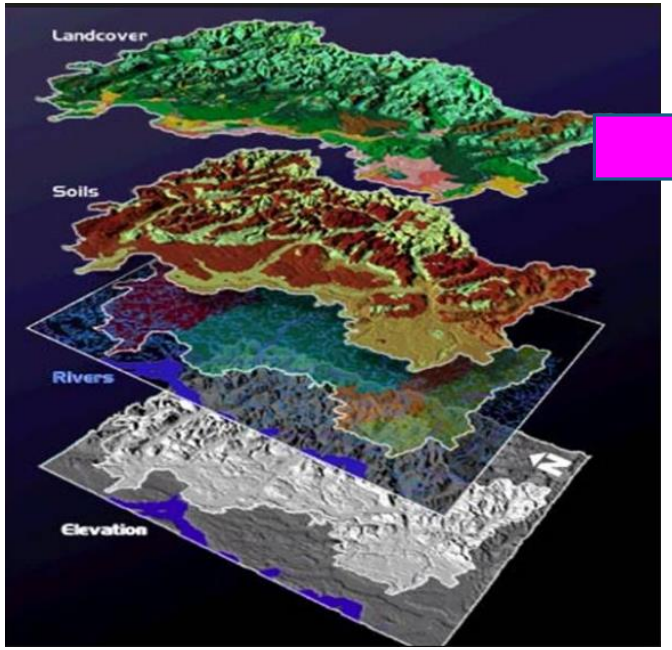
GCMs and RCPs

GFDL
GISS
NCAR
CanES

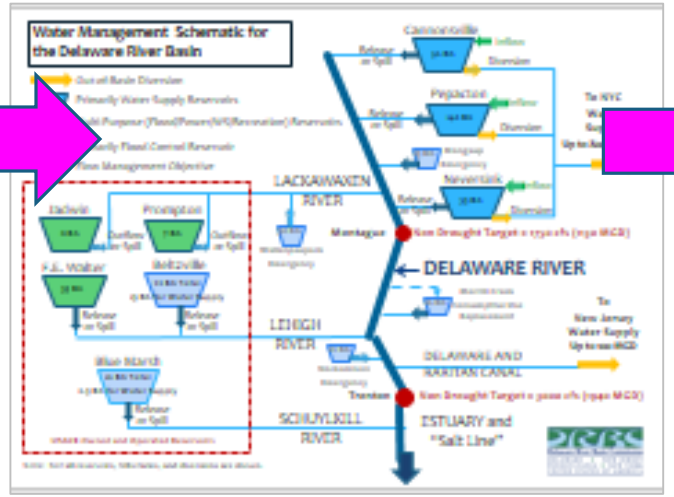


RCP2.6
RCP4.5
RCP6.0
RCP8.5

Hydrologic Model (WATER)

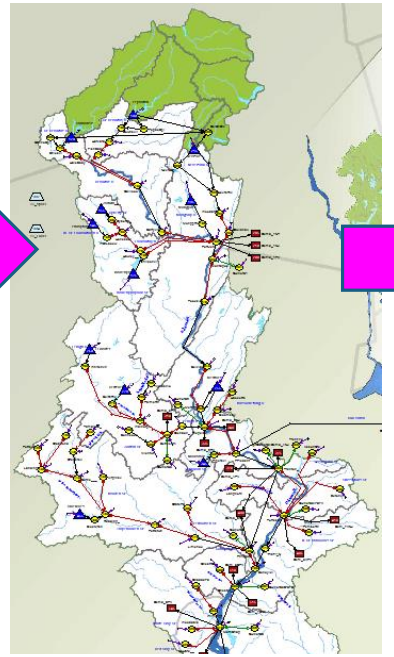


Flow Management Rules



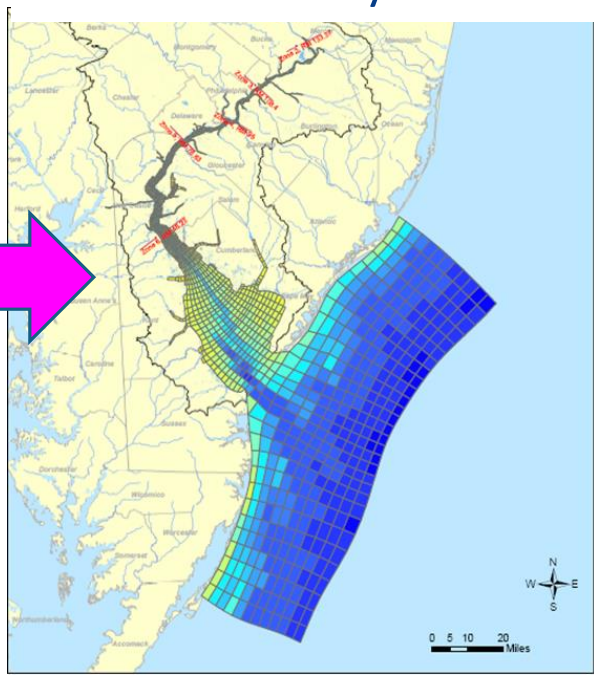
Water Code, FFMP, Dockets

Operations



DRB-Planning Support Tool

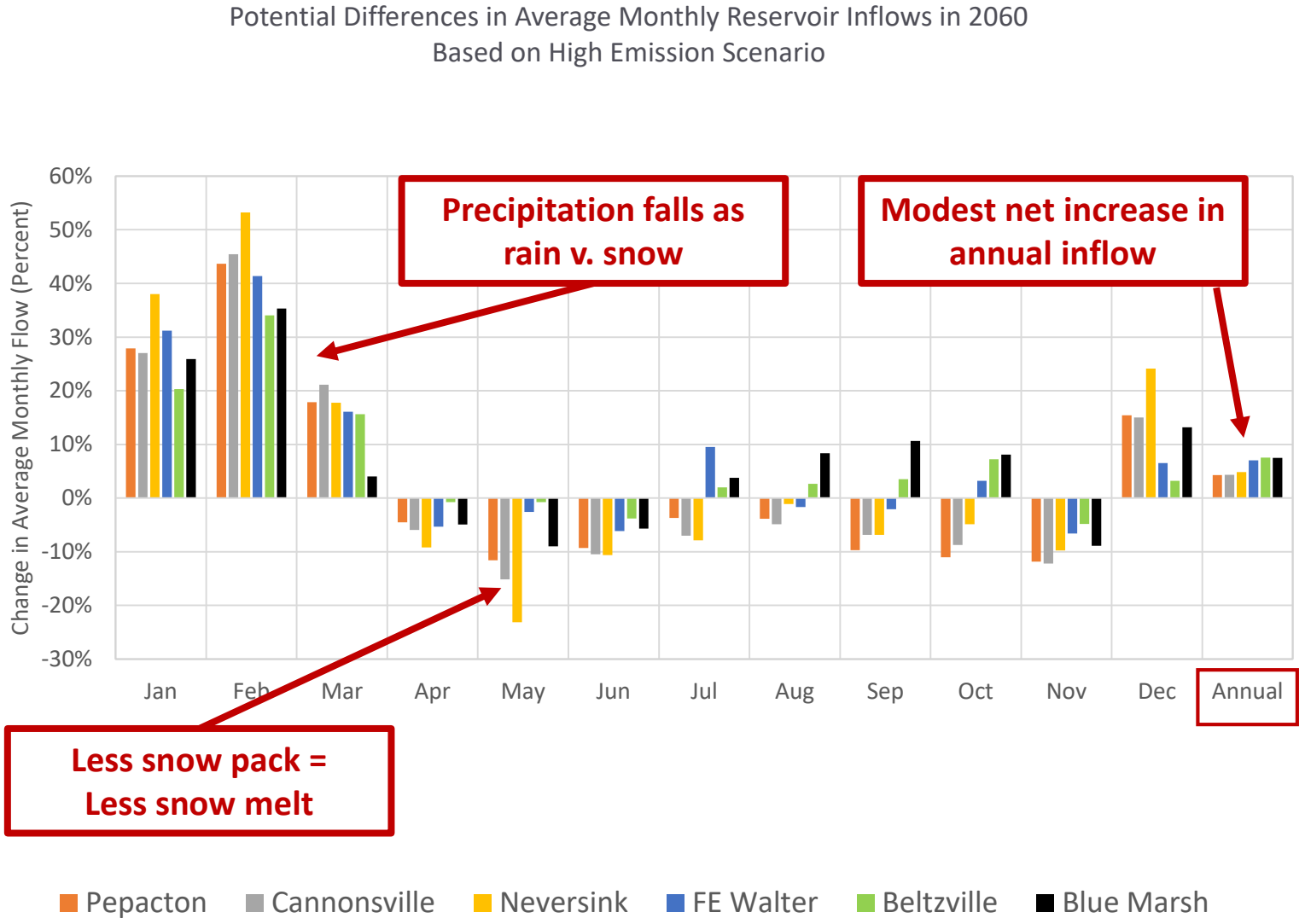
Salinity



EFDC – Designated Use

GCM: Global Circulation Model

Climate Change – Inflows to Reservoirs 2060 / High Emissions



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

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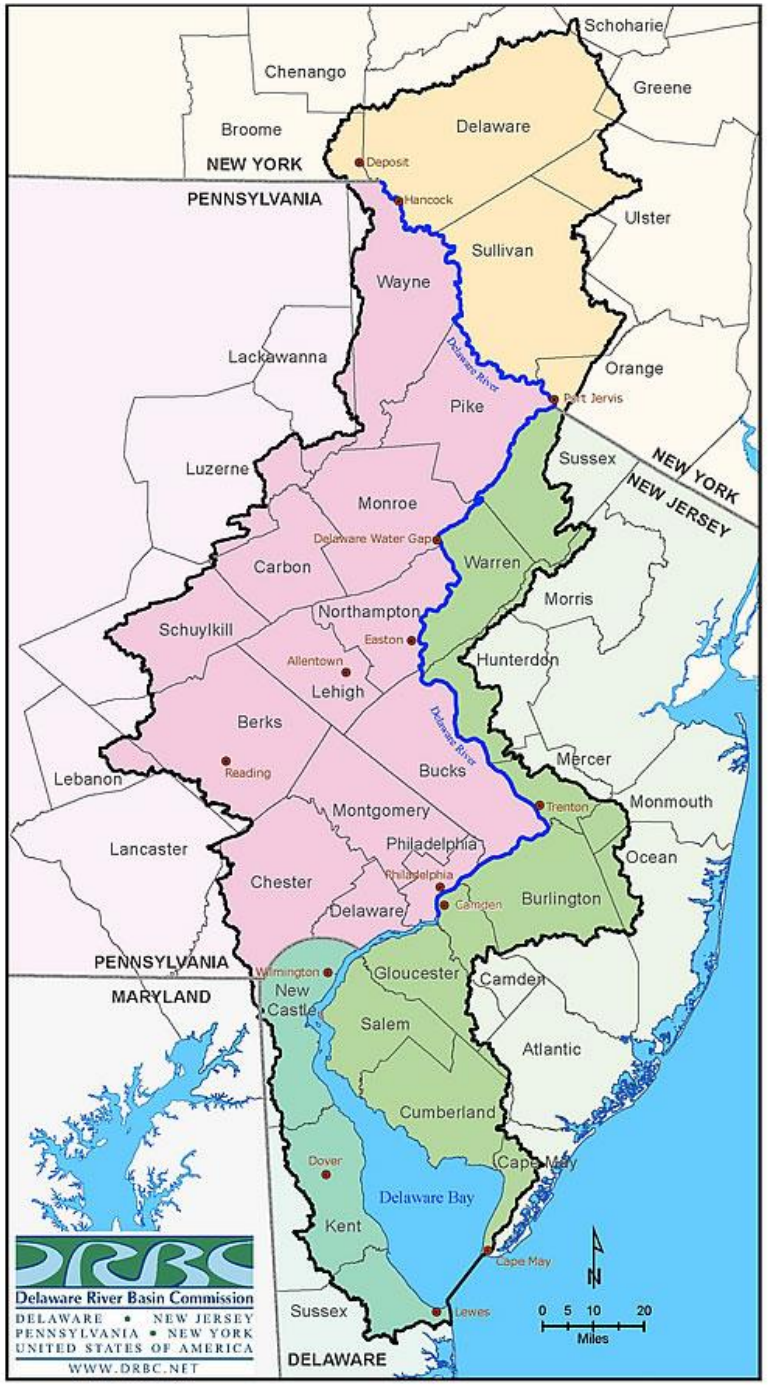

Freshwater Hydrologic Climate Considerations:

