Briefing for Delegation Visits:
Nanjing Water Affairs Bureau – Oct. 23
&
Shaanxi Water Affairs Group – Oct. 31

Photo courtesy of the U.S. Army Corps of Engineers
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.
The Delaware River Basin

- ~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- 6.4 billion gallons are withdrawn every day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
The Delaware River
“Today”

Photo: Delaware River Sojourn

Photo: Aqua Vida

Photo: Delaware River Sojourn

Photo: Nicholas A. Tonelli

Photo: Delaware River Sojourn

Photo: Nicholas A. Tonelli
It Used to Look Like...

Slaughterhouses discharging in 1928 (courtesy PWD Historic Collection)

Bridgeport Canal up from Schuylkill River in 1928. (courtesy PWD Historic Collection)
And Sometimes It Looked Like...

Easton-Phillipsburg free bridge in 1955 (lehighvalleylive.com file photo)

Delaware River at Trenton in 1965 (DRBC photo)
The Problems

- Water supply shortages and disputes over the apportionment of the basin’s waters
- Severe pollution in the Delaware River and its major tributaries
- Serious flooding
The Challenge

- 4 States
- 42 Counties
- 838 Municipalities
- NY City
The Solution:
The Delaware River Basin Commission

- 1961 – President Kennedy and the four Basin State Governors sign the Delaware River Basin Compact, the federal/state law that formed the Delaware Basin Commission (DRBC)
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
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
DRBC Staff and Budget

- Professional Planners, Engineers and Scientists
- 39 Budgeted Staff (12% Vacancy Rate)
- FY2019 Budget = $6.3 million
- Funding from “Signatory Members” = $1.7 M (27%)
- Located in West Trenton, NJ since 1974
Compact Designated Responsibilities

Create a Comprehensive Plan

- Flood damage (and drought) reduction
- Ground and surface water supply development
- Propagation of fish and game
- Related watershed projects
- Recreational facilities

and the regulations towards the attainment of these goals
DRBC Core Responsibilities

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

View from Bowman Hill Tower by Linda Park
Flow

“It has to be wet before it can be clean.”

Dawn at Ten Mile River by Martha Tully
How Wet Has It Been?

Delaware River at Trenton, Median Flow (CFS)
Since 1913, with 2018 in red

NOTE: Highest year was 2011, which included flows resulting from Hurricane Irene and Tropical Storm Lee.
### How Dry Has It Been?

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<tr>
<td>Reservoir Completed</td>
<td>A B</td>
<td>C</td>
<td>D E</td>
<td>F</td>
<td>G</td>
<td>H</td>
<td>I</td>
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#### Drought Years:
- **Drought Watch or Warning**
- **Drought Emergency**

- A=Neversink, B=Pepacton, C=Nockamixon, D=Promtpon and Jadwin, E=FE Walter; F=Cannonsville, G=Belzville, H=Blue Marsh, I=Merrill Creek.

Lake Wallenpaupack and the Mongaup System were constructed in the 1920s; Dates are approximate.
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 Reservoir
- Flow Management Objective

USACE Owned and Operated Reservoirs
- F.E. Walter (35 BG)
- Beltzville (22 BG Total)
- Blue Marsh (16 BG Total)
- Wallenpaupack Emergency

Montague
Non Drought Target = 1750 cfs (1130 MGD)

LEHIGH RIVER
12 BG

SCHUYLKILL RIVER
- 16 BG Total
- 6.5 BG for Water Supply
- Nockamixon Emergency

Trenton
Non Drought Target = 3000 cfs (1940 MGD)

DELAWARE AND RARITAN CANAL
- Up to 100 MGD

To NYC Water Supply
- Up to 800 MGD

To New Jersey Water Supply

Note: Not all reservoirs, tributaries, and diversions are shown.
Salt Line Location: October 7, 2019

10/7/2019
Location:
RM 80

Normal October Location:
RM 72
Water Supply Planning Objectives

- Meet Compact planning requirements (Articles)
  - **Water Supply:** sustainable and resilient
    - During existing extremes - floods and droughts
    - Meeting water demands – consumptive and non-consumptive
    - Under future scenarios that include mega trends - water efficiency, energy needs, climate change, ecological flows
  - **Flow Management:** Support needs and targets – balance supply & flood loss reductions
Current Tasks

Water Supply Planning

**Water Supply Planning (DRBC)**
- Water Use

**Partner Led Efforts**
- DE WSCC
- NJ WSAC
- PA State Water Plan

**Water Demand Projections**
- Public Water Supply
- Power
- Industrial / Commercial
- Agricultural
- Other

**Whitepapers**
- Blue Marsh Reservoir
- Beltzville Reservoir
- Brandywine System
- Power (policy)
- FE Walter Expansion

**Water Availability Analyses**
- Surface water
- Non-tidal (SWEET)
- Tidal (PST & Salinity models)
- Groundwater (USGS recurrence interval)

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2060 Planning Elements
Surface Water Intake

- >1,200 active docket approvals for water (groundwater & surface water).
- ~1,500 surface water withdrawals approved in ~375 dockets.
- ~5,600 groundwater withdrawals approved in ~850 dockets.
Delaware River Basin Water Use: CY2016

