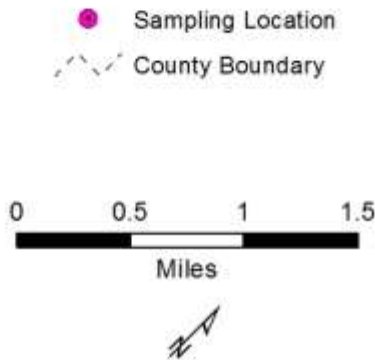


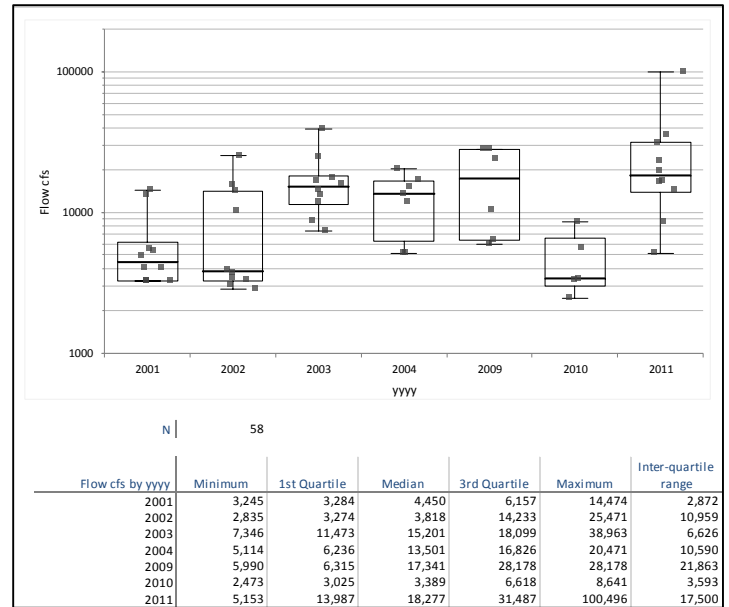
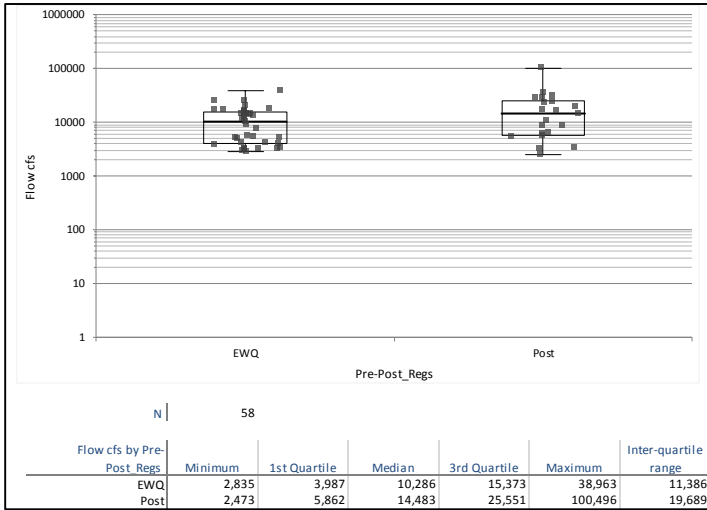
Chapter 4: 1487 ICP Delaware River at Lambertville/New Hope Bridge, NJ/PA



1487 ICP
Delaware River at Lambertville Bridge



Analysis of flow differences between the EWQ and post-EWQ monitoring periods:



Annual flow statistics are plotted above. Flow is plotted on a logarithmic scale. These are May to September flow measurements associated with the time of each water quality sample. Flow is estimated at this location using drainage area weighting based on the USGS continuous stream gage at Trenton, NJ. “Normal” flow is about 10,000 cfs at this location on the Delaware River.

Kruskal-Wallis test

Flow cfs by Pre-Post_Regs	n	Rank sum	Mean rank
EWQ	37	318.2	8.60
Post	21	560.6	26.69

H statistic	3.08
χ^2 approximation	3.08
DF	1
p-value	0.0792 ¹

H0: $\theta_1 = \theta_2 = \theta...$

The median of the populations are all equal.

H1: $\theta_i \neq \theta_j$ for at least one i,j

The median of the populations are not all equal.

¹ Do not reject the null hypothesis at the 5% significance level.

