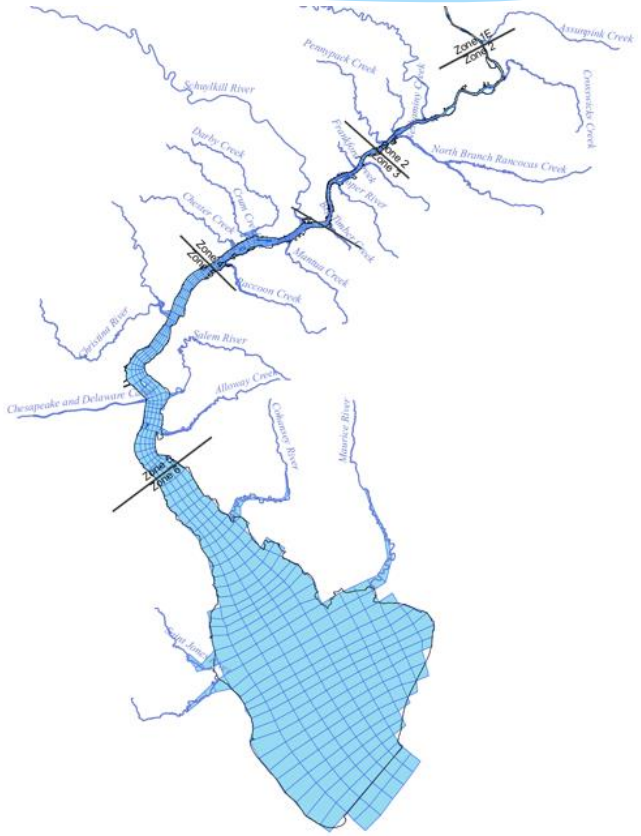
Modeling Eutrophication Processes in the Delaware Estuary to Link Watershed Efforts to Control Nutrient Impacts

Delaware Watershed Research Conference

Philadelphia, PA
November 30, 2018

Principal Investigators:
Namsoo Suk, Ph.D., Li Zheng, Ph.D. and Thomas Fikslin, Ph.D. (Retired)



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Presentation Outline

- Introduction
- Project Goal
- Project Status
  - Data collection
  - Model development

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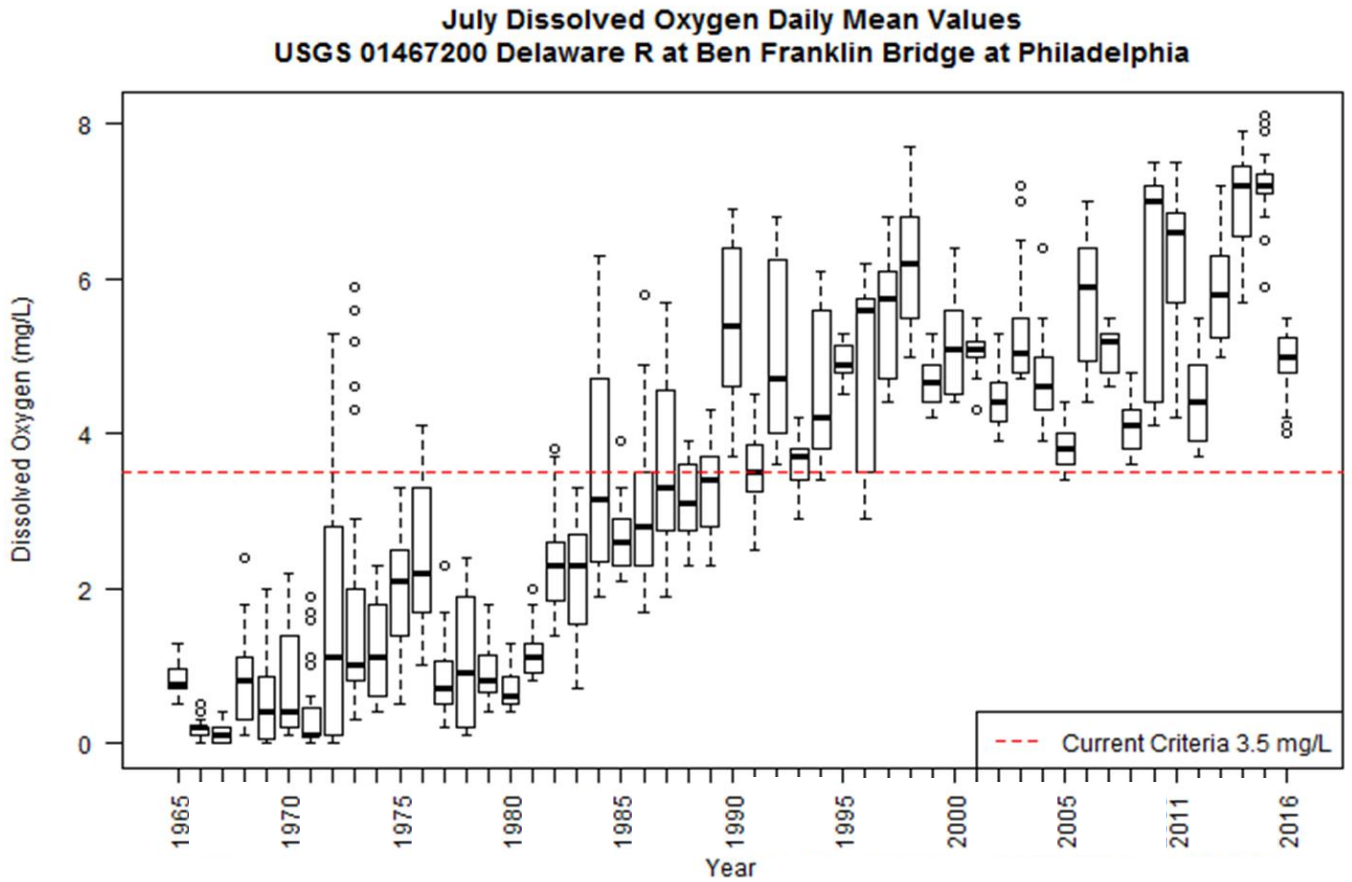
What's Next?