**Total Water Withdrawals** (ground and surface) from the Delaware River Basin: 6,565 mgd

- Thermoelectric
- Hydroelectric
- Other
- Out of Basin Diversions
- Irrigation
- Self-Supplied Domestic
- Industrial - Nonrefining
- Industrial - Refinery
- Public Water Supply

**Major Exports** from the Delaware River Basin: 607 mgd

- NJ (D&R Canal), 82
- NYC, 525

**Consumptive Use** in the Delaware River Basin: 364 mgd

- Thermoelectric, 96
- Public Water Supply, 100
- Irrigation, 117
- Other, 10
- Industrial - Nonrefining, 14
- Industrial - Refinery, 13
- Self-Supplied Domestic, 12
Monthly Total Water Withdrawals for Three Key Sectors in the Delaware River Basin

**Basinwide water use by sector**

- PWS
- Industrial
- Thermo

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<thead>
<tr>
<th>Year</th>
<th>Million Gallons Per Day</th>
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<td>1994</td>
<td>8,500</td>
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<td>2013</td>
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<td>2014</td>
<td>18,500</td>
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Monthly Consumptive Water Use for Three Key Sectors in the Delaware River Basin

![Graph showing annual consumptive water use for three key sectors in the Delaware River Basin from 1994 to 2014. The graph indicates the amount of water used by PWS, industrial, and thermal sectors, with each sector color-coded for easy differentiation.](image-url)
Public Water Supply Demand--DRB

![Graph showing water supply demand and population trends over time. The graph includes data for years 1990 to 2014, with a focus on public water supply, total use, consumptive use portion (estimated to be 10%), trend in total withdrawals, and DRB population.](image-url)
Established in 1980 at the request of the Commonwealth of Pennsylvania. Why?:

- Groundwater interference and conflicts
- Projected water use expected to exceed the safe yield of GW resources
- Loss of water in public and private wells during dry periods.
- Sub-basin groundwater withdrawal limited were modeled, set and implemented by DRBC.
Between 1990-2013 total withdrawals were reduced by approximately 8.5 billion gallons or 23.4 million gallons a day.

More use of surface water sources including the Delaware River.
Fish kill on the Delaware from oil spill in 1929 (courtesy Temple Archives)

Plastic Pollution along waterways
The Quality of Basin Waters Shall Be Maintained For:

- Public drinking water (after reasonable treatment)
- Recreation
- Wildlife, fish and other aquatic life
- Regulated waste assimilation
NPDES Dischargers in DRB

- NPDES = National Pollutant Discharge Elimination System: Requires Permit to discharge
- Set effluent limits and monitoring requirements in the permit
- 1,164 active discharge permits in Delaware River Basin
DRBC Collaborative Results
Aquatic Life Benefits

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

[Graph showing dissolved oxygen levels over time]

Shad making a big comeback in Delaware River

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

Updated Oct 28, 2017; Posted Oct 28, 2017
DRBC Collaborative Results
Local Economic Benefits

- A dead river zone in the Estuary restored.
- Significant improvement in Dissolved Oxygen.

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

Mapping the Delaware River Waterfront’s building boom
By Melissa Romero and Anna Merriman | Updated Sep 26, 2018, 5:30pm EDT

The Dissolved Oxygen “sag” in the Estuary is primary influenced by point source discharges.
Entire basin upstream from Trenton

Believed to be the longest anti-degradation reach in the US.

It’s more beneficial to “keep the clean waters clean” than to allow them to become degraded and attempt to restore them later.
Other Challenges

What’s in our waters?
- PFAS
- Microplastics
- PCBs
- Other Contaminants of Emerging Concern

Climate
- Precipitation
- Temperature
- Sea Level Rise

Can we swim in it?

Frozen Stemware on the Flat Brook by Evan Kwityn
Polychlorinated Biphenyls (PCBs)

- Man-made organic chemicals
- Industrial and commercial applications
  - Electrical insulating
  - Flame retardant
- Banned in 1979
- Possible human carcinogen
- Not water soluble
PCB Loadings
Top Ten Point Source Dischargers mg/day

- 2005: 35,000 mg/day
- 2011: 12,000 mg/day (62% reduction)
- 2013: 9,000 mg/day (71% reduction)
- 2016: 5,000 mg/day (76% reduction)

76% reduction
Surface water:
- Six tidal sites in 2007, 2008, 2009
- Fifteen tidal sites in 2015
- Four non-tidal sites in 2016

Fish:

Sediment:
- Fifteen tidal sites in 2016
Microplastics

Small plastic pieces less than five millimeters long which can be harmful to our ocean and aquatic life.

- Primary microplastics include microbeads which were commonly found in health care products like face washes and toothpastes.
- Secondary microplastics occur when larger pieces of plastic like bottles and fishing line break down through photodegradation.
Climate Change

- 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
Complex Considerations

Freshwater Hydrologic Climate Considerations:
- Precipitation
- Flow
- Temperature
- Evapotranspiration
- Snowpack

Salt Water Climate Considerations:
- Sea Level Rise
“Regional Sea Level Change Projections: 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

Mean Sea Level Trend, Philadelphia:
- 2.93 mm/year (1/10 inch/year)
- 11.5 inches/century
Data: NOAA
Managing, Improving and Protecting Our Shared Water Resources since 1961