Flow was not statistically different between the two periods at this location, though EWQ flow was normal for the May to September period and post-EWQ flow was generally above-normal.

Upstream ICP: Delaware River at Bulls Island 1554 ICP
 Downstream ICP: Delaware River at Washington Crossing 1418 ICP

Tributary BCP Watersheds in Upstream Reach:

Alexauken Creek, NJ – 1495 BCP (new, EWQ definition in progress)

Wickechoke Creek, NJ – 1525 BCP

Lokatong Creek, NJ – 1540 BCP

All other tributaries to the upstream reach are less than 20 square miles drainage area, possess no wastewater discharges, and are expected to exert very little water quality influence upon the Delaware River.

Chapter 4: 1487 ICP

Delaware River at Lambertville/New Hope Bridge, NJ/PA

Alkalinity as CaCO₃, Total mg/l

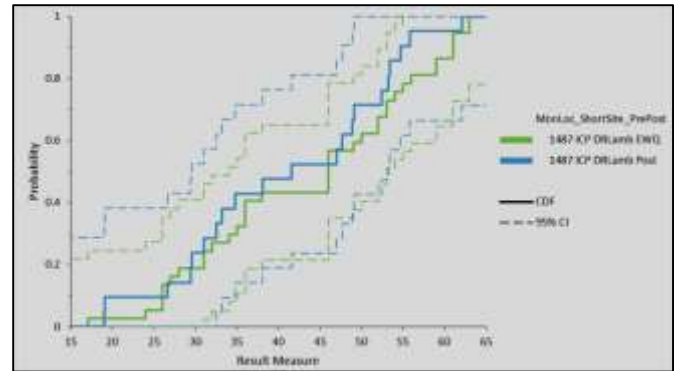
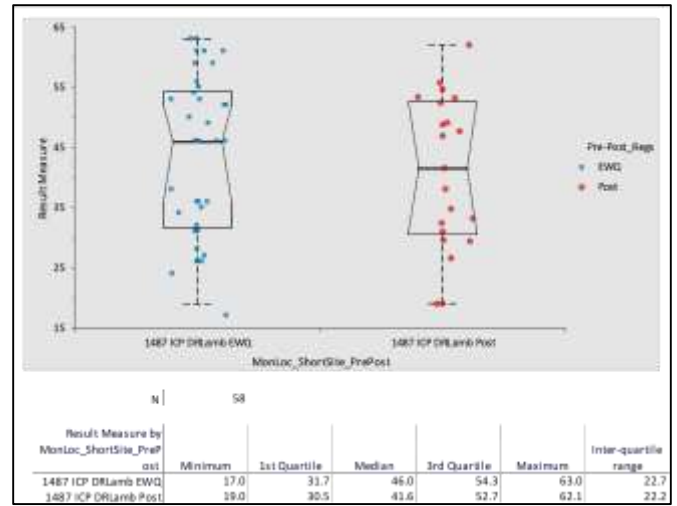
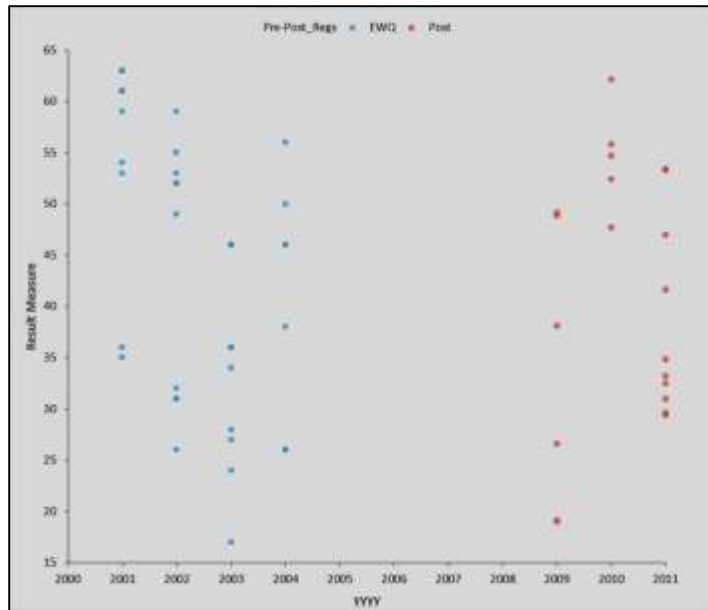
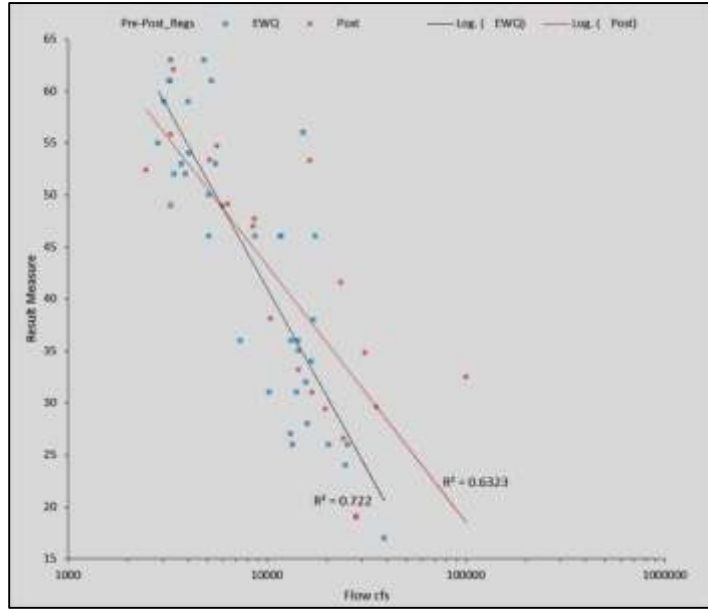
Existing Water Quality (Table 2W):