Daily Mean Dissolved Oxygen in July
USGS 01467200 Delaware R. at Ben Franklin Bridge at Philadelphia

What should be the next generation dissolved oxygen water quality criteria for the urban portions of the Delaware River Estuary to properly protect aquatic life use?

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Goal

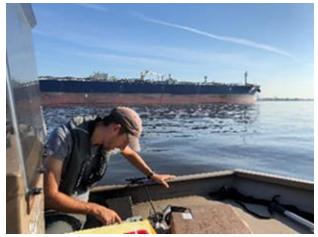
- Develop a linked hydrodynamic and water quality model that will be used to allocate the loads of oxygen demanding nutrients that can be discharged from point and non-point sources into the Delaware River Estuary while maintaining the desired levels of dissolved oxygen.

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

Actions Underway

- Development a linked hydrodynamic and water quality model
  - Model expert panel (Mar. 2018, 2019)
  - Model working group (Nov. 2018)
- Engineering evaluation & cost estimate for improved WWTP ammonia & TN
  - Benefit analysis
- DO needs study for Delaware Estuary fish species

- Enhanced monitoring:
  - Point discharge monitoring
  - BoatRun to year-round
  - Added salinity at tidal boundaries
  - Added nitrate sensors at Trenton & Chester gages
  - Extensive tributary monitoring
  - Light extinction monitoring
  - Primary productivity study



