

Monitoring Advisory and Coordination Committee (MACC)

Delaware River Basin Commission

West Trenton, NJ

November 30, 2016



Delaware River Basin Commission

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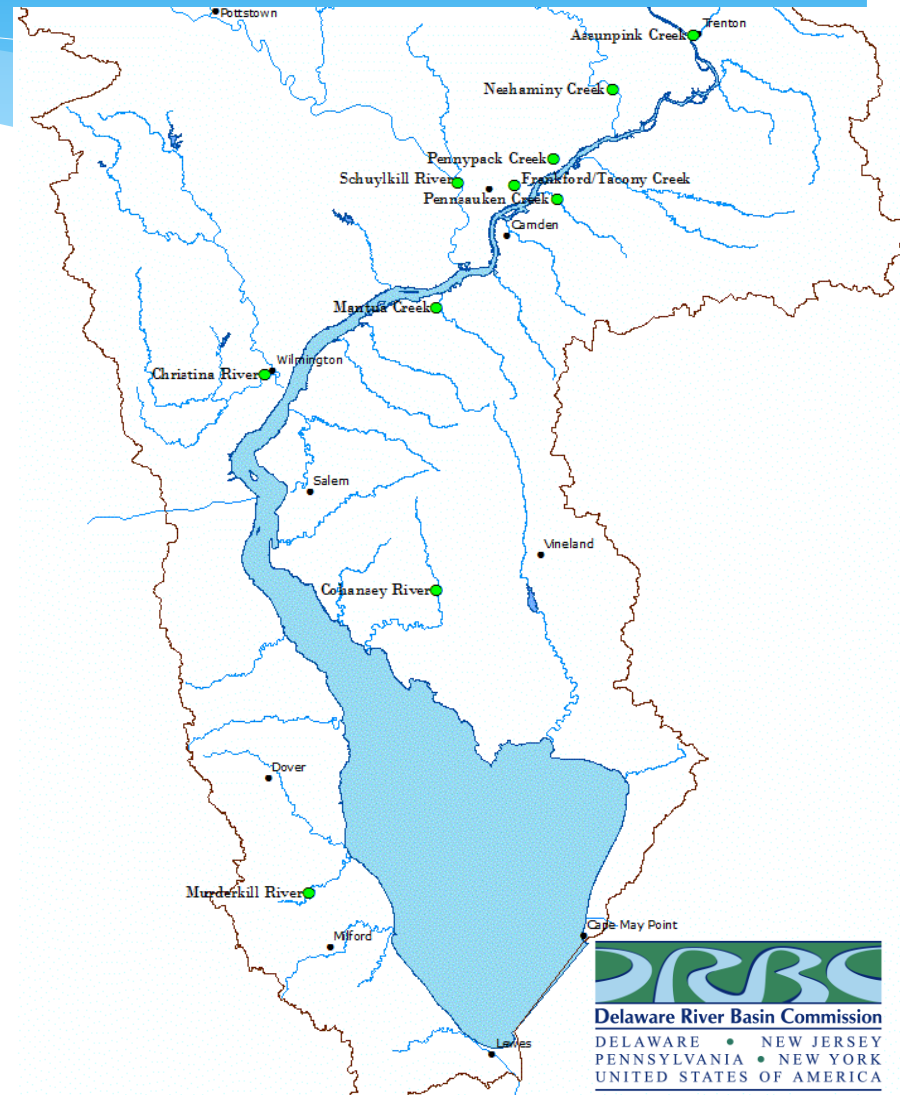


Estuary Tributary Nutrient Monitoring

- * The objective is to cross-check nutrient loading predictions made by USGS SPARROW (SPATIally-Referenced Regression On Watershed attributes) model;
 - * This is one of the first steps toward defining tributary nutrient loadings for the Eutrophication Model as part of the DRBC Nutrient Criteria Development Plan.
- * Ten estuary sample locations (some being tidal):
 - * Assunpink Creek, Neshaminy Creek, Mantua Creek (tidal), Christina River (tidal), Murderkill River (tidal), Pennypack Creek, Pennsauken Creek (tidal), Cohansey River, Schuylkill River, and Frankford/Tacony Creek.