Median 46 mg/l

Lower 95% Confidence Interval 36 mg/l

Upper 95% Confidence Interval 52 mg/l

Defined in regulations as a flow-related parameter



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DRLamb EWQ	37	44.3	1.20
1487 ICP DRLamb Post	21	78.1	3.72

H statistic: 0.43
 X² approximation: 0.43
 DF: 1
 p-value: 0.5120¹

H0: $\theta_1 = \theta_2 = 0...$
 The median of the populations are all equal.
 H1: $\theta_i \neq \theta_j$ for at least one i, j
 The median of the populations are not all equal.
¹ Do not reject the null hypothesis at the 5% significance level.

No water quality degradation is evident. Alkalinity did not measurably change between the EWQ and post-EWQ periods. Alkalinity is inversely related to flow. Post-EWQ median alkalinity fell within the EWQ 95% confidence intervals. The overall distributions were closely matched. Note that flow is plotted on a logarithmic scale.

Chapter 4: 1487 ICP

Delaware River at Lambertville/New Hope Bridge, NJ/PA

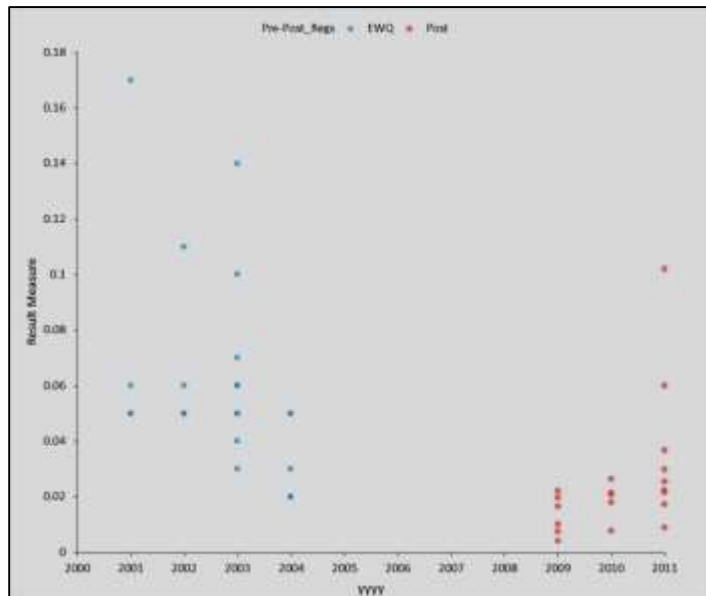
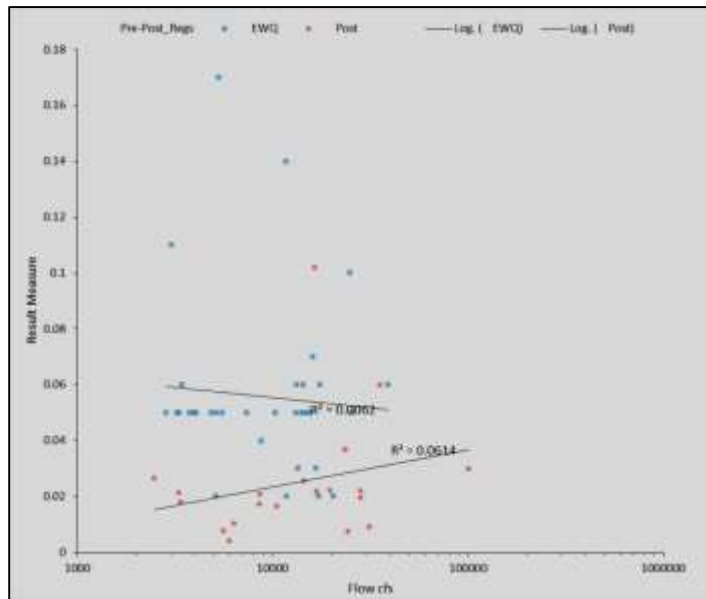
Ammonia Nitrogen as N, Total mg/l