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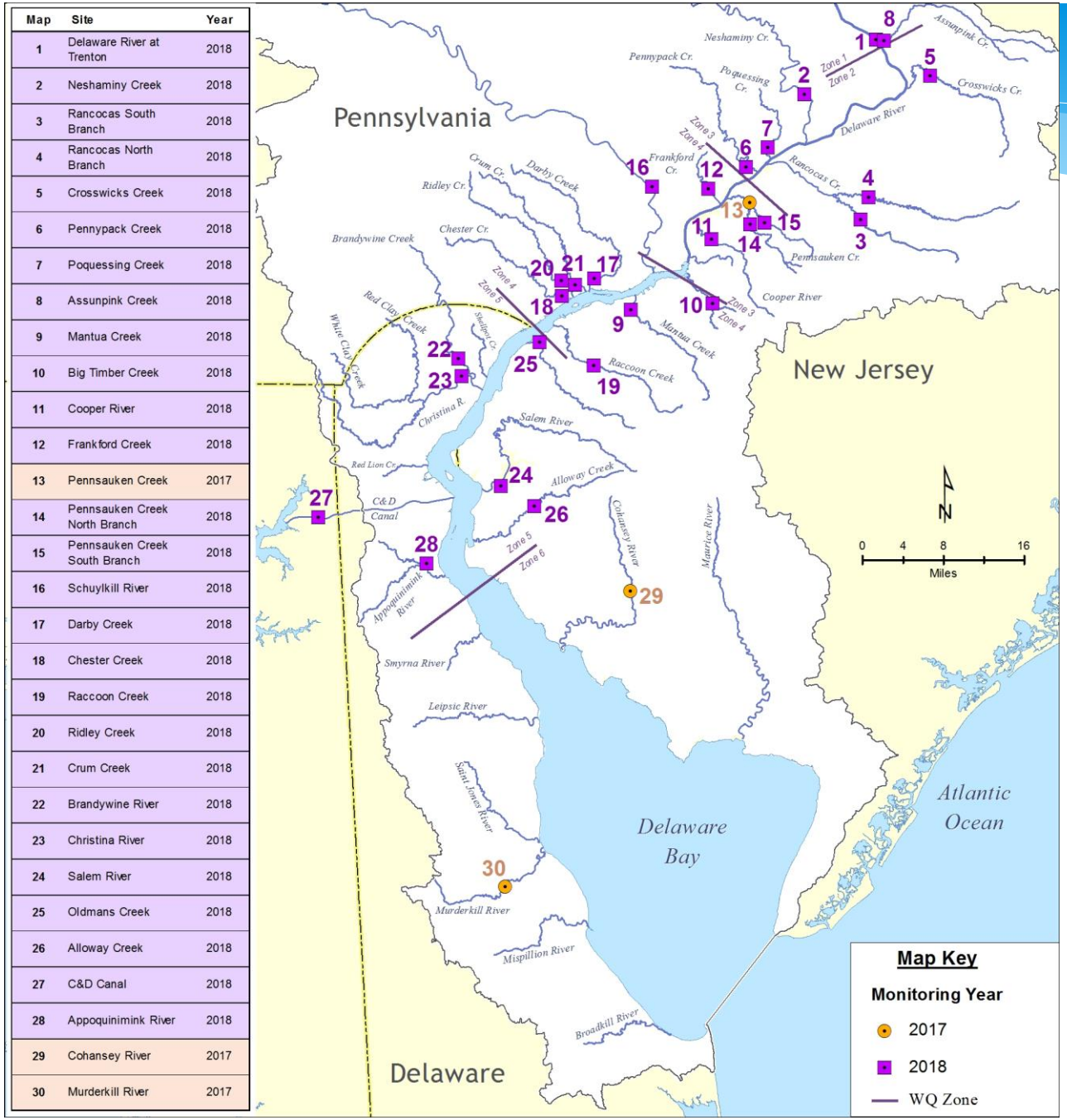
Tributary Monitoring

Map	Site	Year
1	Delaware River at Trenton	2018
2	Neshaminy Creek	2018
3	Rancocas South Branch	2018
4	Rancocas North Branch	2018
5	Crosswicks Creek	2018
6	Pennypack Creek	2018
7	Poquessing Creek	2018
8	Assunpink Creek	2018
9	Mantua Creek	2018
10	Big Timber Creek	2018
11	Cooper River	2018
12	Frankford Creek	2018
13	Pennsauken Creek	2017
14	Pennsauken Creek North Branch	2018
15	Pennsauken Creek South Branch	2018
16	Schuylkill River	2018
17	Darby Creek	2018
18	Chester Creek	2018
19	Raccoon Creek	2018
20	Ridley Creek	2018
21	Crum Creek	2018
22	Brandywine River	2018
23	Christina River	2018
24	Salem River	2018
25	Oldmans Creek	2018
26	Alloway Creek	2018
27	C&D Canal	2018
28	Appoquinimink River	2018
29	Cohansey River	2017
30	Murderkill River	2017



- Water samples collected at 27 tributaries in 2018 to analyze nutrients related parameters:
  - Bi-weekly monitoring for Delaware River at Trenton and Schuylkill River
  - Monthly monitoring for 25 tributaries
- Monitoring stations in tidal portion – collected near one hour before the low slack tide.