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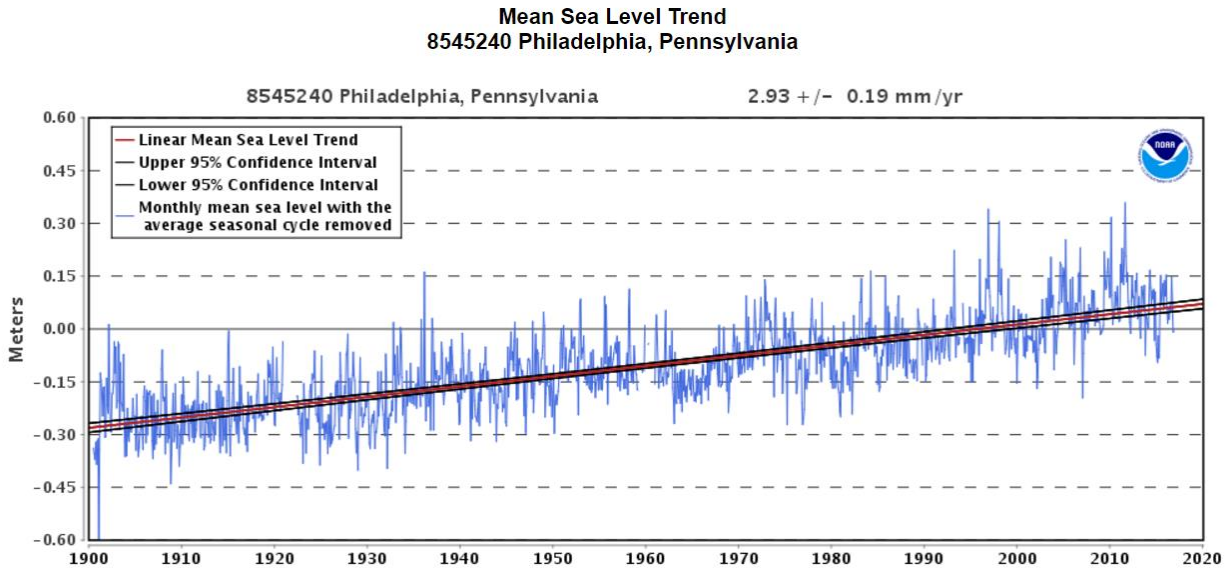
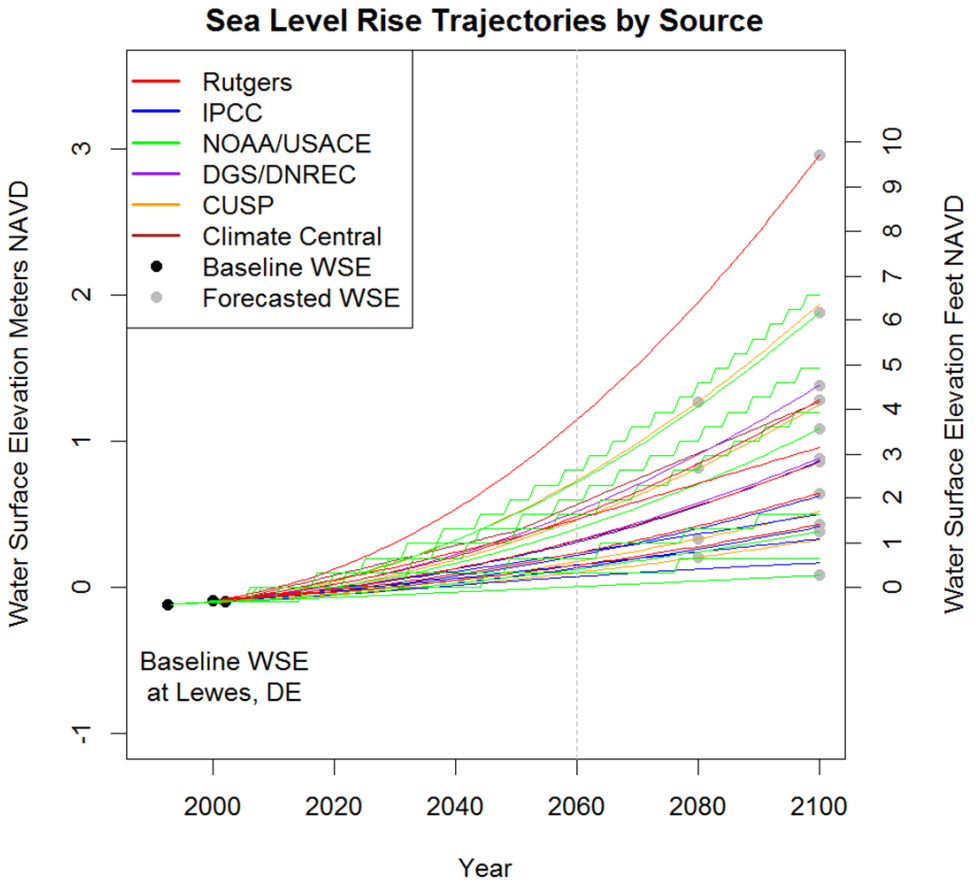
Sea Level Rise

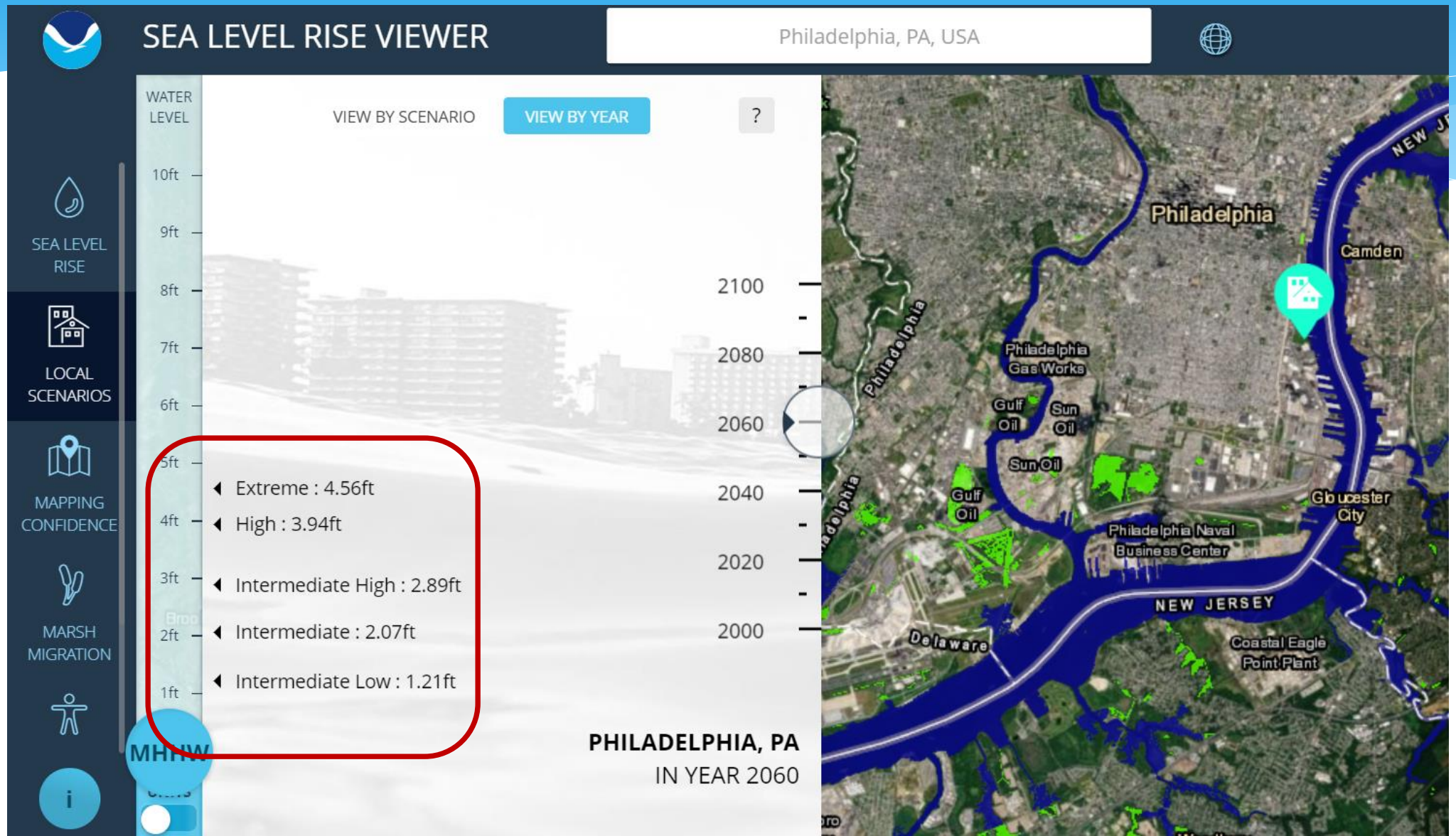
"**<u>Regional Sea Level Change Projections:</u>** It is very likely that in the 21st century and beyond, **sea level change will have a strong regional pattern**, with some places experiencing significant deviations of local and regional sea level change from the global mean change." -IPCC 2013