Existing Water Quality (Table 2W):

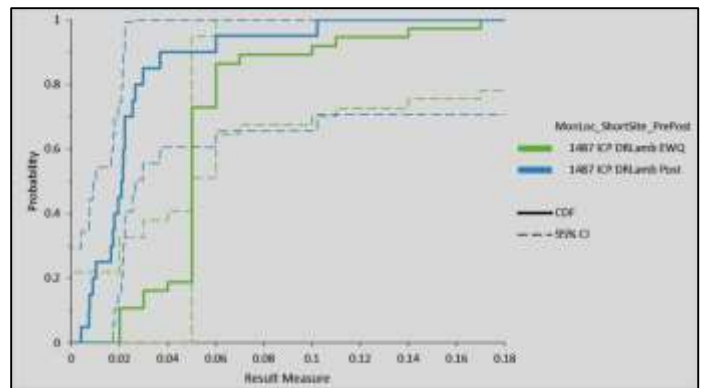
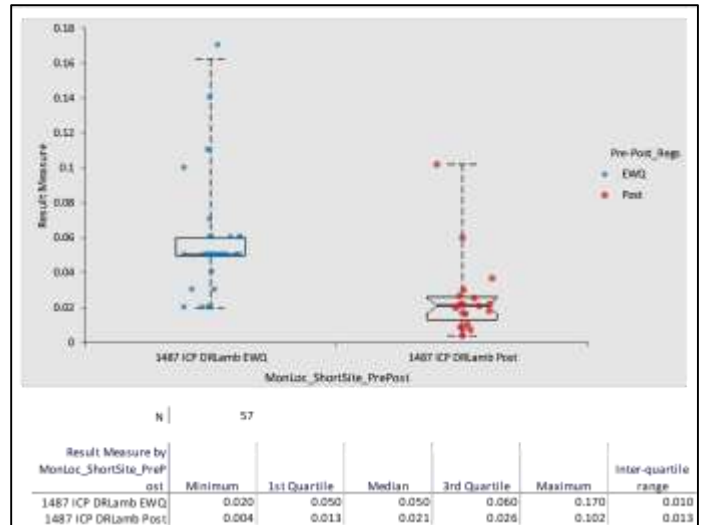
Median <0.05 mg/l

Lower 95% Confidence Interval <0.05 mg/l

Upper 95% Confidence Interval 0.05 mg/l



No water quality degradation is evident. Ammonia concentrations apparently declined. However, differences in detection limits and potential laboratory artifacts introduced uncertainty in the conclusion. No independent data were available to validate results.



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DR Lamb EWQ	37	1948.4	52.66
1487 ICP DR Lamb Post	20	3604.6	180.23

H statistic | 21.10
 X² approximation | 21.10
 DF | 1
 p-value | <0.0001¹

H0: $\theta_1 = \theta_2 = \theta...$

The median of the populations are all equal.

H1: $\theta_i \neq \theta_j$ for at least one i, j

The median of the populations are not all equal.