Estuary Tributary Nutrient Monitoring

- * The first round of samples collected in August and September of 2016;
 - * Four sampling events in total;
 - * Aimed to sample near end of falling tide at tidal sites;
 - * Parameters analyzed: COD (Chemical Oxygen Demand), Chloride, $\text{NO}_2 + \text{NO}_3$, Ammonia, TKN (Total Kjeldahl Nitrogen), Total Phosphorus, Orthophosphate, and Alkalinity.
- * More intensive monitoring scheduled for 2017 and 2018 to support Estuary Eutrophication modeling.



Winter Estuary Ammonia Monitoring

- * Question: Is ammonia building up over winter due to lower oxidation rate?
- * Monitoring in Feb 2016
 - * 9 urban mainstem estuary sites (from shore)
 - * 4 sampling events
- * Ammonia
- * NO₂+NO₃
- * TKN
- * *Comparison with other data sets as well*
- * Strong evidence for higher Ammonia concentrations in winter

Sediment PCB Monitoring

Collected Aug & Sep 2016



60 Sample locations + QA/QC

PCBs, 209 congeners,
method 1668A

Dioxins

Grain size, TOC,
bulk & dry
density

OC Pesticides

Perfluorinated
compounds

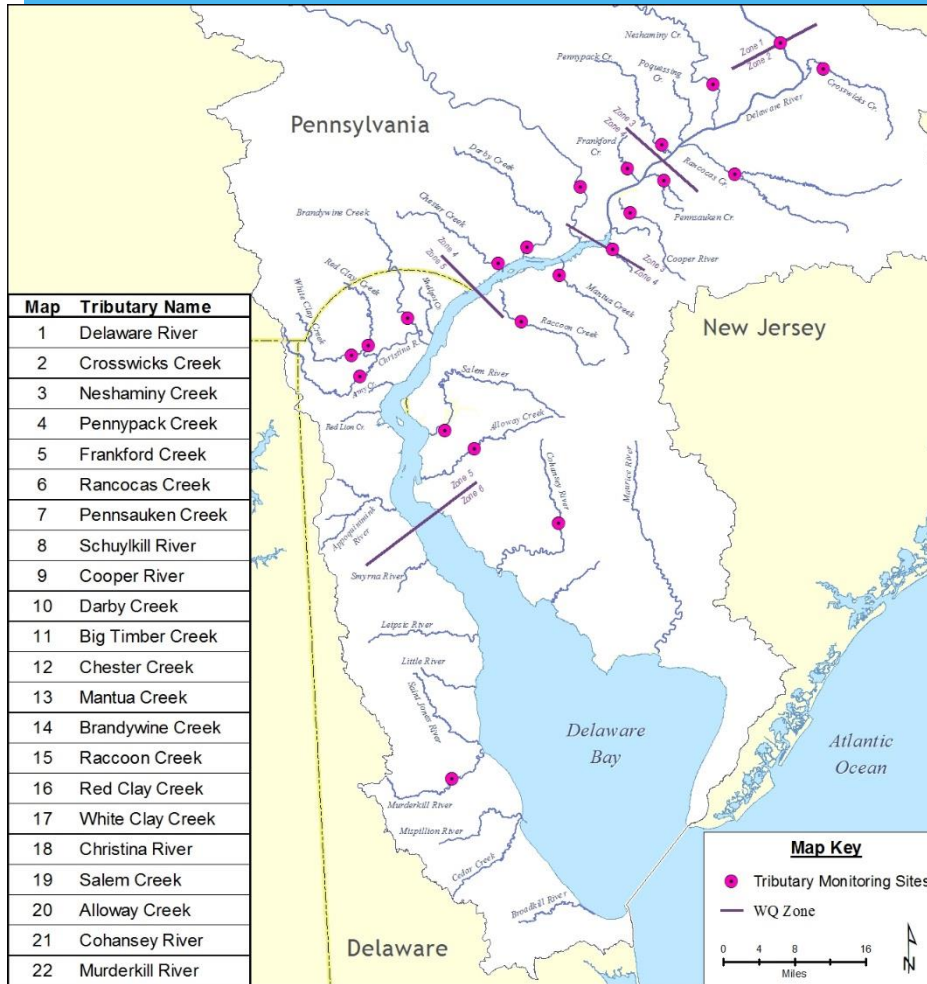
All samples

11 samples

16 samples

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Tributary PCB Monitoring



- * 22 Tributaries to the estuary
- * Low flow (July & August 2016)
- * High flow (ongoing)
- * PCBs, 209 congeners, method 1668A
- * TOC, POC, TSS, and chlorophyll-a