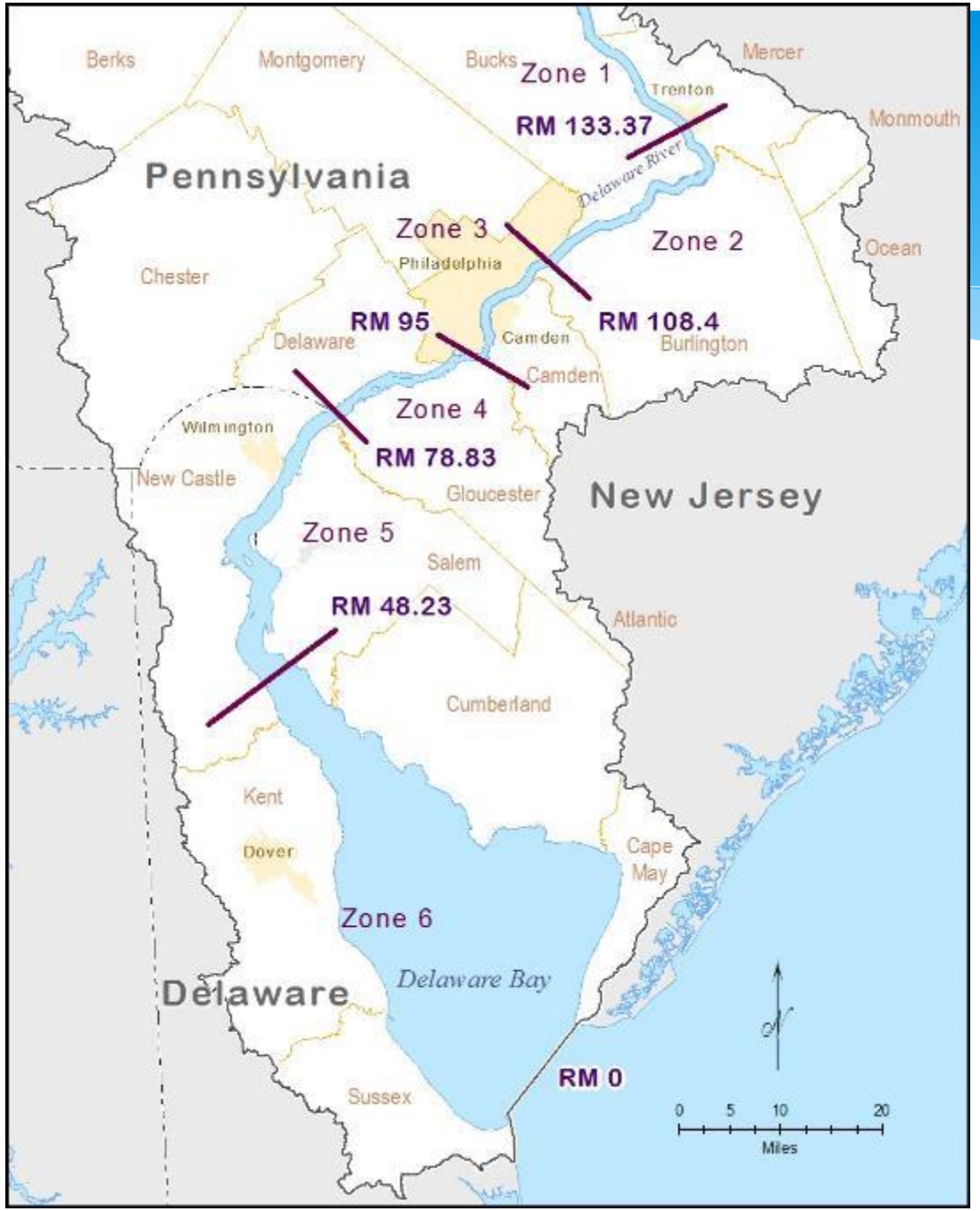


<u>NOAA: Philadelphia, PA</u>
2.93 mm / year
0.96 ft. / 100 years



NOAA Sea Level Rise Viewer
Philadelphia, PA @ 2060

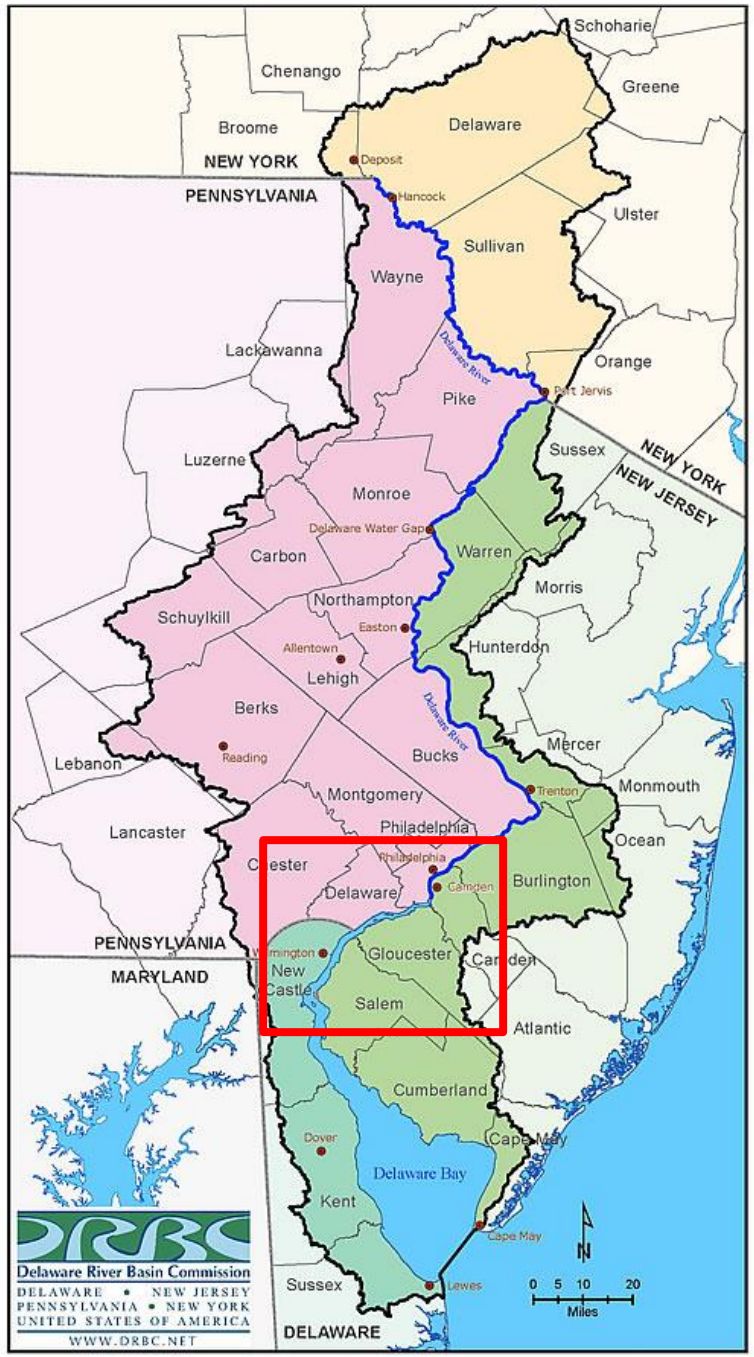




Delaware River Estuary

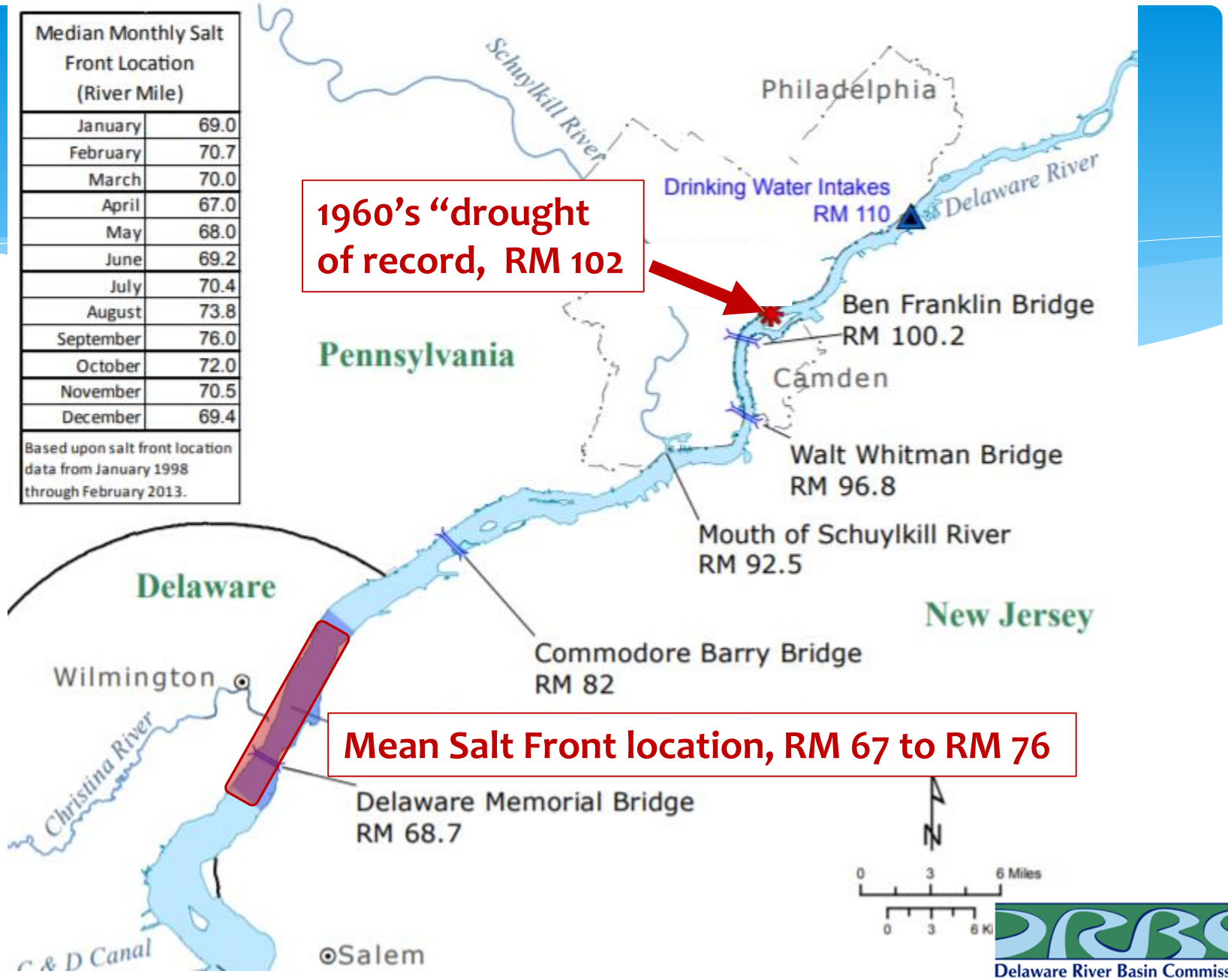
River Miles:

RM 0.0 =	Atlantic Ocean (Cape May / Lewes)
RM 70 =	Wilmington, DE
RM 82 =	Comm. Barry Bridge, Chester, PA
RM 100 =	Ben Franklin Bridge, Philadelphia Camden
RM 133 =	“Head of Tide”, Trenton, NJ



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.



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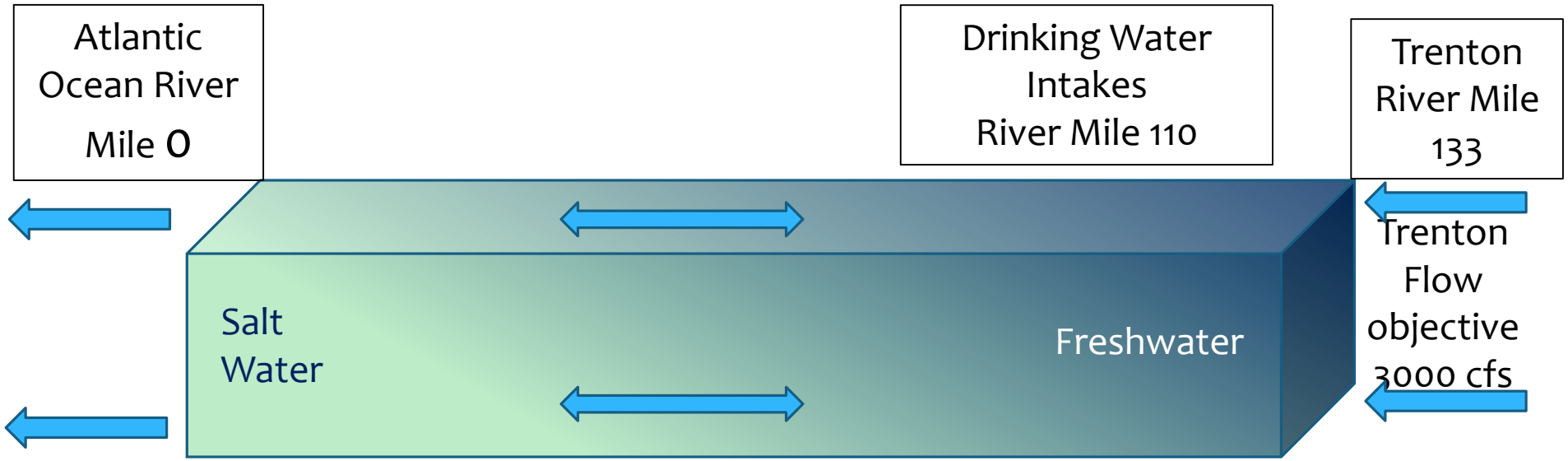
Sea Level Rise and Salinity



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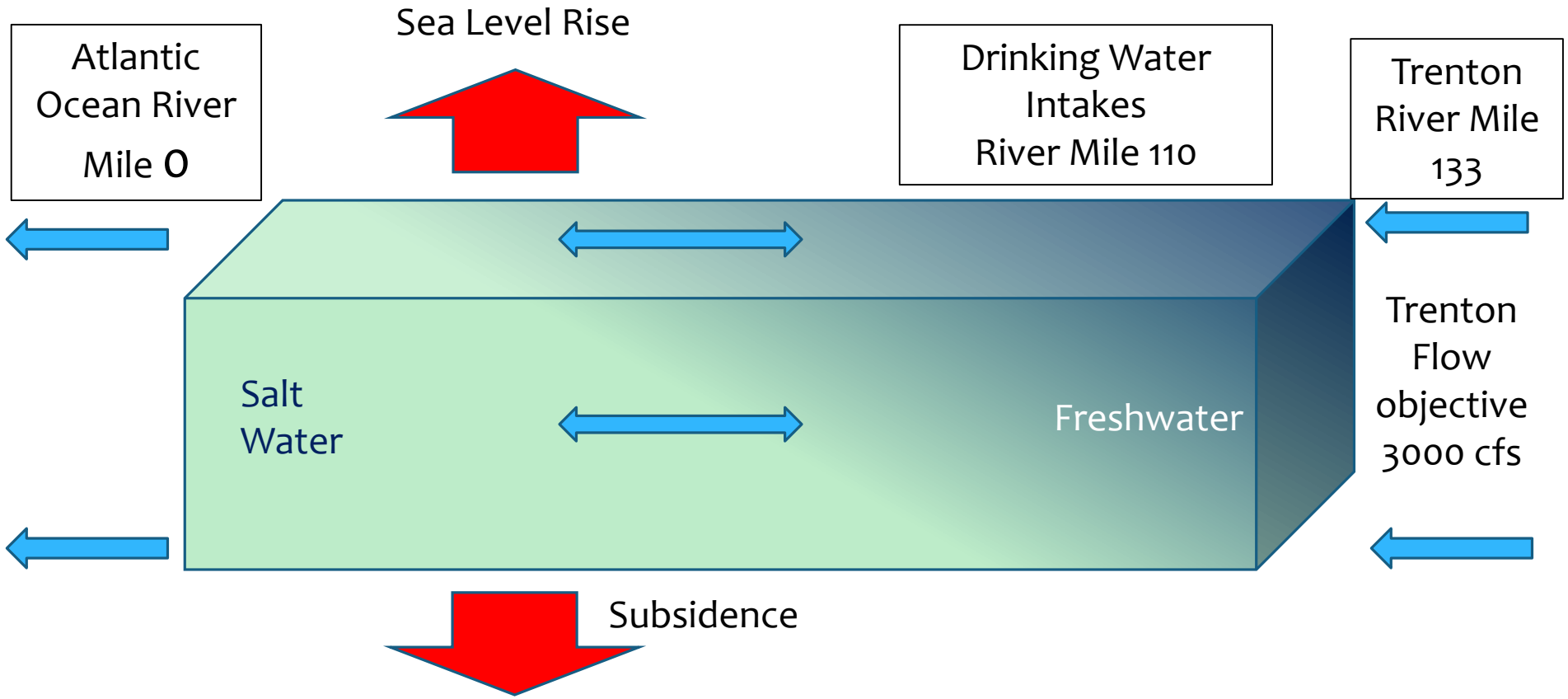
Sea Level Rise and Salinity

? Future Ocean and River Salinities ?