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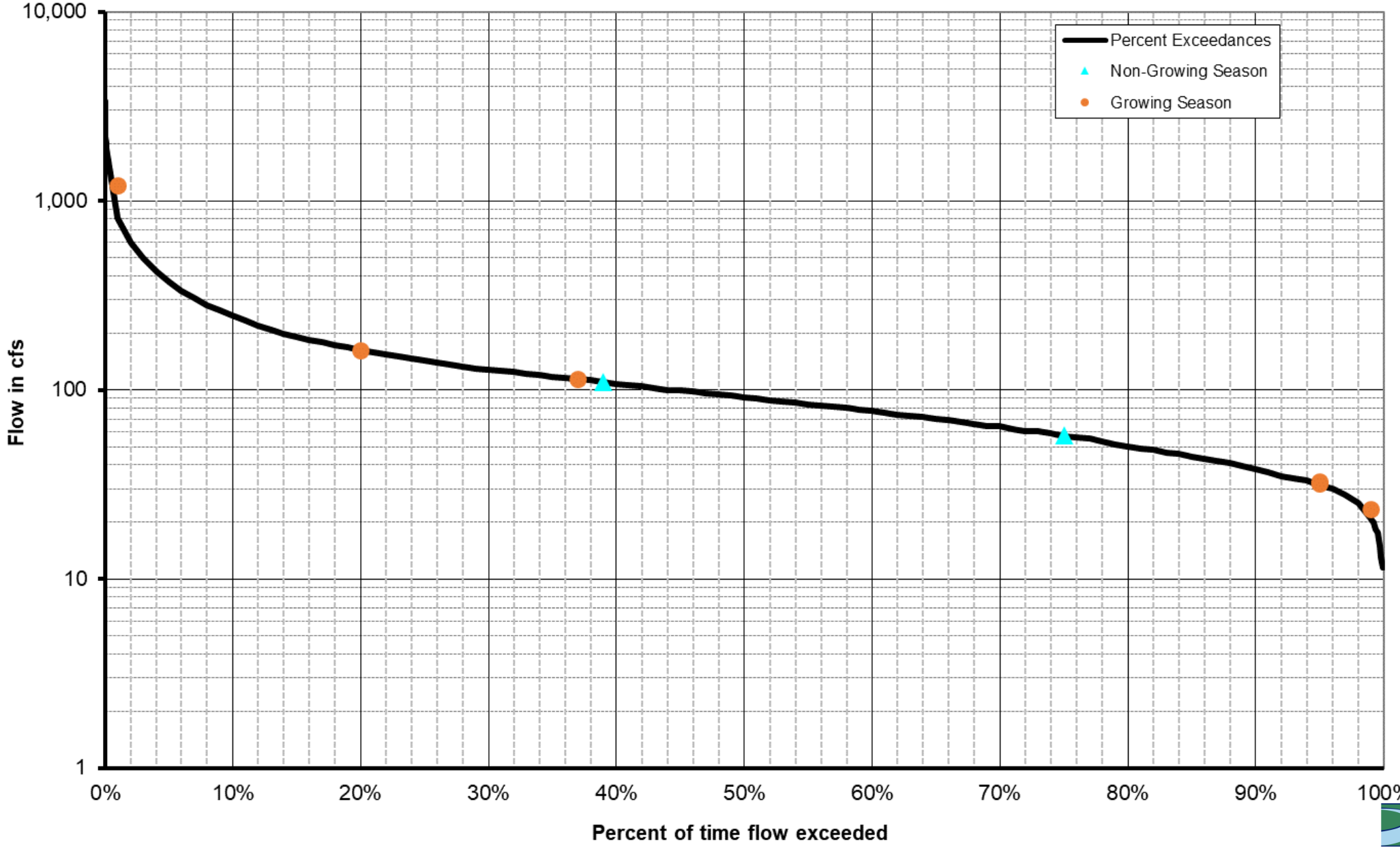
Crosswicks (GRW 6; NGRW 2) USGS Gage 01464500