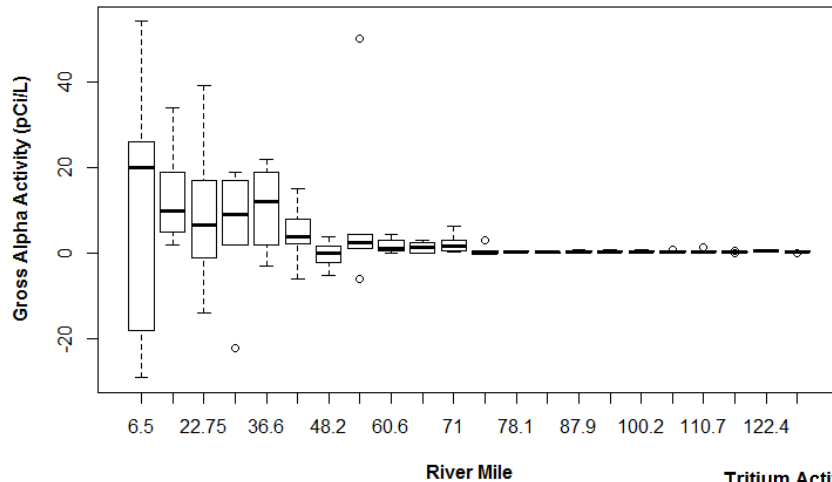
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Boat Run Radiochemistry: Tritium, Gross Alpha, and Gross Beta

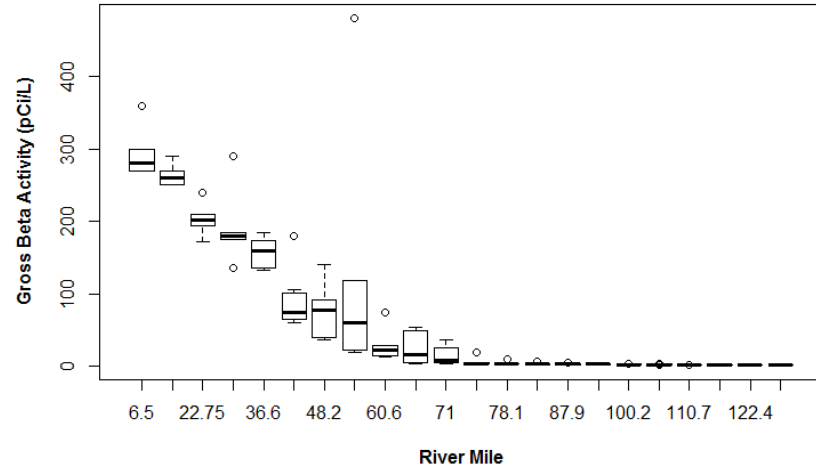
- * Delaware Estuary Boat Run Water Quality Monitoring (Delaware DNREC contracted for this work);
 - * Sample 22 locations starting at River Mile 6.5 (South Brown Shoal) and ending at River Mile 131.04 (Biles Island Channel);
 - Once per month, gross alpha and gross beta samples were collected at all locations, along with a replicate and a blank (24 samples total per month). Tritium samples were collected at 5 locations at locations spanning from River Mile 44.0 to River Mile 66.0 along with a blank (6 samples total per month);
 - NJDOH reports radiochemistry results as both the activity concentration \pm uncertainty and sample-specific minimum detectable concentration (MDC).