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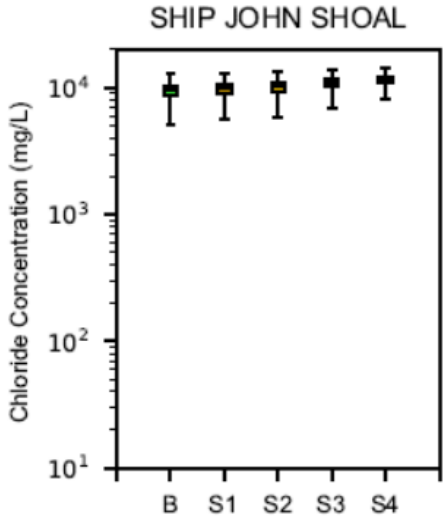
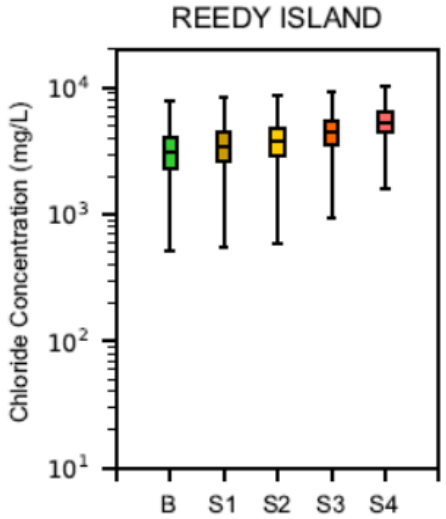
Impact of Sea Level Rise

What is chloride concentration at certain locations under various scenarios?

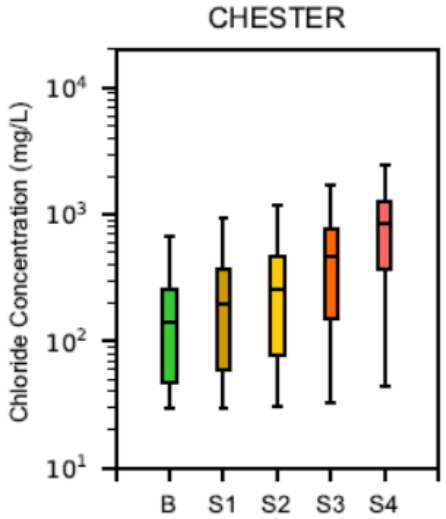
River Mile (RM 37)



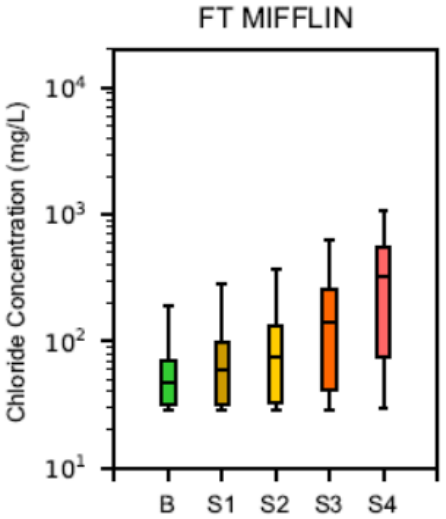
RM 52



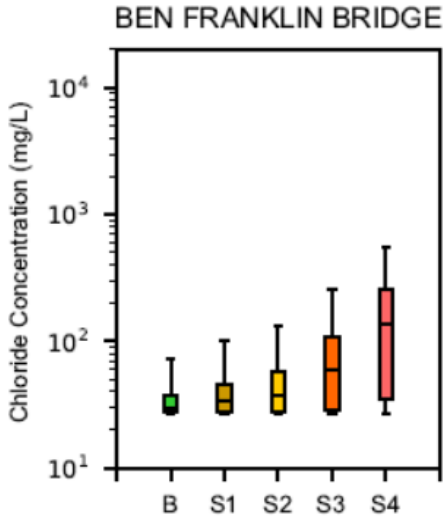
RM 83



RM 91



RM 100



Baseline (B)	Scenario 1, SRL = 0.3 m (S1)	Scenario 2, SRL = 0.5 m (S2)	Scenario 3, SRL = 1.0 m (S3)	Scenario 4, SRL = 1.6 m (S4)
0 ft.	**1 ft**	**1.6 ft**	**3.2 ft**	**5.2 ft.**

As sea level rises salinity intrusion increases

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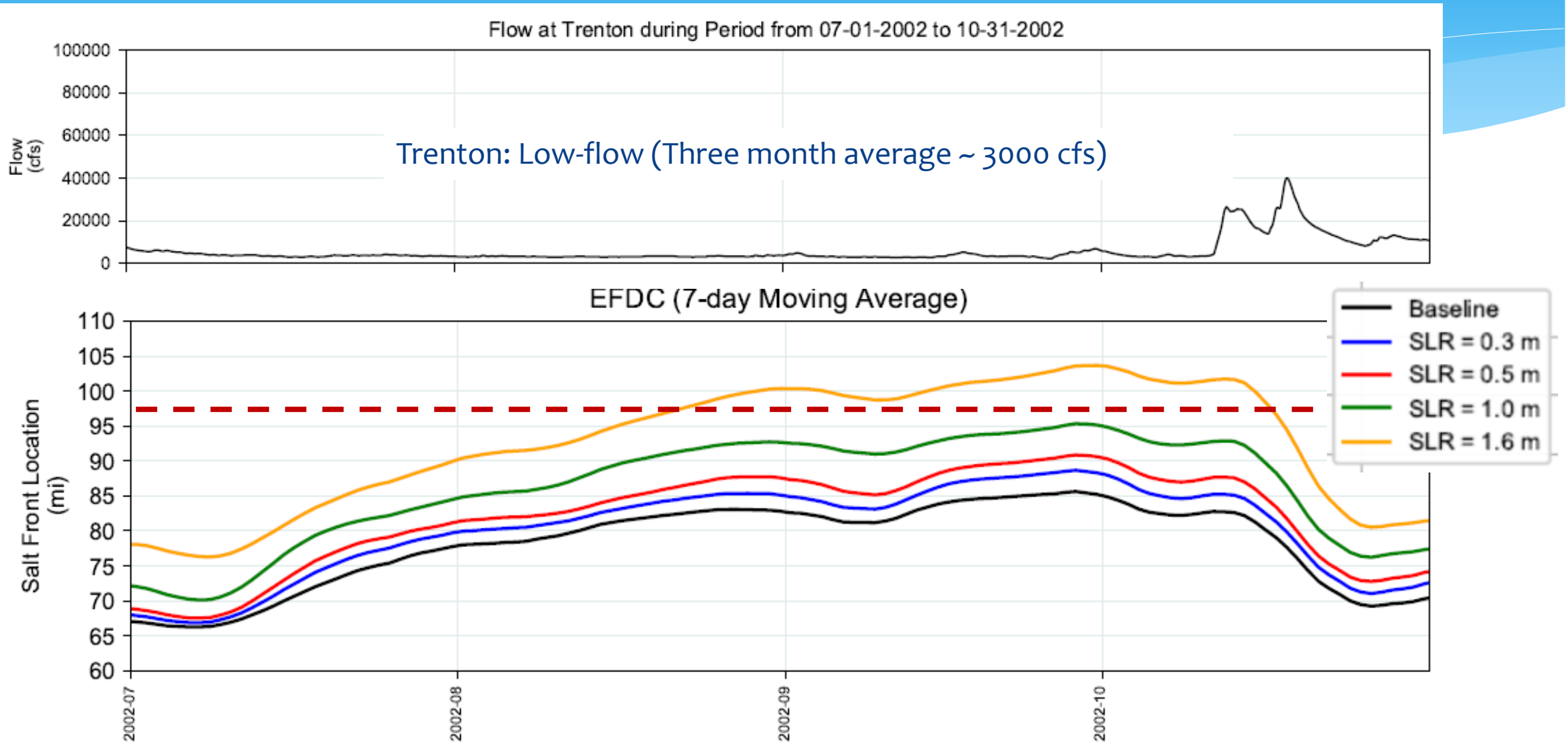
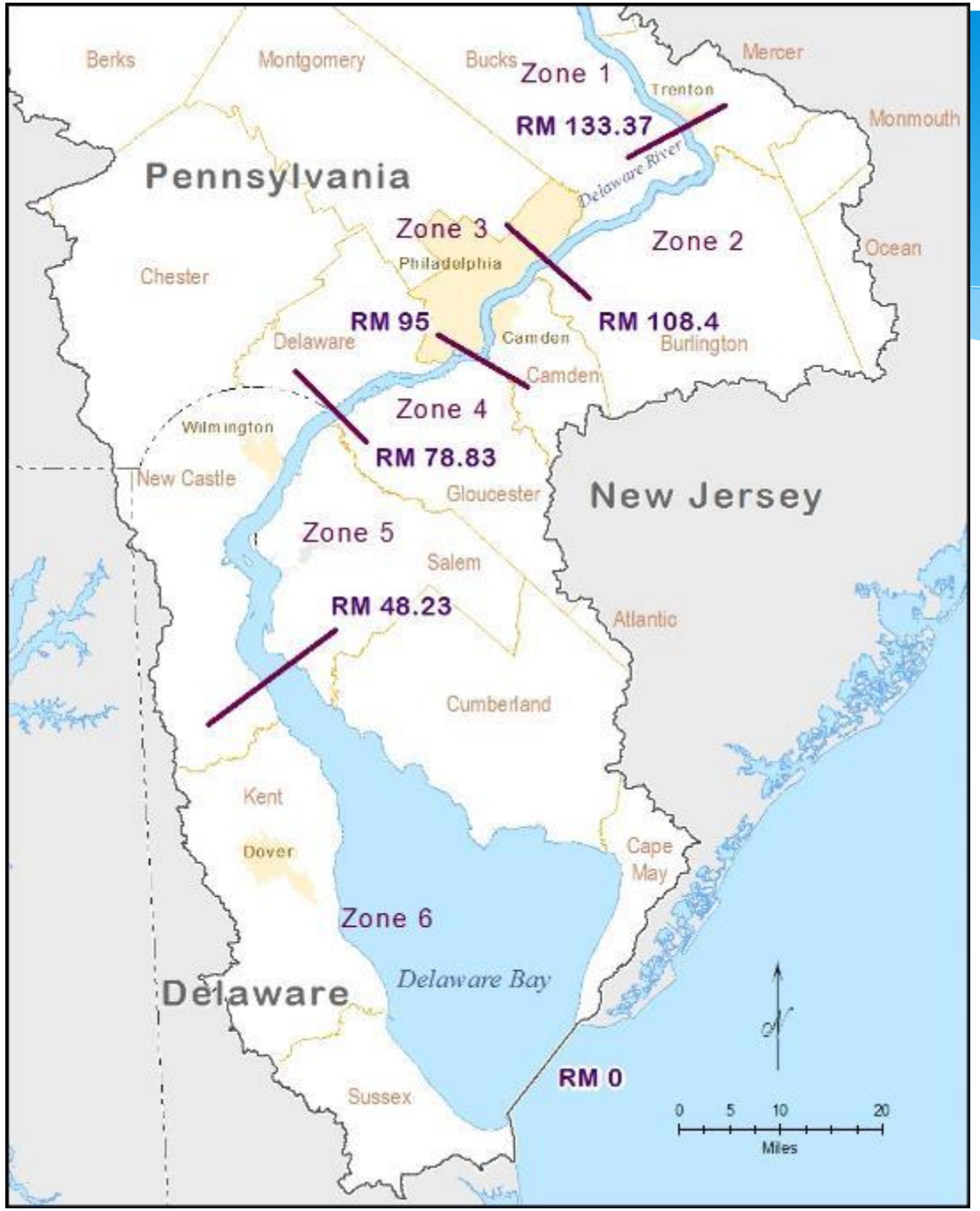
Impact of Sea Level Rise

What is the location of the salt front under various scenarios?





