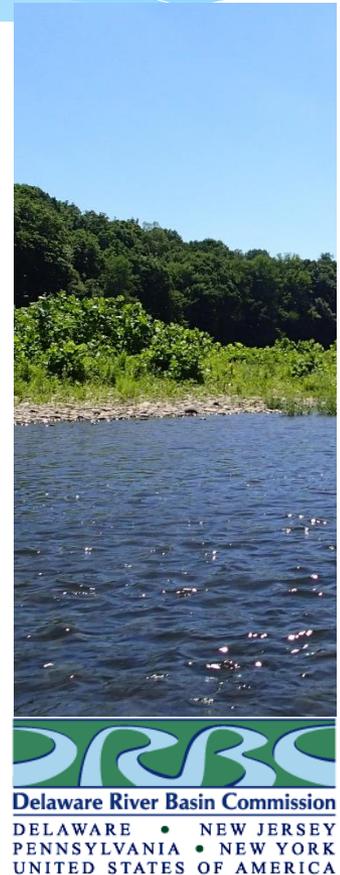


Delaware River Basin Commission

Special Protection Waters: 2009-2011 Lower Delaware Measurable Change Assessment

Delaware Watershed Research Conference 2017

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Preview of Main Discussion Points

1. Special Protection Waters program and definition of DRBC's "Existing Water Quality";
2. DRBC's Special Protection Waters Monitoring Program;
3. Overview of Lower Delaware River Measurable Change Assessment results and some examples.

Special Protection Waters (SPW)



It is the policy of the Commission that there be no measurable change in existing water quality except towards natural conditions in waters considered by the Commission to have exceptionally high scenic, recreational, and/or water supply values.

– Sec 3.10.3A.2

SPW Overview

SPW is a program adopted in 1992 designed to prevent degradation in rivers and streams where the existing water quality is better than water quality standards;

- * DRBC approval is required for new and expanding industrial and municipal wastewater treatment plants in SPW;
 - * To obtain approval, new or expanding discharges must demonstrate to DRBC through Existing Water Quality models that no measurable change to existing water quality will occur;
 - * Permit is issued if demonstrated that the facility is able to maintain the level of protection required within SPW.

Existing Water Quality (EWQ)

- * DRBC must first define the “Existing Water Quality” (EWQ);
 - * Defined on a site-specific basis;
 - * Allows for a practical and repeatable assessment process.
- * Existing Water Quality (EWQ) is a baseline condition that needs to be defined in order to assess any future measurable changes.
- * EWQ has been defined for Delaware River and tributary locations throughout the 197-mile non-tidal stretch at 85 locations.

Special Protection Waters Monitoring Program

- * An effort to monitor and manage water quality in SPW and National Wild and Scenic River segments of the 197-mile non-tidal stretch of river.
- * The program is a collaborative effort and supports the SPW regulations;
 - * DRBC and National Park Service (NPS) partner in this effort;
 - * DRBC monitors the Lower Delaware, while NPS partners lead monitoring in Upper and Middle Delaware River segments;
- * Goals are to assess whether EWQ is maintained in SPW.

Special Protection Waters Monitoring Program Methods

- May through September bi-weekly sampling;
- Conventional parameters, nutrients, bacteria, and field parameters;
- All EPA or USGS methods, EPA-Approved QAPP
- Quality Assurance sampling included Replicates, Field Blanks, and Sample Equipment Rinsate Blanks