Boat Run Radiochemistry: Tritium, Gross Alpha, and Gross Beta

Gross Alpha Activity - Delaware River Mainstem

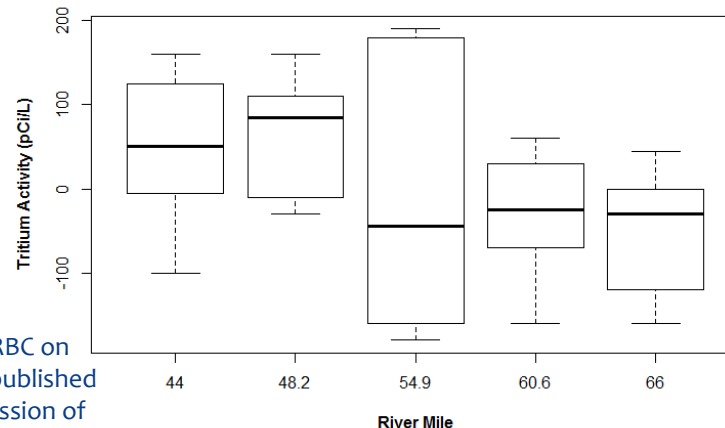


Gross Beta Activity - Delaware River Mainstem



EPA Maximum Contaminant Level for Tritium is 20,000 pCi/L. Exceedances occurred (estimated 10 million pCi/L) at PSEG Nuclear's Salem/Hope Creek reactor complex in early 2015. NJDEP requested that DRBC sample between River Mile 66 and 44 in October 2015 and starting April 2016 .

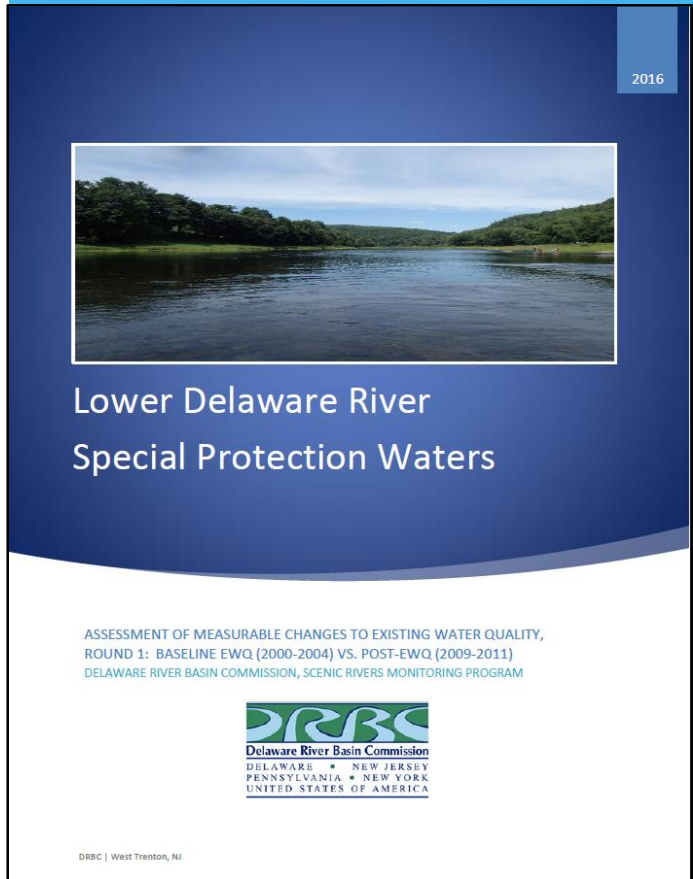
Tritium Activity - Delaware River Mainstem



DRBC Stream Quality Objectives for Radioactivity in Zones 2-6:

- *Alpha emitters not to exceed 3 pCi/L*
- *Beta emitters not to exceed 1,000 pCi/L*

Lower Delaware Measurable Change Assessment 2009-2011



DRBC Publication is Available

Released (pdf) July 2016

Executive Summary,
24 Chapters (one per site):
Within-site measurable changes

3 Appendices:
New ICP/BCP sites
Statistical Guide
Flow Estimation Methods

http://www.state.nj.us/drbc/home/newsroom/news/approved/20160808_LDSPW-EWQrpt.html

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Summary Matrix of Measurable Changes: 440 Within-Site Comparisons at a Glance