Delaware River Estuary

River Miles:

RM 0.0 = Atlantic Ocean

RM 100 = Ben Franklin Bridge, Philadelphia / Camden

RM 133 = “Head of Tide”, Trenton, NJ

WQ Assessment Units:

Zone 1: Non-tidal (Upstream from Trenton)

Zone 3: Philadelphia / Camden

Zone 6: Delaware Bay

Federal Clean Water Act Basics

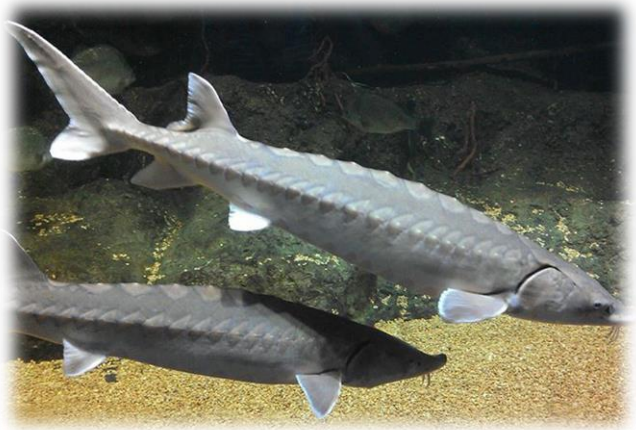
Water Quality Standards

- Designated Uses
- Water Quality Criteria
- Antidegradation

Designated Uses

* **“What do we want to use this water body for?”**
* **Clean Water Act “Fishable / Swimmable” goals.**
* **<u>Examples:</u>**
  * Public water supply (drinking water)
  * Aquatic Life
  * Water based recreation
  * Fishing / fish consumption
  * Industrial water supply
  * Agriculture water supply

https://www.nps.gov/dewa/learn/nature/fish.htm



https://www.fisheries.noaa.gov/species/atlantic-sturgeon

Main Stem Delaware River Designated Uses

Designated Uses by DRBC Water Quality Management Zones

Designated Use	DRBC WQM Zone or AU									
	1A	1B	1C	1D	1E	2	3	4	5	6
Aquatic Life	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Drinking Water	✓	✓	✓	✓	✓	✓	✓			
Primary Recreation	✓	✓	✓	✓	✓	✓		✓	✓	✓
Secondary Recreation							✓	✓		
Fish Consumption	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Shellfish Consumption										✓

Water Quality Criteria: To Protect Designated Uses

Zone	River Mile	Aquatic Life Use
2	108.4 – 133.4	maintenance and propagation of resident fish and other aquatic life
3	95 – 108.4	maintenance of resident fish and other aquatic life
4	78.8 – 95	maintenance of resident fish and other aquatic life
5	70 – 78.8	maintenance of resident fish and other aquatic life
	48.2 – 70	maintenance and propagation of resident fish and other aquatic life
6	0 – 48.2	maintenance and propagation of resident fish and other aquatic life maintenance and propagation of shellfish

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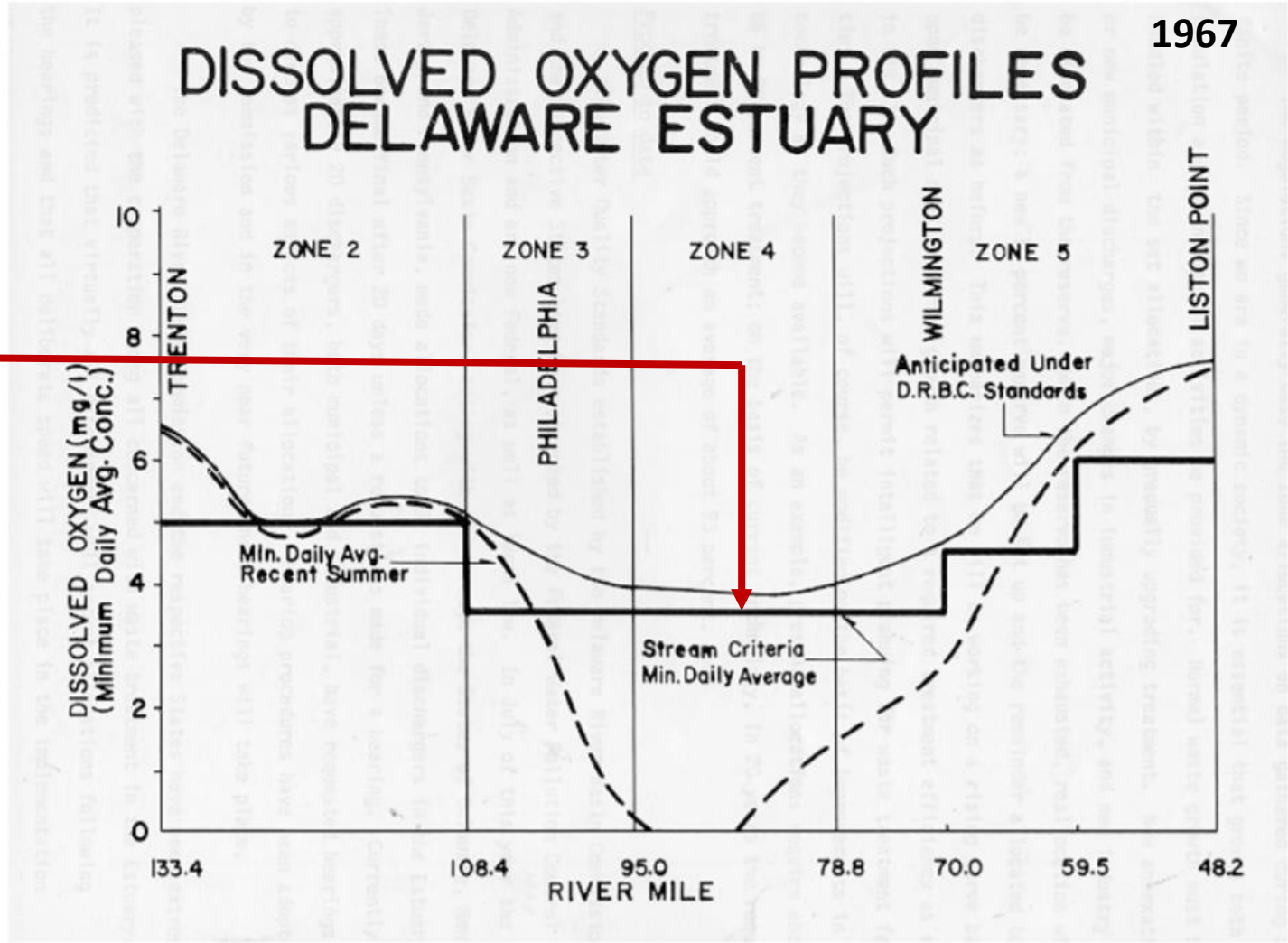
1967



Dissolved Oxygen Success

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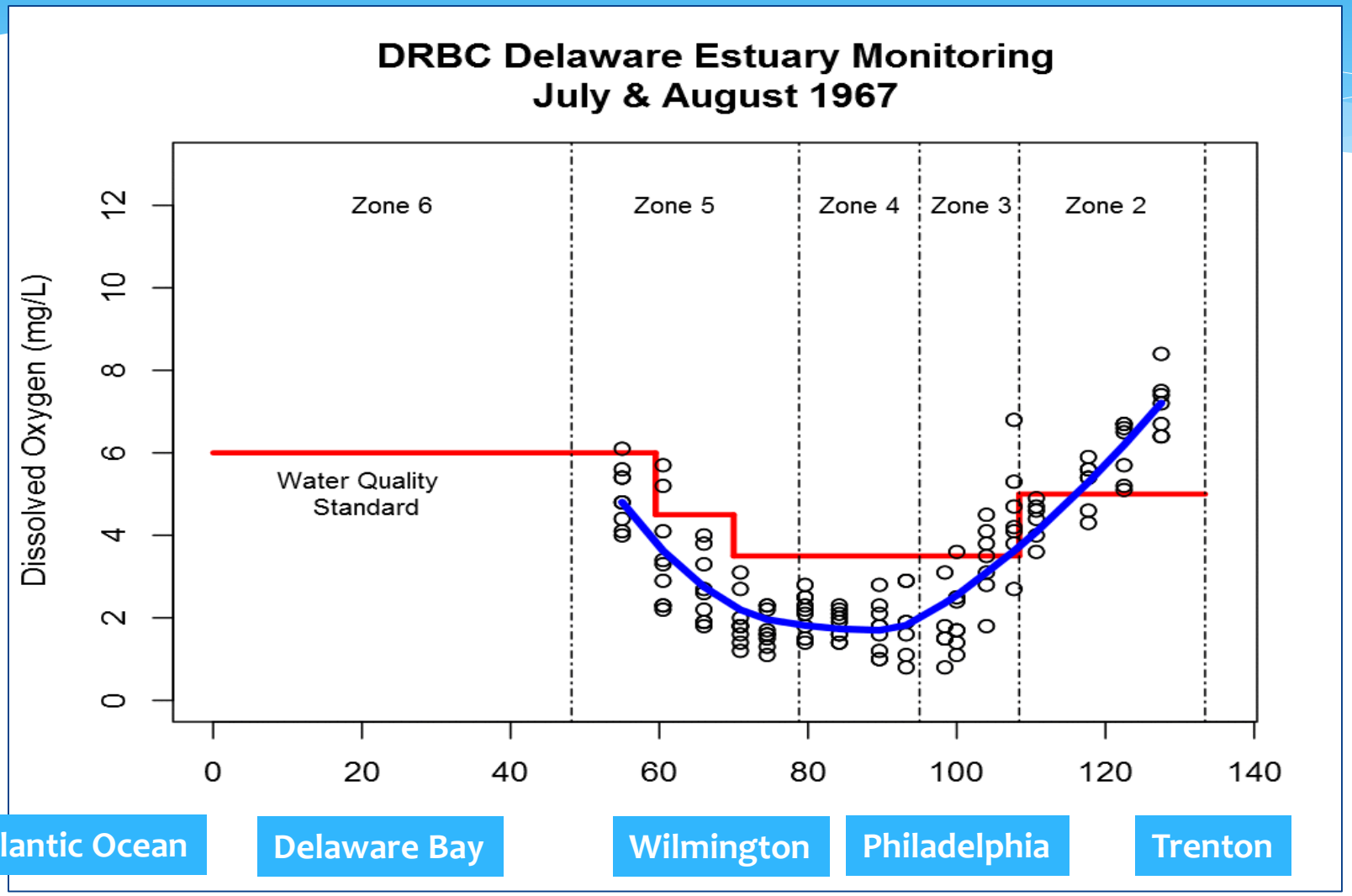
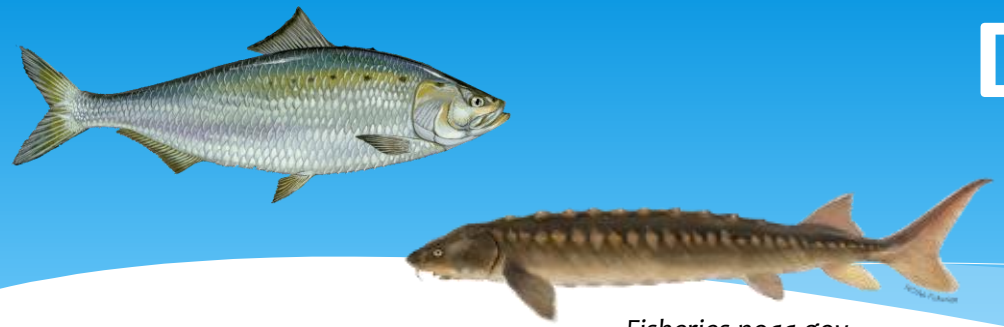
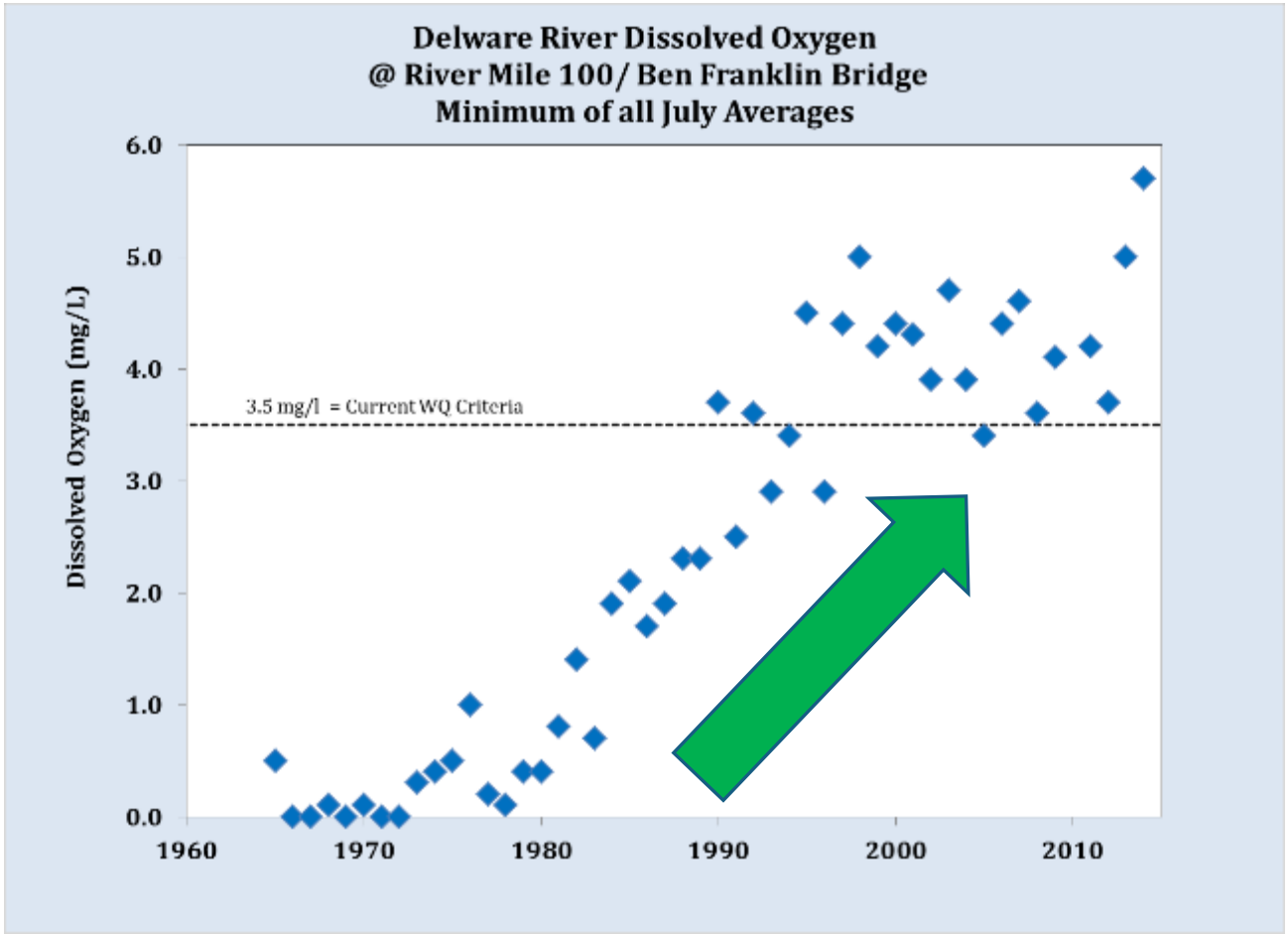