¹ Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

The post-EWQ detection limit (0.004-0.006 mg/l) was much lower than the EWQ period (0.05 mg/l 2002-2003; 0.02 mg/l in 2004). The EWQ data set possessed 24/37 undetected results, which interfered with estimation of the median concentration. Under lower detection levels there was only one non-detect result in the post-EWQ period. Only 10% (2/20) of post-EWQ results were above 0.05 mg/l, where 27% (10/37) of EWQ results were above 0.05 mg/l. This may represent a water quality improvement.

Chapter 4: 1487 ICP

Delaware River at Lambertville/New Hope Bridge, NJ/PA

Chloride, Total mg/l

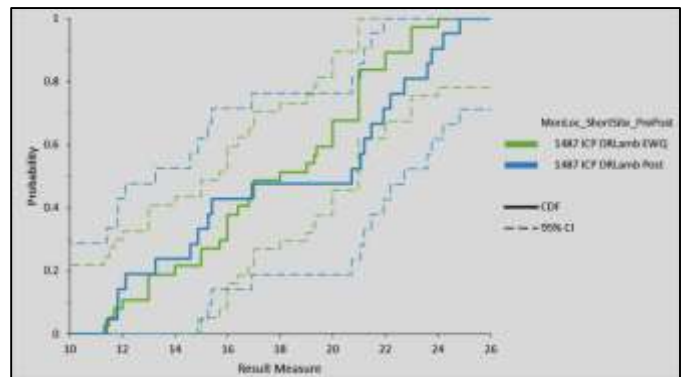
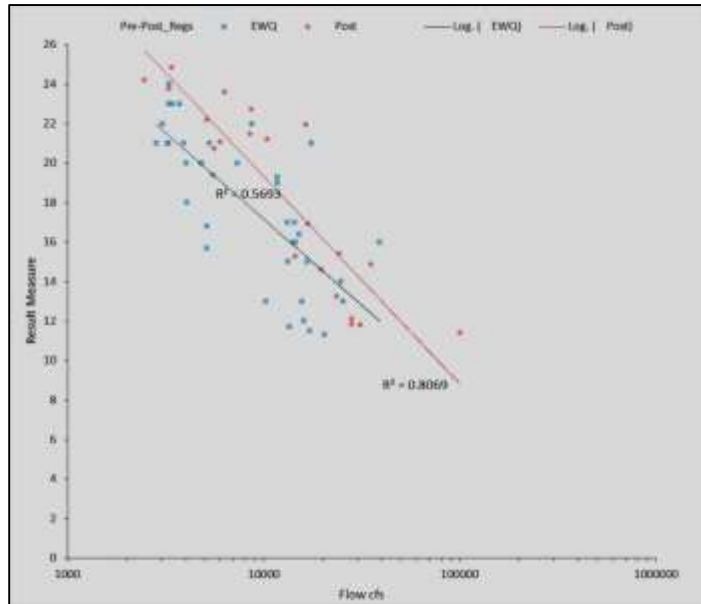
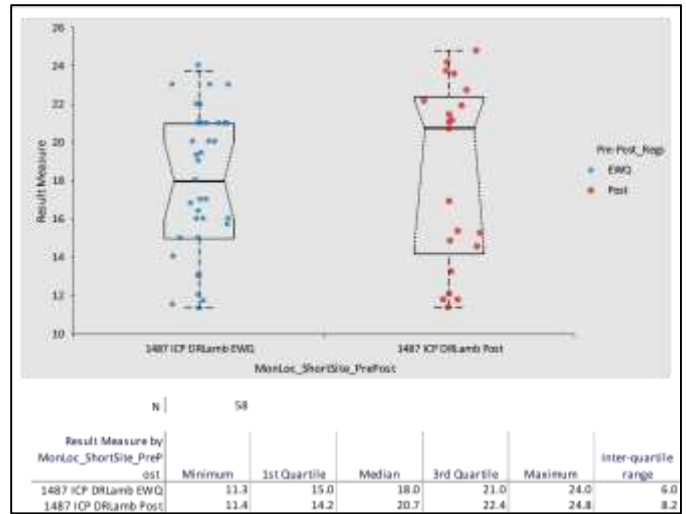
Existing Water Quality (Table 2W):