Good News:
88% of water quality tests showed no degradation

Site Color Key		Dark Blue = Interstate Control Point (ICP)										Dark Red = Pennsylvania Tributary Boundary Control Point (BCP)					Dark Green = New Jersey Tributary Boundary Control Point (BCP)								
Parameter	Site-->	Del. River at Trenton	Del. River at Washngth Crossing	Pidcock Creek, PA	Delaware River at Lambrtville	Wicke-cheokee Creek, NJ	Lockatong Creek, NJ	Delaware River at Bulls Island	Pauna-cussing Creek, PA	Tohickon Creek, PA	Tinicum Creek, PA	Nishi-sakawick Creek, NJ	Del. River at Milford	Cooks Creek, PA	Musco-netcong River, NJ	Del. River at Rieglsvll	Pohat-cong Creek, NJ	Lehigh River, PA	Del. River at Easton	Bushkill Creek, PA	Marins Creek, PA	Pequest River, NJ	Del. River at Belvidere	Paulins Kill River, NJ	Del. River at Portland
	Site Number-->	1343 ICP	1418 ICP	1463 BCP	1487 ICP	1525 BCP	1540 BCP	1554 ICP	1556 BCP	1570 BCP	1616 BCP	1641 BCP	1677 ICP	1737 BCP	1746 BCP	1748 ICP	1774 BCP	1837 BCP	1838 ICP	1841 BCP	1907 BCP	1978 BCP	1978 ICP	2070 BCP	2074 ICP
Field	Dissolved Oxygen (DO) mg/l											~													
	Dissolved Oxygen Saturation %											~													
	pH, units																								
	Water Temperature, degrees C																								
Nutrients	Ammonia Nitrogen as N, Total mg/l																								
	Nitrate + Nitrite as N, Total mg/l																**								
	Nitrogen as N, Total (TN) mg/l																**								
	Nitrogen, Kjeldahl, Total (TKN) mg/l																								
	Orthophosphate as P, Total mg/l																								
	Phosphorus as P, Total (TP) mg/l																								
Bacteria	Enterococcus colonies/100 ml	~			~																				
	Escherichia coli colonies/100 ml	**	**	**	**	**	**			**	**	**													
	Fecal coliform colonies/100 ml																								
Conventionals	Alkalinity as CaCO3, Total mg/l																								
	Hardness as CaCO3, Total mg/l											~													
	Chloride, Total mg/l			**		**	**	**	**	**		**	**	**	**	**	**	**	**	~	**	**	**	**	**
	Specific Conductance µmho/cm			**		**	**	~	**	**	**	**	**	**	**	**	~	**	**	~	~	~	**	~	
	Total Dissolved Solids (TDS) mg/l																								
	Total Suspended Solids (TSS) mg/l																								
	Turbidity NTU																								
KEY		= No indication of measurable change to EWQ								** = Indication of measurable water quality change toward more degraded status					~ = Weak indication of measurable water quality change toward more degraded status										

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Existing Water Quality Atlas of the Delaware River Special Protection Waters

Delaware River Basin Commission

Existing Water Quality Atlas of the Delaware River Special Protection Waters



DRBC Special Protection Waters Program

May 2016



Maps, Watershed Population, Land Use & Flow Statistics, and Site-Specific Existing Water Quality Tables from West Branch Delaware River to Trenton

85 River Reaches & Watersheds → 88 by 2018

Upper Delaware: 11 ICP's, 19 BCP tribs.

Middle Delaware: 7 ICP's, 20 BCP tribs.

Lower Delaware: 10 ICP's, 18 BCP tribs.

(28 DR sites & 57 tributary watersheds)

Report Released September 2016:

http://www.state.nj.us/drbc/programs/quality/spw_ewq-atlas.html

Best existing scientific knowledge of water quality, flow and characteristics of the Delaware River and its tributaries.

Planned Annual Updates and Additions including discharge inventory, new sites and parameters, updated population and land use, improved flow estimation.

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Scenic Rivers Monitoring Program Shiny App

- * R Statistical Programming used to build application;
- * Interactive visual representation of data across SRMP sites;
 - * User may select: range of years, whether to display boxplot by River Mile or by Month, whether to view strictly ICP sites, strictly BCP sites, or view both, and whether or not to display outliers;
 - * Includes data from outside of DRBC's SRMP (USGS-NWIS and state data for example).