Growing Season: April 16 – October 15



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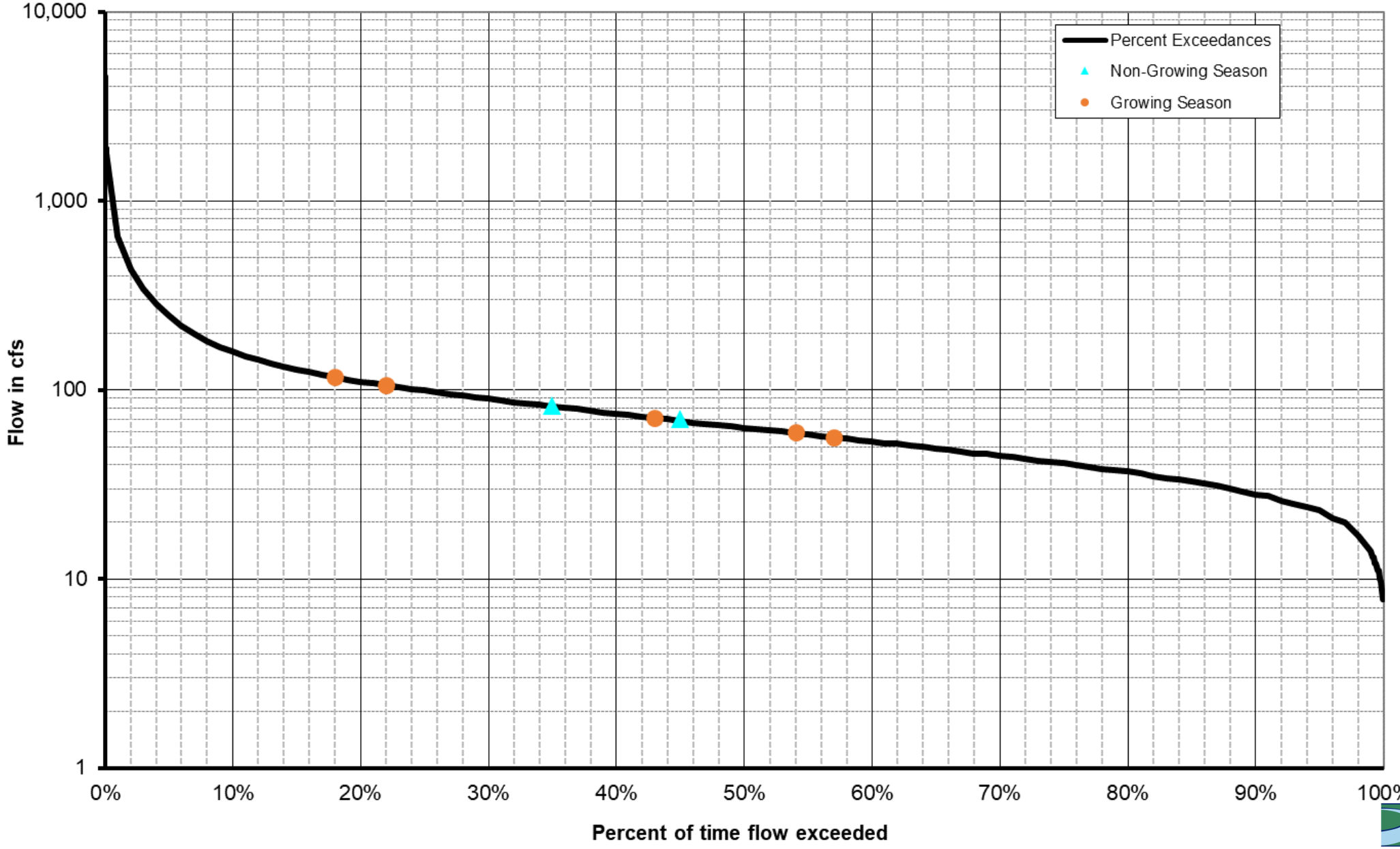
Chester Creek (GRW 5; NGRW 2) USGS Gage 01477000 Growing Season: April 16 – October 15



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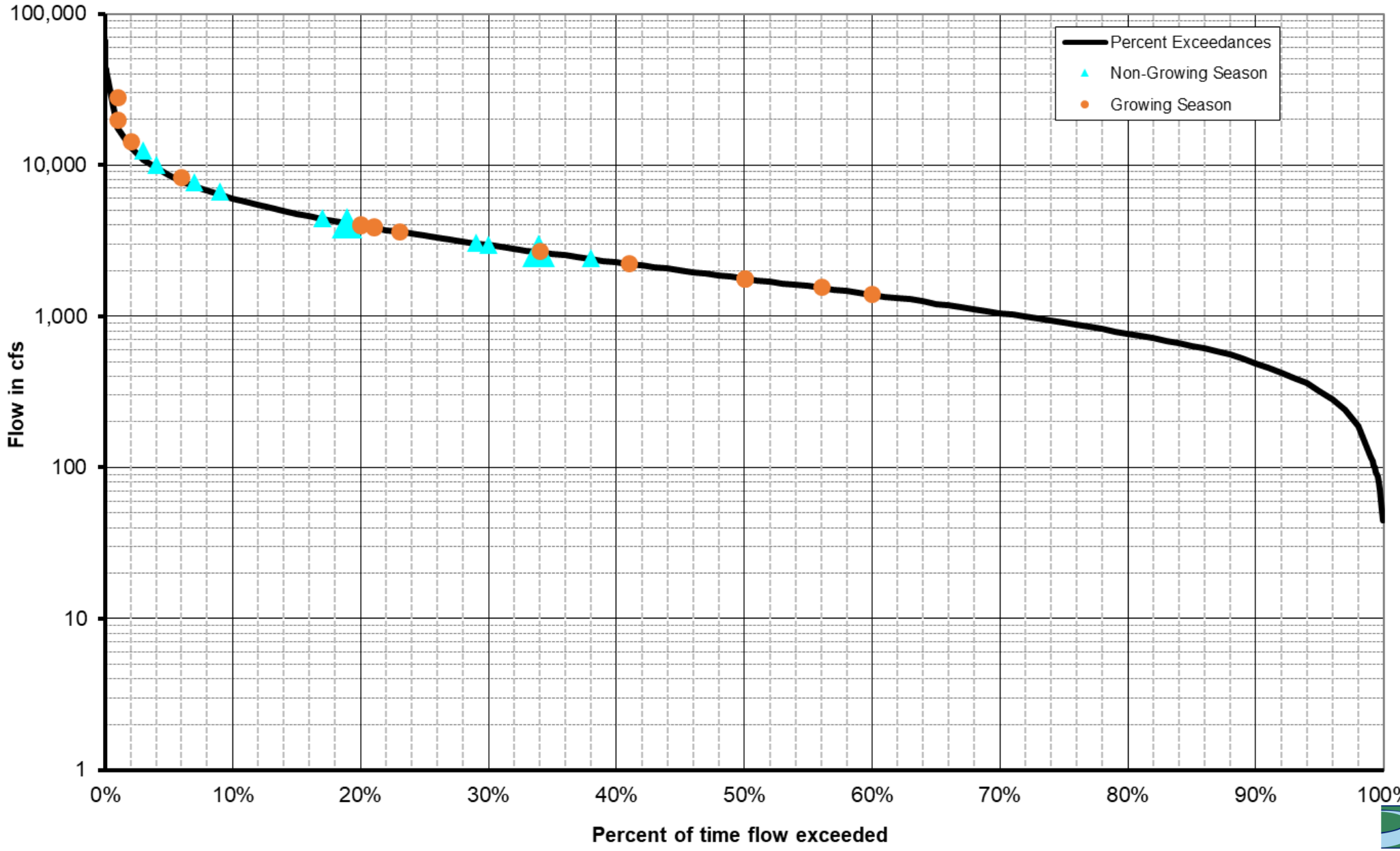
Schuylkill River (GRW 16; NGRW 10) USGS Gage 01474500 Growing Season: April 16 – October 15