* 3.5 mg/L criteria near Philadelphia, Camden, & Wilmington protect fish migration (not propagation)
* By 2000's that criteria is nearly always met

DRBC Collaborative Results
Aquatic Life Benefits



Fisheries.noaa.gov



- **A dead zone in the Estuary restored.**
- Significant improvement in dissolved oxygen.

News / Local News / Easton Area

Shad making a big comeback in Delaware River https://www.pressofatlanticcity.com/news/shad-make-a-big-comeback-in-delaware-river/article_bd20f7b6-9888-54ec-8930-8c476eec7013.html

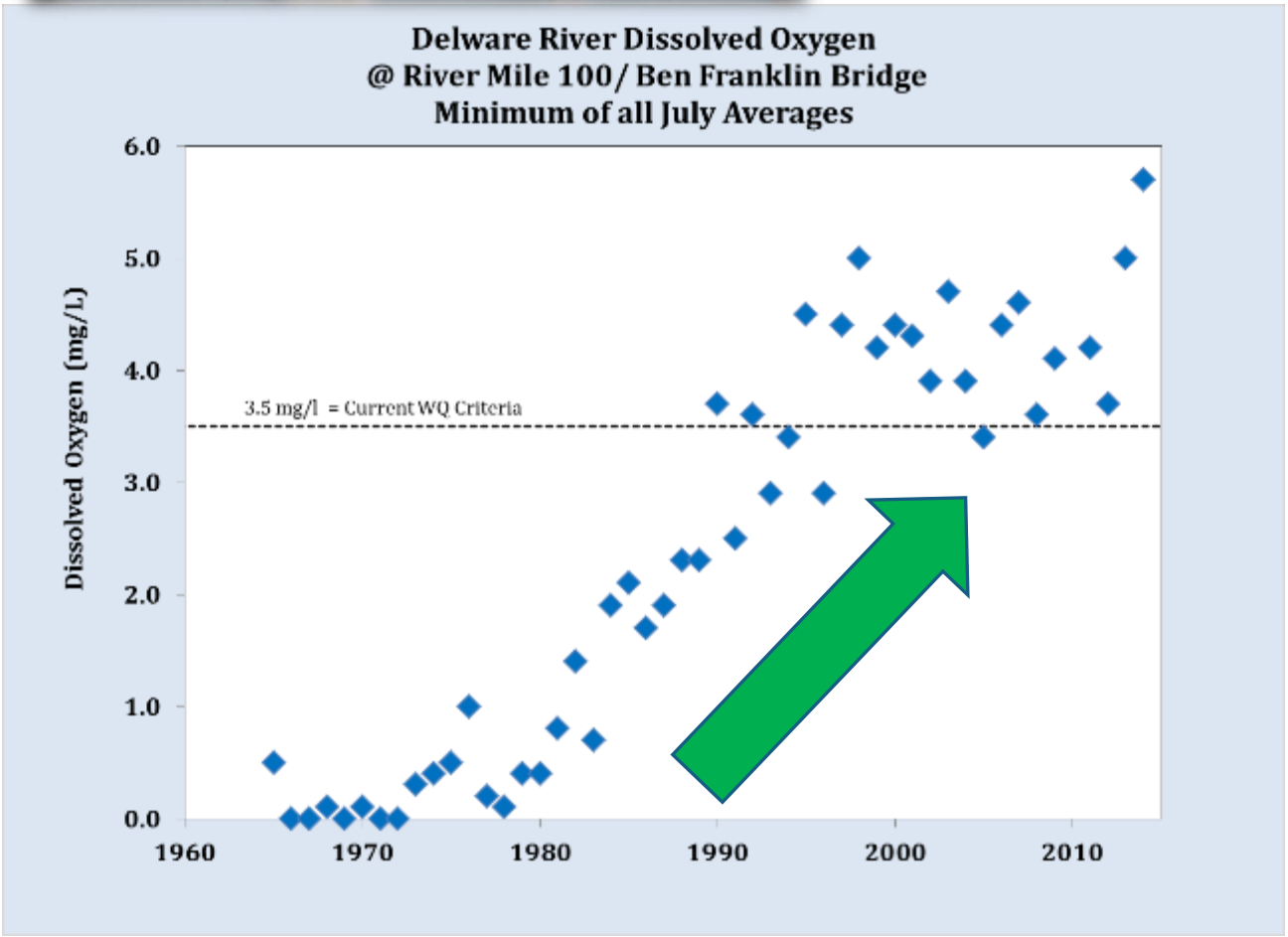
There's good news for one of N.J.'s most endangered fish

Updated Oct 28, 2017; Posted Oct 28, 2017

https://www.nj.com/news/2017/10/atlantic_sturgeon_still_depleted_but_slowly_recove.html

Photo: https://urbanland.uli.org/development-business/camdens-comeback/; Volley for Robert A. M. Stern Architects

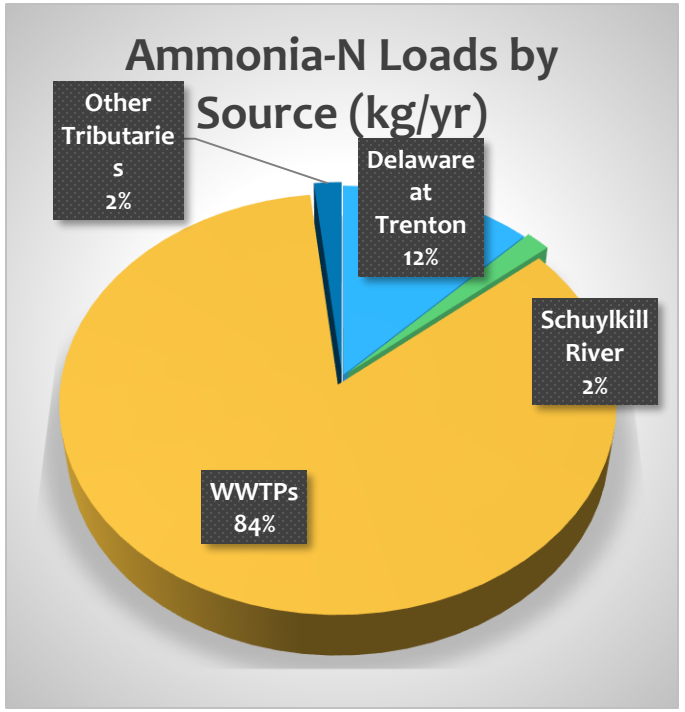
DRBC Collaborative Results
Local Economic Benefits

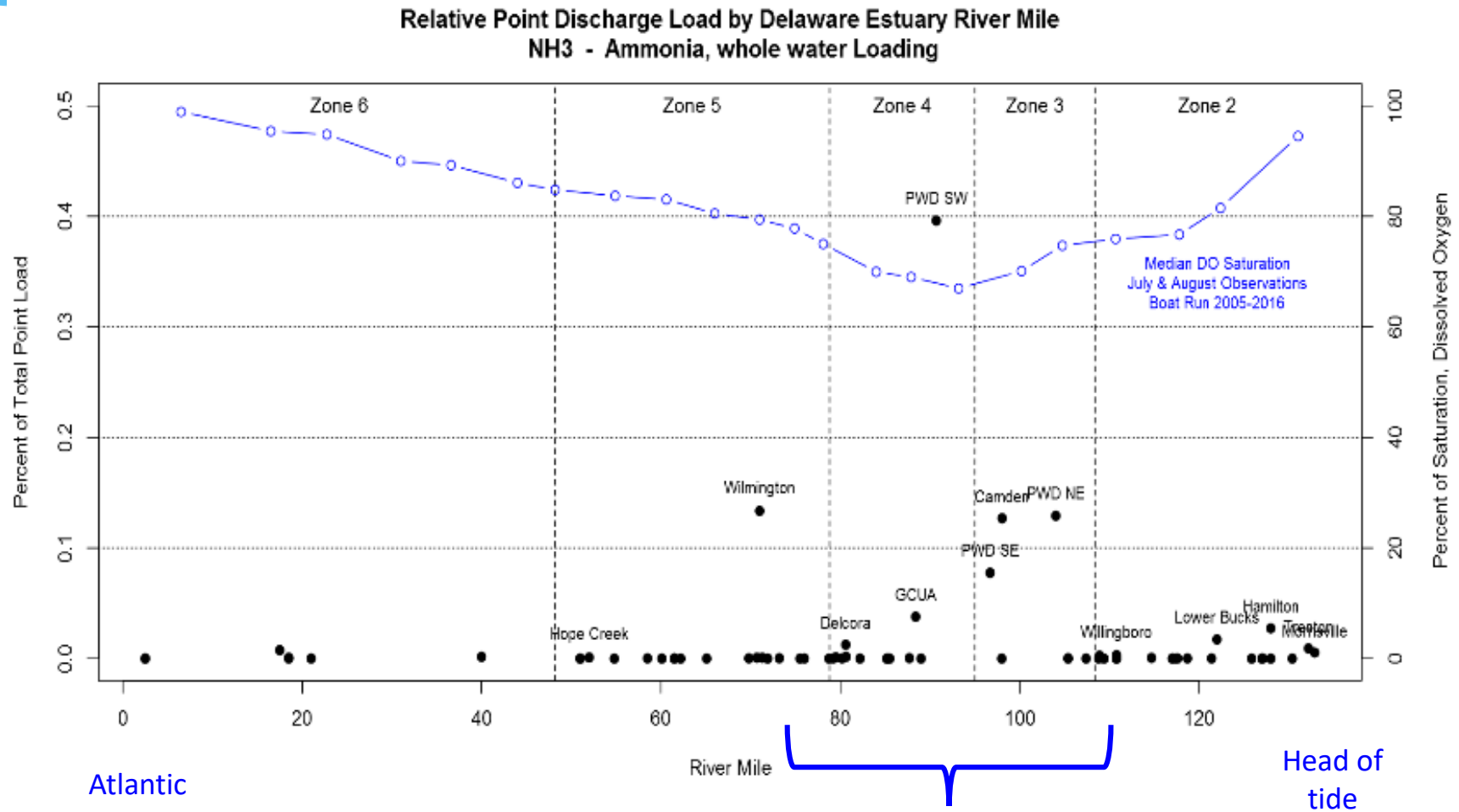


- **A dead zone in the Estuary restored.**
- Significant improvement in dissolved oxygen.