Special Protection Waters

Red portion of the map indicates the Upper Delaware River

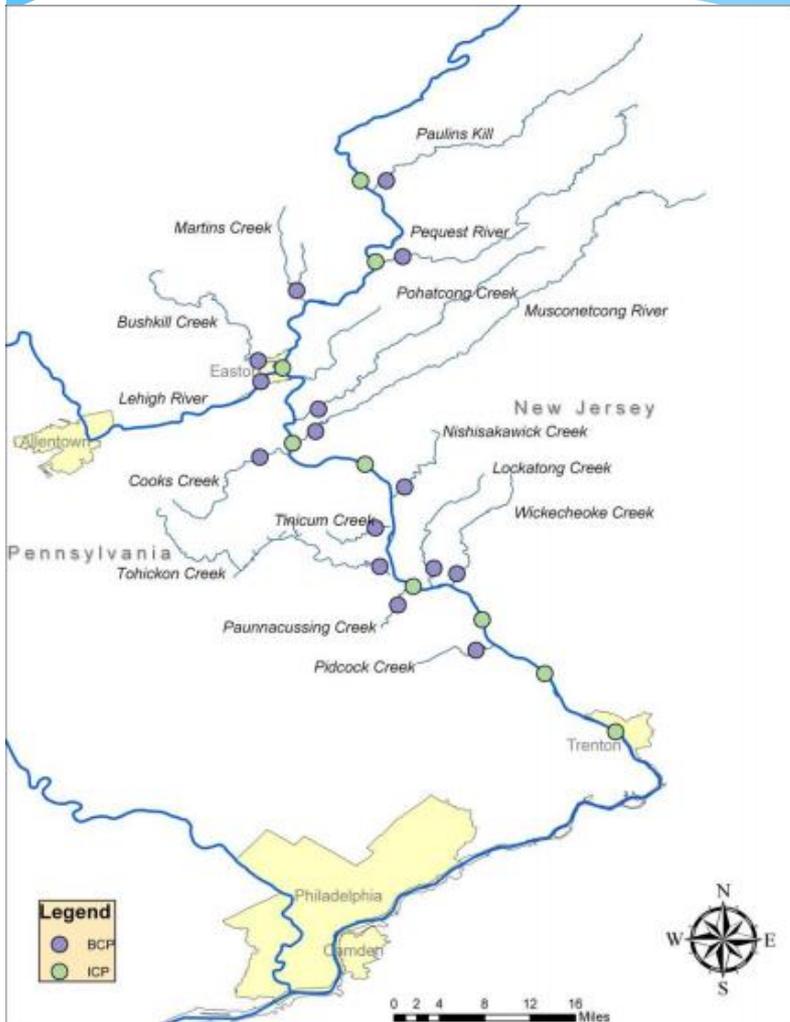
Teal portion of the map indicates the Middle Delaware River (or Delaware Water Gap Recreational Area)

Green portion of the map indicates the Lower Delaware River

SPW rules cover about 6,680 miles of the 13,800 square miles Delaware River Basin watershed area



Lower Delaware Measurable Change Assessment



- * The 2009-2011 Lower Delaware Measurable Change Assessment released in 2016;
- * Discusses water quality at 24 sites within the 76-mile Lower Delaware River segment;
- * Existing Water Quality established from 2000-2004;
- * Assessment period (2009-2011) used to determine statistically significant (95% confidence level) changes in water quality.

Lower Delaware Measurable Change Assessment Approach

Quantitative plots and statistical tests were used in combination for assessment of within-site changes to each parameter between the EWQ and post-EWQ time periods

1. Flow conditions analyzed during study periods to assess possible effects upon water quality analyses
2. Scatter Plot of Concentration vs. Stream Flow (cfs), EWQ vs. Post-EWQ
3. Scatter Plot of Annual Concentration, 2000-2011
4. Box Plot Comparison of EWQ vs. Post-EWQ Concentrations
5. Cumulative Distribution Function (CDF) Comparison of EWQ vs. Post-EWQ
6. Kruskal-Wallis Statistical Test of Difference between EWQ and Post-EWQ

***Link for the Measurable Change Assessment is included on the last slide**

Lower Delaware Assessment Findings

- 88% of tests reveal no evidence of water quality degradation and actually reveal lowered water quality concentrations in many areas;
 - Nutrients concentrations decreased at many sites since 2000;
 - Chlorides and specific conductance increased at most locations, which is not a Delaware River Basin problem, but a U.S.A. issue;
 - Still well below water quality criteria despite the increase;
 - E. coli concentrations increased from Nishisakawick Creek (Frenchtown, NJ) southward;
 - Increased concentrations concomitantly occurred with the replacement of the Frenchtown sewage treatment plant in order to meet modern day treatment standards.