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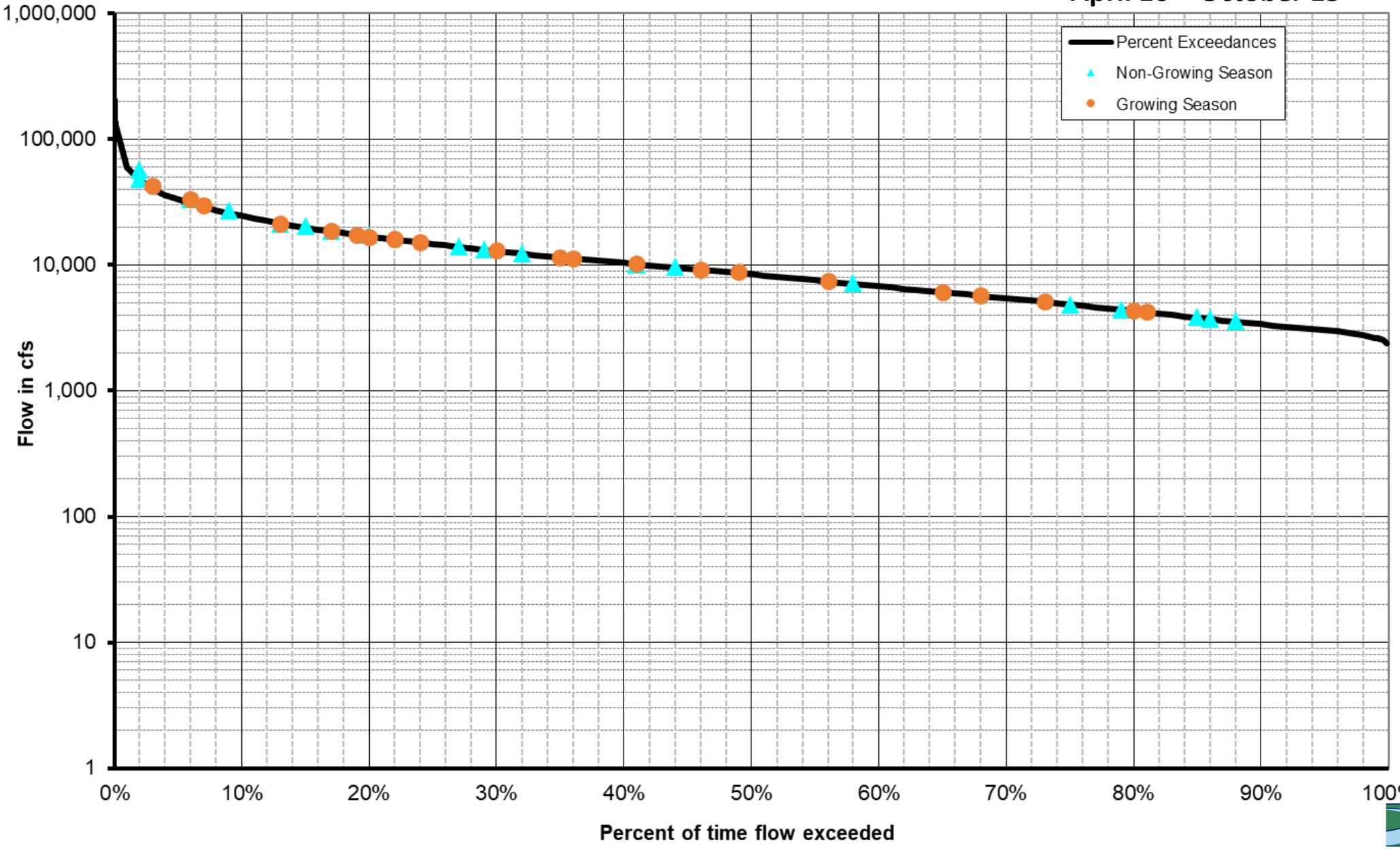
Delaware River @ Trenton (GRW 22; NGRW 22) USGS Gage 01463500