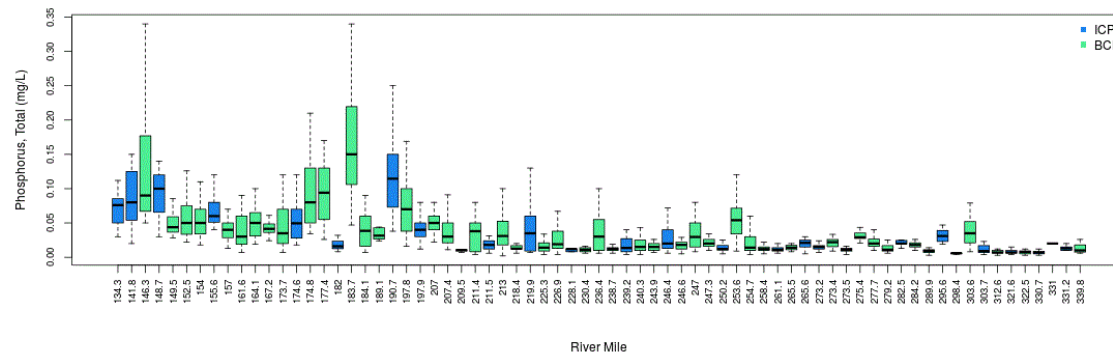
Scenic Rivers Monitoring Program Shiny App

Scenic Rivers Monitoring Program Explorer

Phosphorus, Total (mg/L)

2000 through 2016

River Mile Guide: Mouth of Delaware Bay at River Mile 0, Trenton at River Mile 133, Delaware Water Gap at about River Mile 217, and the head water of the Delaware River at about River Mile 348



Data Summary for Phosphorus, Total (mg/L)

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
0.0020	0.0120	0.0220	0.0413	0.0500	0.8710	2163

[More about SRMP](#)

For more information about this project, contact Robert Limbeck with any comments or questions (Robert.Limbeck@drbc.nj.gov)

programmed by Elaine Panuccio (Elaine.Panuccio@drbc.nj.gov)

Select a Monitoring Parameter:

Phosphorus, Total (mg/L) ▼

Select Range of Years:

2000 2016

Display by:


River Mile
 Month

Control Points (select at least one):

Interstate Control Point (ICP)
 Boundary Control Point (BCP)

**ICP sites: Delaware River Mainstem sites
 BCP sites: Delaware River Tributary sites

Show outliers



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Contaminants of Emerging Concern

<http://www.state.nj.us/drbc/quality/reports/emerging/>

- * Pharmaceuticals and Personal Care Products (**PPCP**) surface water samples SEPA tribs 2013; tidal main stem 2007-2009, proposed 2017
- * Per and poly fluoroalkyl substances (**PFAS**), [e.g., stain repellants and fire fighting foams] fish, surface water and sediment samples 2004 to 2016



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Estuary Eutrophication Monitoring Needs

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Some milestones / drivers 2016

- * WQAC Recommendations to Commissioners January 2016;
- * Commissioner deliberation toward consensus Resolution;
- * Proposal by NOAA to designate Delaware Estuary as Critical Habitat for Atlantic Sturgeon;