https://philly.curbed.com/maps/delaware-river-philadelphia-development-projects

Ammonia-Nitrogen





Atlantic Ocean

Head of tide

Urbanized portion of Delaware Estuary

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Aquatic Life Designated Uses in Current DRBC Regulations since 1967

	Zone	River Mile	Aquatic Life Use	Migratory Fishes	24-hour average D.O. Criteria
Urbanized portion of Delaware Estuary	2	108.4 – 133.4	**maintenance** and **propagation** of resident fish and other aquatic life	**passage** of anadromous fish	5.0 mg/l
	3	95 – 108.4	**maintenance** of resident fish and other aquatic life	**passage** of anadromous fish	3.5 mg/l
	4	78.8 – 95	**maintenance** of resident fish and other aquatic life	**passage** of anadromous fish	3.5 mg/l
	5	70 – 78.8	**maintenance** of resident fish and other aquatic life	**passage** of anadromous fish	3.5 mg/l
		48.2 – 70	**maintenance** and **propagation** of resident fish and other aquatic life	**passage** of anadromous fish	4.5 – 6.0 mg/l
The Delaware Bay	6	0 – 48.2	**maintenance** and **propagation** of resident fish and other aquatic life **maintenance** and **propagation** of shellfish	**passage** of anadromous fish	6.0 mg/l

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Evaluation of Existing Aquatic Life Use

- Some ***strong*** evidence for successful reproduction for:
  - White Perch (Zones 3 & 4), Striped Bass (Zone 5)
- Some ***moderate*** evidence for successful reproduction for:
  - American Shad (Zone 3), Alewife (Zones 3 & 4), Bay Anchovy (Zones 4 & 5)
- Evidence for ***weak*** reproductive success in each Zone:
  - Atlantic Sturgeon (Zone 4), American Shad (Zone 4), Blueback Herring (Zones 3 & 4)

Existing Use Evaluation for Zones 3, 4, & 5 of the Delaware Estuary Based on Spawning and Rearing of Resident and Anadromous Fishes

September 30, 2015

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WWW.DRBC.NET

https://www.nj.gov/drbc/library/documents/ExistingUseRpt_zones3-5_sept2015.pdf

✓ **Update to DRBC Water Quality Regulations – How?**

Key Questions

1. What water quality criteria must be achieved to protect ***target fish species*** and ***life stages***?
2. What ***seasonal, geographic*** and/or ***temporal conditions*** must be considered along with any suggested changes to related water quality criteria?
3. What are the estimated ***oxygen demand*** and nutrient (pollutant) loadings from point and non-point ***sources*** in the Estuary today?
4. What total wasteload and load **allocations** must be achieved to protect target species?
5. How and to whom will loads ***be allocated***?
6. What are the capital and operating ***costs*** of technologies to achieve higher levels of dissolved oxygen in the Estuary?
7. What physical, chemical, biological, social and ***economic*** factors will affect the attainment of the water quality standards?

DRBC Resolution 2017-4
Adopted Sept. 13, 2017

- The Commission recognizes that the water quality and aquatic life uses of Zones 3 and 4 and upper Zone 5 of the Delaware River Estuary have substantially and significantly improved since DRBC adopted designated uses and water quality criteria for these reaches in 1967.

- The Commission shares the following goals for the Delaware River Estuary:
  - ✓ The improved conditions and uses we collectively have achieved should be protected.
  - ✓ The path of continuous water quality improvement in these shared waters must continue.

- Initiate a rulemaking process to establish the designated uses and determine the criteria required to support these uses in Zones 3, 4 and the upper portion of Zone 5.

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DRBC Resolution 2017-04:

Required before Rulemaking

- 6(a). Input on the **dissolved oxygen requirements of aquatic species**
- 6(b). Field studies of the occurrence, spatial and temporal distribution of the life stages of Estuary fish species
- 6(c). Input from consultations pursuant to the **Endangered Species Act** ("ESA")
- 6(d). Development and calibration of a **eutrophication model** for the Delaware River Estuary and Bay;
- 6(e). Determination of the nutrient **loadings from point and non-point sources** necessary to support key aquatic species;
- 6(f). Evaluation of the **capital and operating costs for treatment** capable of achieving higher levels of dissolved oxygen;
- 6(g). Evaluation of the physical, chemical, biological, **social and economic factors affecting the attainment of uses**,
- 6(h). Preparation of a draft report and final report containing findings and conclusions.

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Science Based Approach

Review DO requirements for key sensitive species in the Estuary.

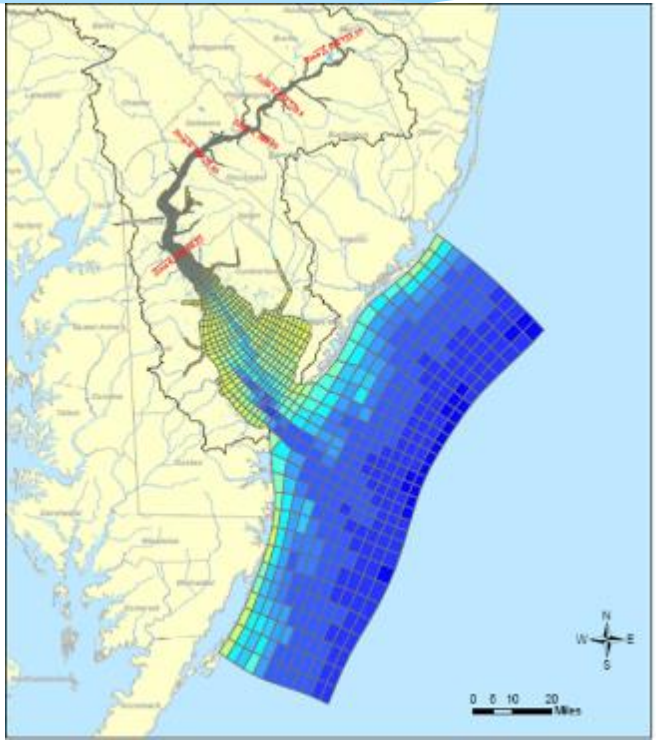
Enhanced Estuary monitoring.

Develop a linked hydrodynamic and water quality model for the Estuary.

Determine higher level of DO to protect the designated use.

Develop waste load allocations to achieve new DO criteria.

Review treatment costs, cost impacts and attainability.



What are the DO Requirements?

Summer Requirements

	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6		
Median Salinity (‰)	0.11	0.11	0.15	1.04	16.00		
Salinity Range (‰)	0.10-0.22	0.10-0.20	0.10-0.80	0.10-12.00	0.40-31.40		
Median Temperature (°C)	25.61	25.65	25.62	26.00	24.83		
Temperature Range (°C)	19.57-32.39	20.11-29.04	20.48-29.23	20.42-29.35	18.98-28.90		
Common Name	Stage	DO Value (mg/l)				Notes	Reference
Shortnose Sturgeon	Juvenile	3	3	3	NA	NA	Significant decrease in percent survival (23°C, 0-5‰).	Jenkins et al. 1993
Shortnose Sturgeon	Juvenile	NA	NA	NA	3.5	3.5	Chose 8.7 mg/l over 3.5 mg/l in controlled experiment (20°C, 8‰).	Niklitschek and Secor 2010
Atlantic Sturgeon	Larval	3	3	3	3	-	Prey consumption significantly reduced (15°C, 0‰).	Wirgins and Chambers 2018
Atlantic Sturgeon	Juvenile	6.3	6.3	6.3	6.3	6.3	Optimal for survival, low mortality rates, and growth (20°C, 1‰).	Niklitschek and Secor 2009a
American Shad	Larval	5	5	5	-	-	Required for spawning and survival.	Stier and Crance 1985
American Shad	Juvenile	4	4	4	4	4	Respiration rates increase, survival is possible with limited exposure.	Tagatz 1961
American Shad	Adult	-	-	-	5	5	Required for spawning and survival.	Stier and Crance 1985
Blue Crab	Juvenile	-	-	-	NA	6.44	LC50 (20°C, 20‰).	Stickle et al. 1989
Blue Crab	Juvenile	-	-	-	4.08	NA	LC50 (20°C, 10 ‰).	Stickle et al. 1989
Atlantic Rock Crab	Larval	-	-	-	-	6.05	LD50 (30°C, 30 ‰).	Vargo and Sastry 1977
Eastern Elliptio	Juvenile	4	4	4	4	-	Behavioral changes begin (23-25°C).	Sparks and Strayer 1998
Scud	Adult	4.3	4.3	4.3	NA	NA	24-Hour LC50 (20°C, freshwater)	Sprague 1963
Scud	Adult	4.09	4.09	4.09	NA	NA	Highest DO resulting in significant mortality (20°C, freshwater)	Hoback and Barnhart 1996
Channel Catfish	Egg	4.4	4.4	4.4	-	-	Decrease in hatching success (25°C).	Carlson et al. 1974
Channel Catfish	Larval	4.4	4.4	4.4	-	-	Decrease in larval survival (25°C).	Carlson et al. 1974
Channel Catfish	Juvenile	5	5	5	5	-	Feeding reduced.	Randolph & Clemens 1976
Channel Catfish	Adult	3.95-6.4	3.95-6.4	3.95-6.4	3.95-6.4	3.95-6.4	Gill ventilation doubles and lactic acidosis occurs (18°C).	Burggren and Cameron 1980
Largemouth Bass	Juvenile	8	8	8	-	-	Growth reduced (26°C).	Stewart et al 1967
White Perch	Juvenile	3.6-6.3	3.6-6.3	3.6-6.3	3.6-6.3	3.6-6.3	Growth threshold effect seen between these ranges (20°C).	Hanks and Secor 2011
White Perch	Adult	NA	NA	NA	4	4	Avoided areas with this DO (21°C).	Meldrim, Gift, and Petrosky 1974
Striped Bass	Egg	5	5	5	5	-	Egg hatching rates decreased (18.3°C).	Turner and Farley 1971
Striped Bass	Larval	5	5	5	5	5	Survival decreases below this (18.3°C).	Turner and Farley 1971
Striped Bass	Juvenile	8	8	8	NA	NA	High growth rate (20-27°C, freshwater).	Brandt et al. 2009
Striped Bass	Juvenile	5	5	5	5	5	High survival.	Krouse 1968 in Bain and Bain 1982
Summer Flounder	Juvenile	-	-	-	-	5	Growth reduced (30°C, 25‰).	Stierhoff et al. 2006
Summer Flounder	Adult	-	-	-	-	4.52	Chronic effects on survival and growth.	Bailey et al. 2014
Yellow Perch	Juvenile	5.1	5.1	5.1	-	-	Lowest concentration for 100% survival (19°C).	Moore 1942
Yellow Perch	Adult	4.3	4.3	4.3	4.3	-	Lowest concentration for 100% survival (26°C).	Moore 1942
Bluefish	Juvenile	-	-	-	5	5	Typically not found in areas with DO less than this.	Shepherd and Packer 2006

Where: "-" indicates absence of a species from a Zone and "NA" indicates that a species is likely to inhabit that Zone but no DO data was found matching the temperature and salinity.