Growing Season:
April 16 – October 15



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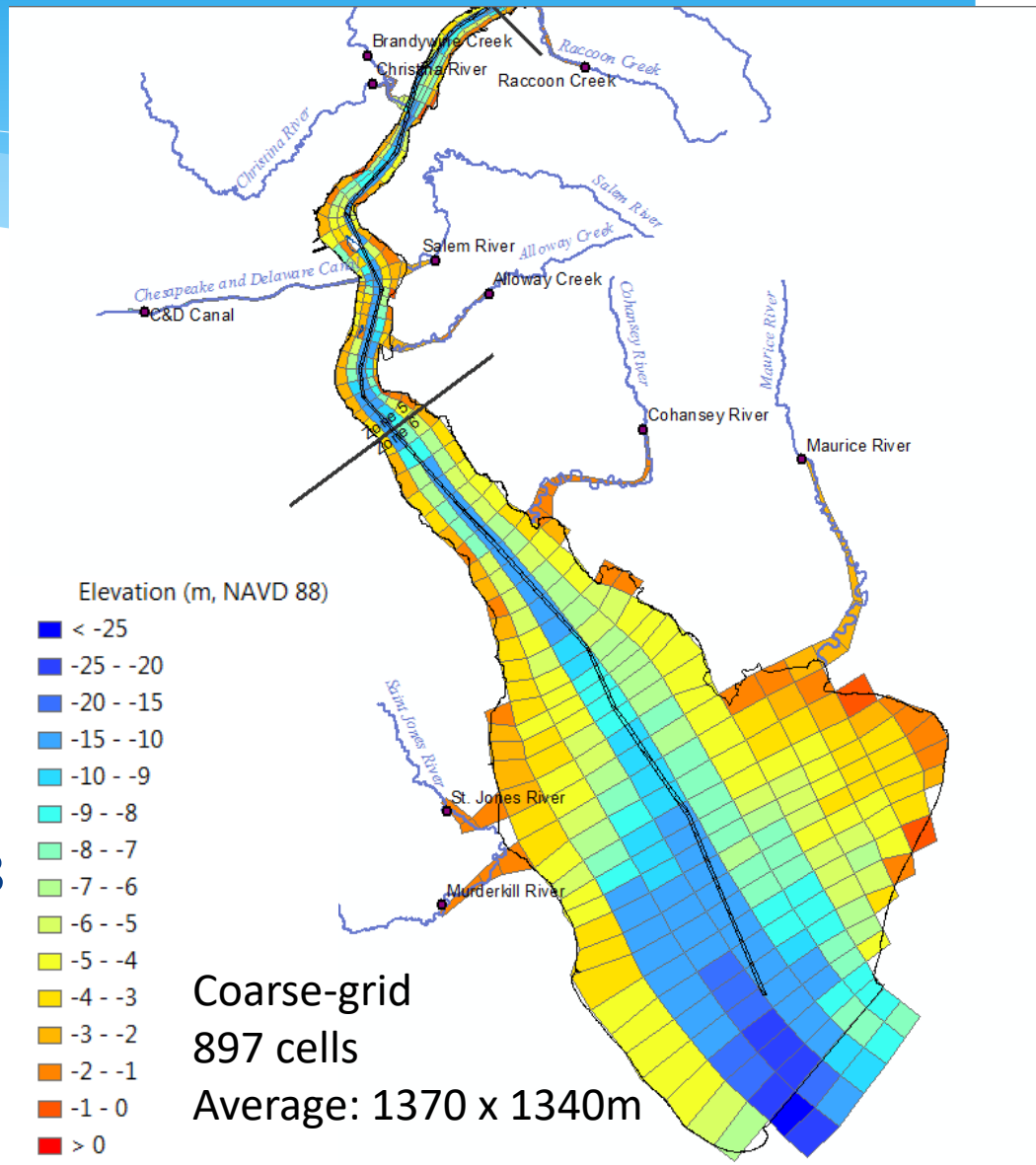
Status: Linked EFDC – WASP8 Model