Median 18 mg/l

Lower 95% Confidence Interval 16 mg/l

Upper 95% Confidence Interval 20 mg/l

Defined in regulations as a flow-related parameter

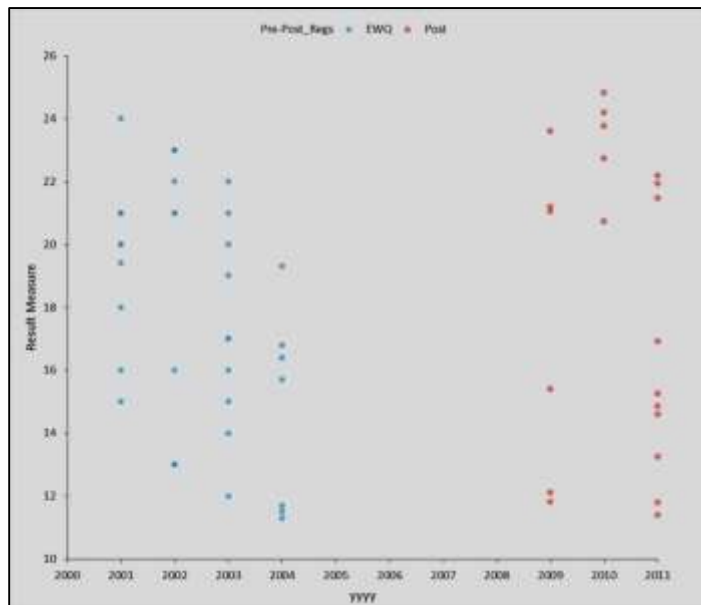


Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DRLamb EWQ	37	48.8	1.32
1487 ICP DRLamb Post	21	86.0	4.10

H statistic	0.47
χ^2 approximation	0.47
DF	1
p-value	0.4913 ¹

H0: $\theta_1 = \theta_2 = \theta_3 \dots$
 The median of the populations are all equal.
 H1: $\theta_i \neq \theta_j$ for at least one i,j
 The median of the populations are not all equal.
¹ Do not reject the null hypothesis at the 5% significance level.



Some evidence exists of water quality degradation. Chloride concentrations apparently did not measurably change between the two periods. Sources of analytical uncertainty included potential laboratory artifacts and insufficient post-EWQ sampling (n=21). Post-EWQ median concentration was above the upper EWQ 95% confidence interval, but there were too few post-EWQ data (n=21) for a significant difference. Both sets are strongly related to flow, which is plotted on a logarithmic scale.

Chapter 4: 1487 ICP

Delaware River at Lambertville/New Hope Bridge, NJ/PA

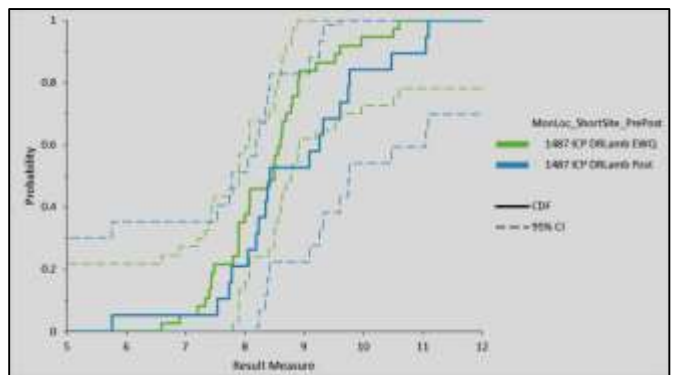
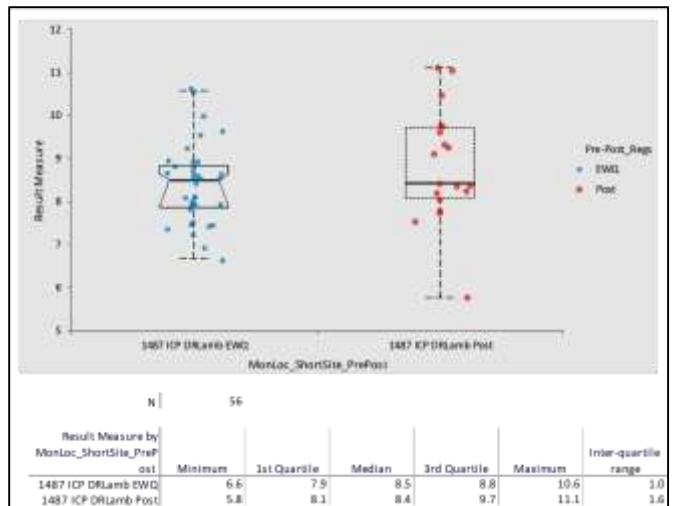
Dissolved Oxygen (DO) mg/l