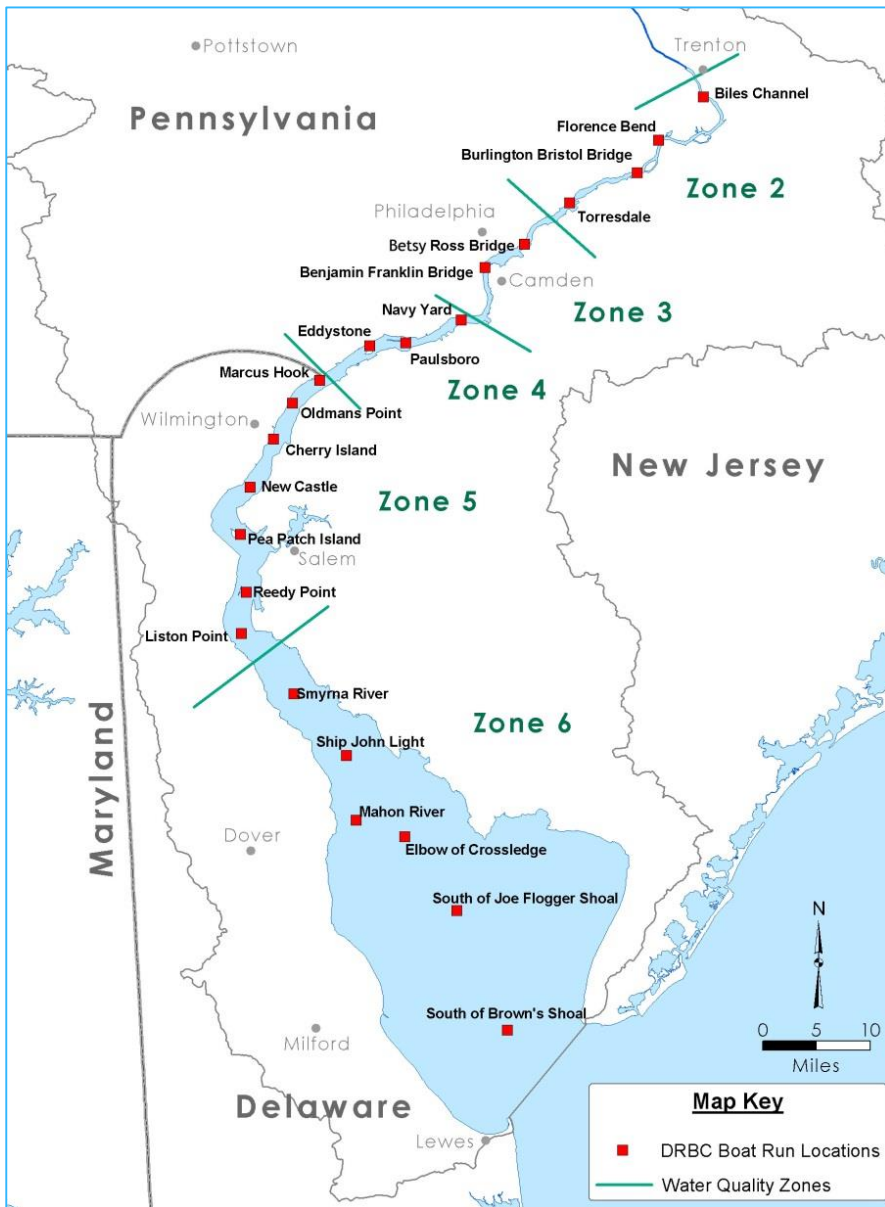
- * Applied for / received funding from WPF to support eutrophication modeling;
- * Hired new modeler, Li Zheng, Ph.D.;
- * Eutrophication Model Expert Panel met Nov. 2 & 3, 2016;

Expert Panel Data Collection Recommendations

- * Measure primary productivity in Zones 2, 3, 4, and upper 5 with an emphasis on respiration rates (2018);
- * Measure point discharge organic carbon – TOC (2018);
- * Extend sulfate measurement to full boat run (2017 – 2018);
- * During intensive-monitoring period, perform even more intensive monitoring during critically important period for nutrient control for temperate rivers (2018);
- * Post meeting (inferred from general feedback);
 - Add FSS to Boat Run, compute VSS (2017 – 2018);
 - Add organic carbon to Delaware at Trenton twice per month sampling (2017 – 2018).

Boat Run Expansion

22 Sites, once per month



Boat
Run
Explorer

- * Beginning Jan 2017
- * Year-round
 - * Routine
 - * Nutrients
 - * Sodium, BLM & Algal params (sulfate all stations)
- * April - October
 - * Bacteria
 - * Metals
- * Possible continuation, additional expansion 2018, 2019