The Academy of Natural Sciences of Drexel University

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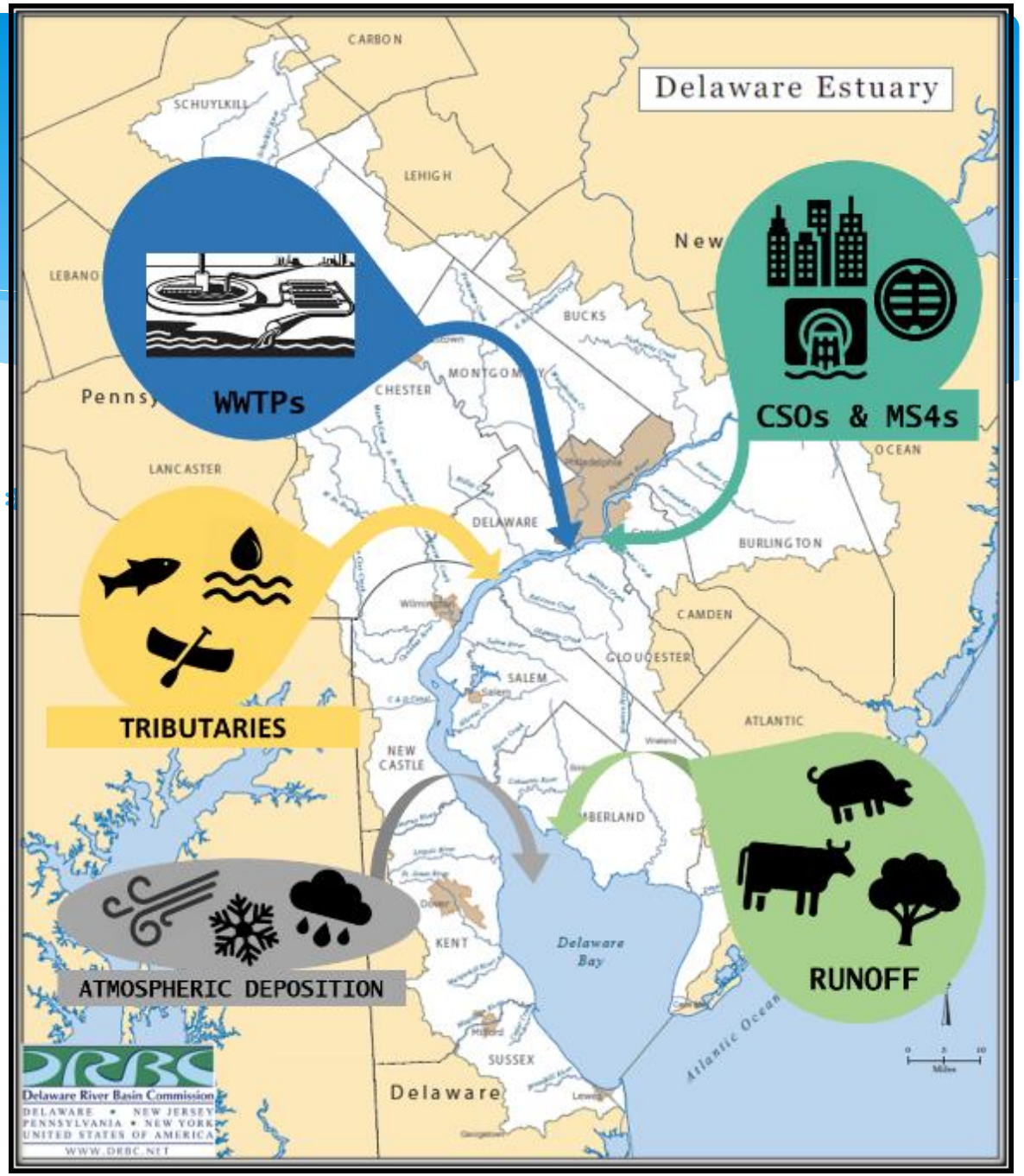
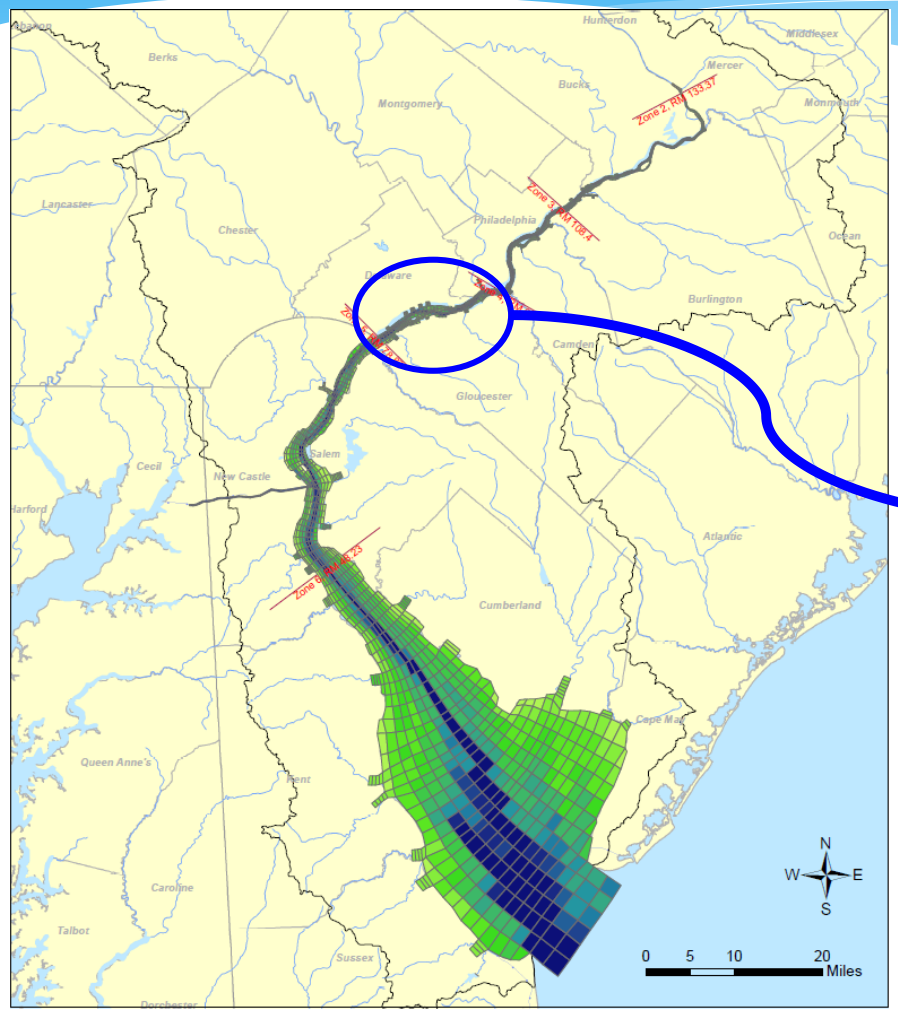
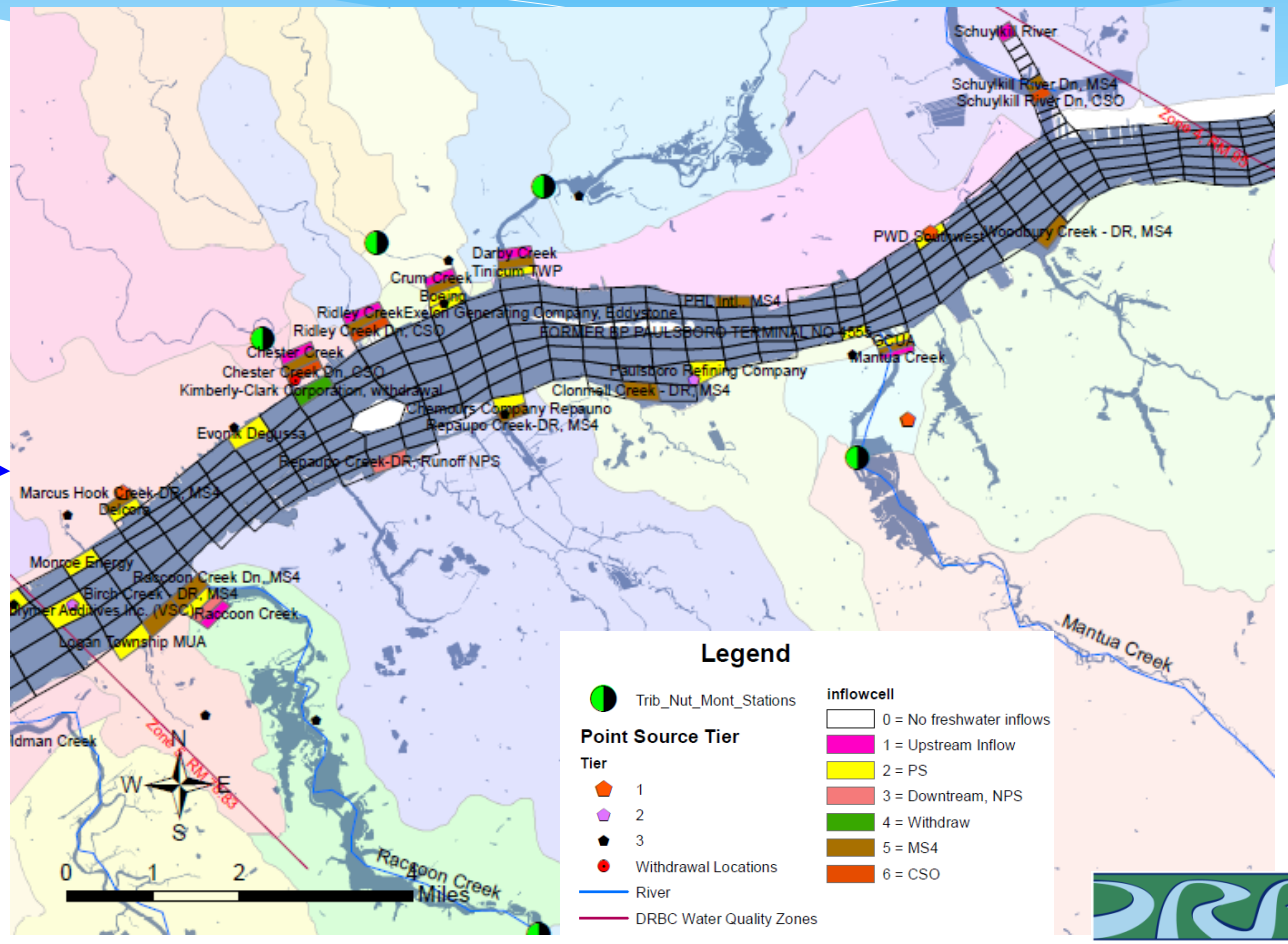
Development of linked hydrodynamic and water quality model

- Tributary Loads
  - Delaware River at Trenton (Zone 1)
  - Schuylkill River
  - ~ 29 other tributaries
- Tidal Boundaries
  - Ocean at mouth of Delaware Bay
  - C&D Canal
- Direct Basin Loads
  - Wasteloads: **WWTPs**, CSOs, MS4
  - Nonpoint Source (runoff outside MS4)
  - Wet/Dry deposition onto water surface



Water Quality Model





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Model Goal

- Develop a linked hydrodynamic and water quality model that will be used to allocate the loads of oxygen demanding nutrients that can be discharged from point and non-point sources into the Delaware Estuary while maintaining the desired levels of dissolved oxygen.

- The achievable level of dissolved oxygen will be turned into water quality criteria through DRBC's rule making processes

Stakeholder and Expert Input

Water Quality Advisory Committee	
Academia / Science	Stroud Water Research Center
Delaware	DNREC
Environmental Group	Delaware Riverkeeper Network
Watershed Organization	Wildlands Conservancy
National Parks Programs	National Park Service
New Jersey	NJDEP
New York	NYDEC
Pennsylvania	PADEP
Industry	Chemours and Exelon
Municipal	Philadelphia Water and City of Wilmington
US EPA	US EPA

Expert Panel for Estuary Model Development	
U.S. Army Corps of Engineers	Dr. Carl Cerco (Retired)
Rutgers University	Dr. Bob Chant
Tufts University	Dr. Steve Chapra
U.S. EPA Region 4	Tim Wool
LimnoTech	Dr. Vic Bierman

Funding Support for the Designated Use Studies

Delaware River Basin Commission

Managing, Protecting and Improving
our shared Basin water resources since 1961.

Built on a shared and foundational commitment in the ***Delaware River Basin Compact*** to:

- Manage complex interstate water resource systems and needs.
- Collaborate with members on shared waters management issues – from headwaters to the Ocean.
- Adapt to achieve mission results.
- **Develop policies and practices based upon science.**
- Partner to achieve for the Basin, what individual members cannot achieve alone.

Steve Tambini, Executive Director

Steve.Tambini@drbc.gov

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