Key for Summary Matrix

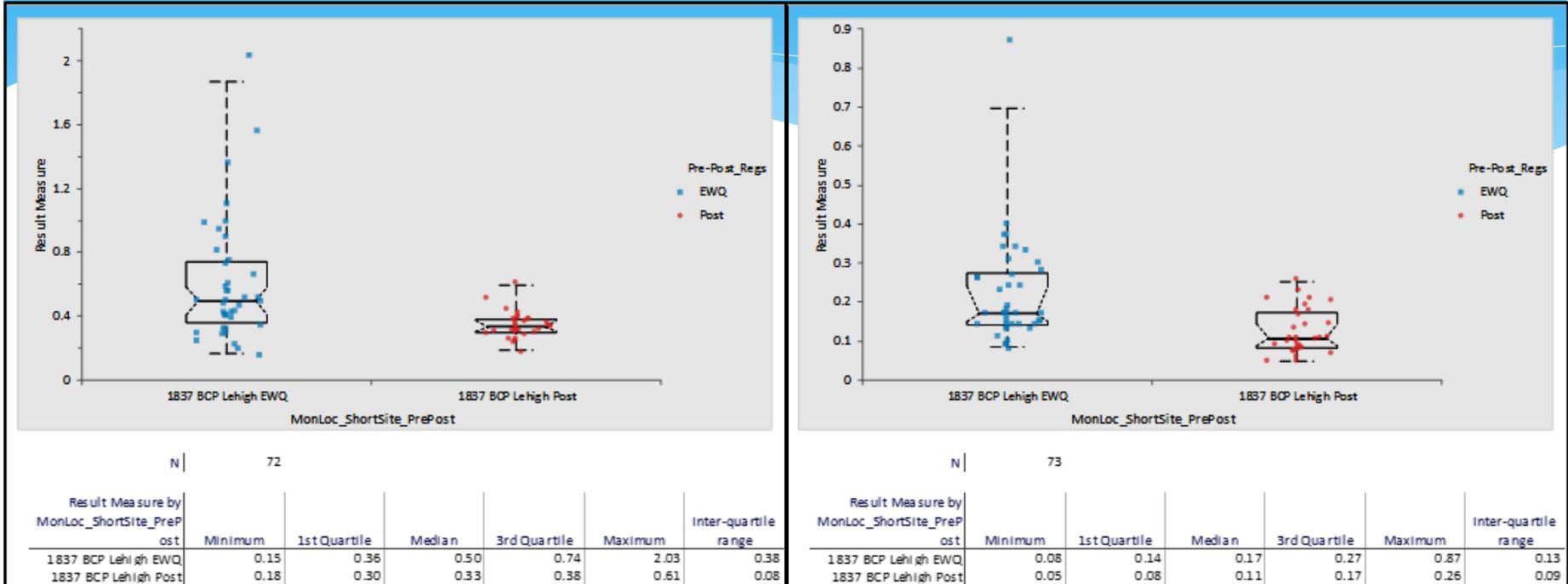
Assessment Key (2000-2004 baseline vs. 2009-2011 assessment round 1)

	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

Summary Matrix of Measurable Changes: 480 Within-Site Comparisons at a Glance

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)									
Site-->		Del. River at Trenton	Del. River at Washngtn Crossing	Pidcock Creek, PA	Delaware River at Lambrville	Wicke-cheokee Creek, NJ	Lockatong Creek, NJ	Delaware River at Bulls Island	Pauna-cussing Creek, PA	Tohickon Creek, PA	Tincum 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	Martins Creek, PA	Pequest River, NJ	Del. River at Belvidere	Paulins Kill River, NJ	Del. River at Portland	
Parameter		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							