- Multiple versions of EFDC model was tested using coarse grid 2-D and 3-D models
  - Reasonably simulate water surface elevations
  - Slight over predict extreme temperatures in Bay section (likely resolve by implementing local metrological data)
  - Under predicts salinity intrusion (code validation underway)
  - Review & refine turbulence model input parameters
- Successfully linked coarse grid 2-D EFDC and WASP8 with key source loadings



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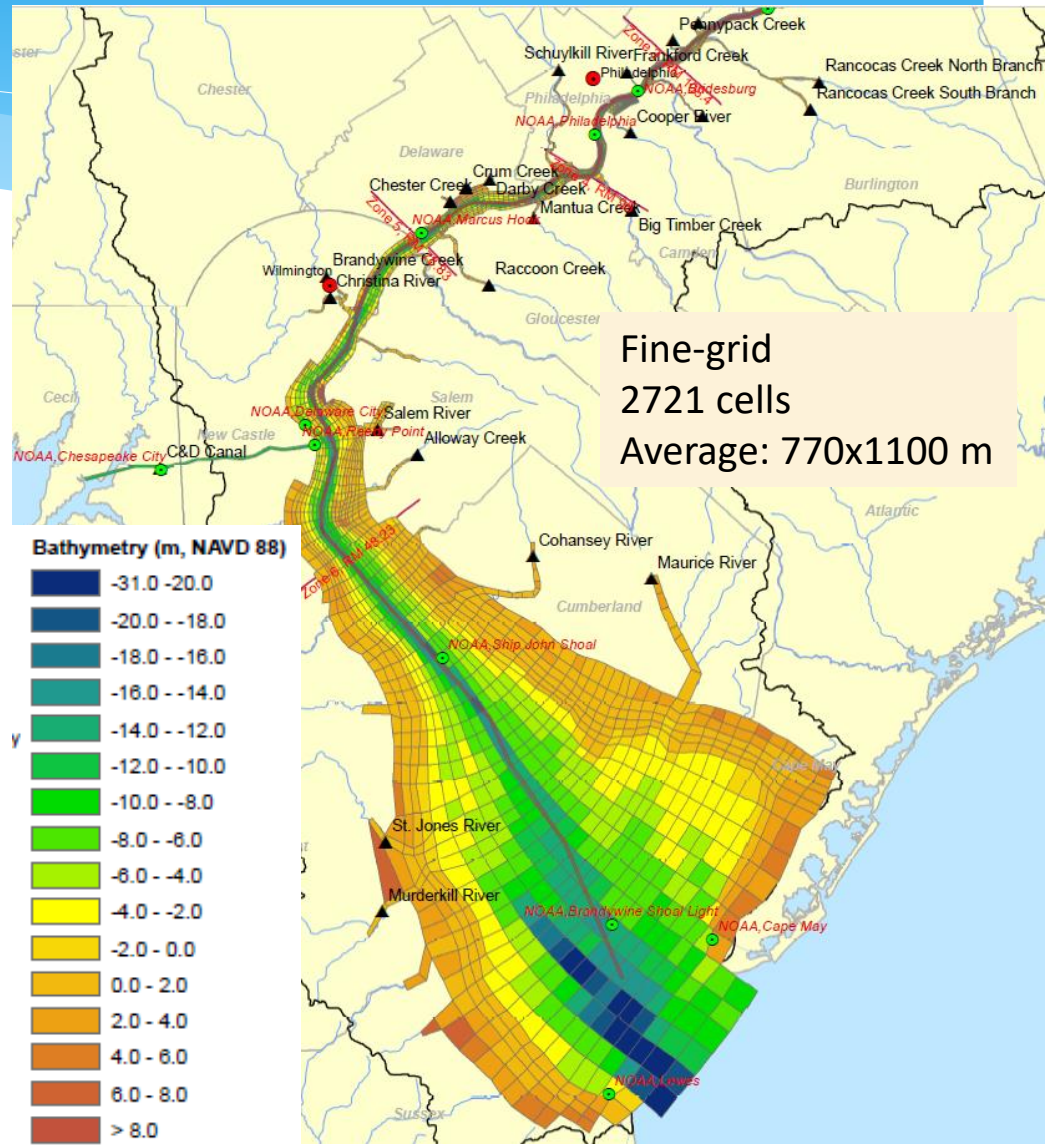
Next Steps: Linked EFDC – WASP8 Model

- Refine grid resolution
  - Better delineation of navigation channel
  - 8~10 vertical layers
  - Increase computational time step ~20 seconds
- Implementation of GVC hybrid grid
- Link 3-D fine grid EFDC and WASP8
- Initiate model calibration using 2017 – 2018 data sets



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Questions?

More Information: https://www.nj.gov/drbc/quality/conventional/DO.html

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  - Thomas Fikslin: Retired

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