Boat Run Parameters

Routine, Nutrients, Algal

- * Alkalinity (Titrimetric, pH 4.5)
- * Carbon, Organic - Dissolved (DOC)
- * Carbon, Particulate₃
- * Chloride, Total
- * Conductance, Specific - Field
- * Hardness as CaCO₃
- * Nitrogen, Total, Alkaline Persulfate
- * Orthophosphorus, Soluble
- * Oxygen, Dissolved - Membrane Electrode
- * Oxygen, Dissolved - Saturation
- * pH, Field
- * Phosphorus, Total, Alkaline Persulfate
- * Residue, Filterable (TDS)
- * Residue, Nonfilterable (TSS)
- * Fixed Suspended Solids (FSS)
- * Salinity

- * Secchi Depth in Meters
- * Temperature, Air
- * Temperature, Water
- * Turbidity (Nephelometric)
- * Ammonia as N, Dissolved
- * Nitrate as N, Dissolved
- * Nitrate/Nitrite as N, Dissolved
- * Nitrite as N, Dissolved
- * Nitrogen, Dissolved, Alkaline Persulfate
- * Nitrogen, Particulate
- * Phosphorus, Dissolved, Alkaline Persulfate
- * Phosphorus, Particulate
- * Chlorophyll-a
- * Silica, Dissolved
- * PAR extinction at 1-meter

Monitoring Intensive Period

- * Request for cooperating organizations to temporarily align monitoring initiatives / resources to focus on Delaware Estuary, in support of eutrophication model development;
- * DRBC monitoring assets will be expanded, focused on estuary, but...
- * One entity can't do it all;
- * Calendar year 2018 and possibly 2019.

Monitoring Intensive Period Conceptual “wish list”

- * Redirect deployment of spectral analyzers for Nitrate, TOC;
- * Deployment of ADCPs;
- * Make NOAA PORTS whole;
- * Repeat of RARE-type monitoring;
- * Continuation / expansion of cooperator ambient monitoring;
- * Top / bottom DO logger deployments;
- * Targeted / expanded point discharge monitoring.

Delaware River at Trenton – Nutrient Monitoring

- * Monitoring of the Delaware River at Trenton for nutrient data;
 - * Development of Delaware Estuary eutrophication model to define relationship between nutrient loadings and dissolved oxygen response;
 - * Delaware River at Trenton accounts for largest nutrient loading input to the Delaware Estuary, thus is necessary to accurately represent this portion of the basin.

Delaware River at Trenton – Nutrient Monitoring

- * Bi-monthly composite samples will be collected from the Calhoun Street Bridge and will be analyzed by NJDOH ECLS for nutrients and parameters that are important for model calibration;
 - * Monitoring will begin January 2017 and will extend through December 2017;
 - * If funding is available, this monitoring program will occur through 2018, which is DRBC’s “intensive-monitoring year” for establishment of the eutrophication model development and calibration;
 - * Parameters to be analyzed:
 - COD (Chemical Oxygen Demand), Chloride, NO₂ + NO₃ (as N), Ammonia, TKN (Total Kjeldahl Nitrogen), Total Phosphorus, Orthophosphate, TSS (Total Suspended Solids), TVS (Total Volatile Solids), Alkalinity, TOC (Total Organic Carbon), DOC (Dissolved Organic Carbon), Sulfate, Silica, and Chlorophyll a;
 - Chlorophyll a will be analyzed by the Academy of Natural Sciences, whereas the remainder of the parameters will be analyzed by NJDOH.

MACC Administrative Items

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Resolution on Advisory Committees

March 2016

- * **Key Points**
- * “Reserved Positions”
 - * State, Federal, specified organization
- * “Non-reserved Positions”
 - * All others
- * Non-Reserved positions, 5-year appointment
- * Non-reserved appointments expiring in 6 months advertised on DRBC web site for 10 business days
- * Candidates (including previous appointee) apply, resume & letter of interest and qualifications
- * http://www.nj.gov/drbc/library/documents/ResForMinutes031616_a_dv-comm.pdf

Proposed Implementation for MACC

- * Re-established June 2014 (from unofficial to official)
- * http://www.nj.gov/drbc/library/documents/Res2014-04_MACCestablishment.pdf
- * Specified Organizations:
 - * Partnership for the Delaware Estuary (MACC advises PDE in addition to DRBC)
 - * Philadelphia Water Department (reserved appointment)
- * Recommend that non-reserved appointments ‘started’ in June 2014. Expiration June 2019.
- * Discussion?