EWQ vs. Post-EWQ Box Plots

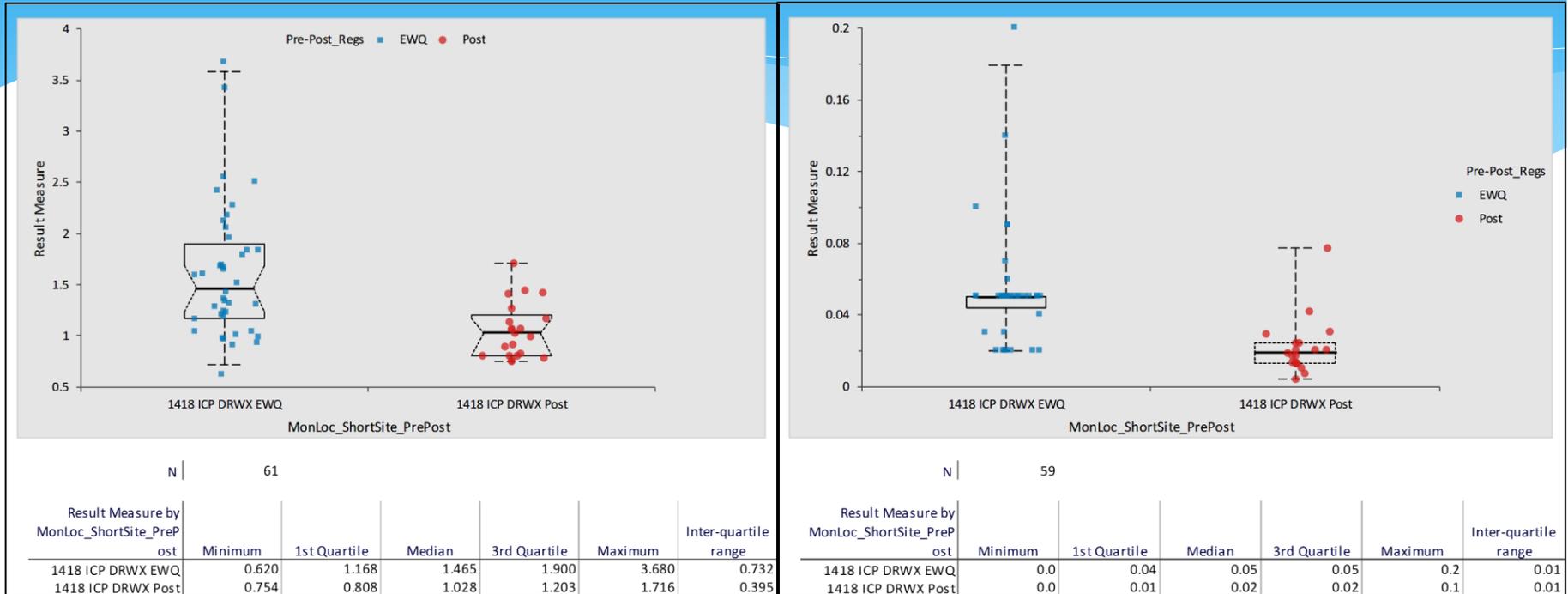


Lehigh River: **Kjeldahl Nitrogen**

Lehigh River: **Total Phosphorus**

Improvements seen in Lehigh River water quality. These improvements were statistically significant.

EWQ vs. Post-EWQ Box Plots



Improvements seen in the Delaware River at Washington Crossing water quality. These improvements were statistically significant.

2016



Lower Delaware River Special Protection Waters

ASSESSMENT OF MEASURABLE CHANGES TO EXISTING WATER QUALITY,
ROUND 1: BASELINE EWQ (2000-2004) VS. POST-EWQ (2009-2011)
DELAWARE RIVER BASIN COMMISSION, SCENIC RIVERS MONITORING PROGRAM



DRBC | West Trenton, NJ

Is the SPW program working?

The results of the Lower Delaware Measurable Change Assessment (2009-2011) demonstrates that DRBC's SPW program is an effective anti-degradation program and plays a vital role in the management of water quality in the Delaware River Basin.



Contacts

Link to the Lower Delaware

Assessment: http://www.nj.gov/drbc/library/documents/LowerDel_EWQrpt_2016/LDel_EWQrpt_2016_entire.pdf

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DRBC Existing Water Quality Atlas of the Delaware River Special Protection Waters:

http://www.nj.gov/drbc/library/documents/SPW_EWQ-Atlas/entire-report.pdf