Existing Water Quality (Table 2W):

Median 8.50 mg/l

Lower 95% Confidence Interval 7.90 mg/l

Upper 95% Confidence Interval 8.63 mg/l



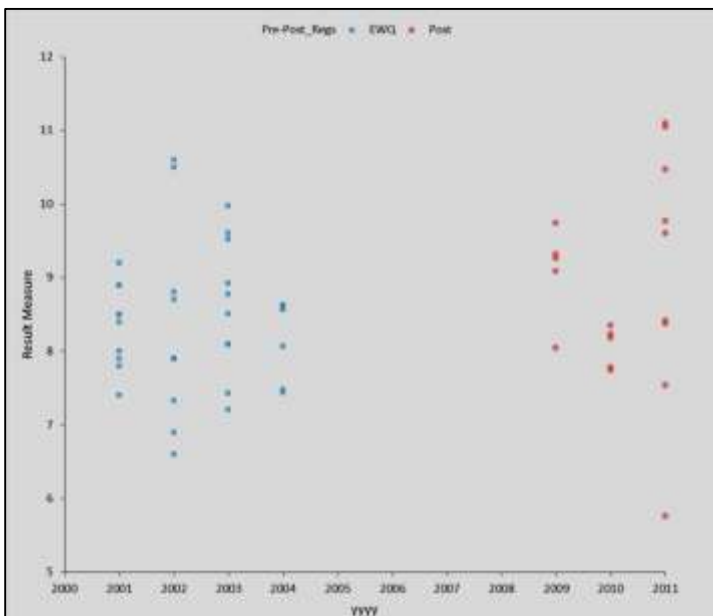
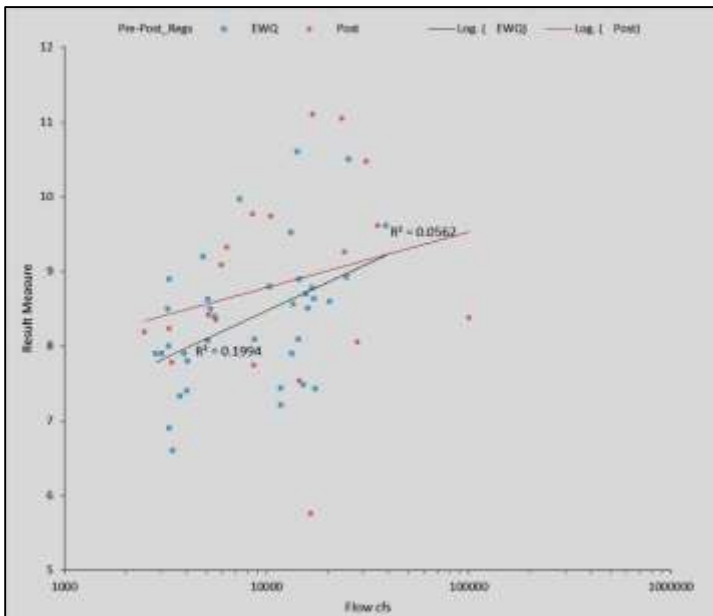
Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DRLamb EWQ	37	164.4	4.44
1487 ICP DRLamb Post	19	320.2	16.85

H statistic 1.82
 X² approximation 1.82
 DF 1
 p-value 0.1770¹

H0: $\theta_1 = \theta_2 = \dots$
 The median of the populations are all equal.
 H1: $\theta_i \neq \theta_j$ for at least one i,j
 The median of the populations are not all equal.
¹ Do not reject the null hypothesis at the 5% significance level.

No water quality degradation is evident. No measurable change took place between the EWQ and Post-EWQ periods. Post-EWQ dissolved oxygen concentrations fell within the EWQ 95% confidence intervals. Note that flow is plotted on a logarithmic scale for best view of the data. DO is unrelated to flow.



Chapter 4: 1487 ICP

Delaware River at Lambertville/New Hope Bridge, NJ/PA

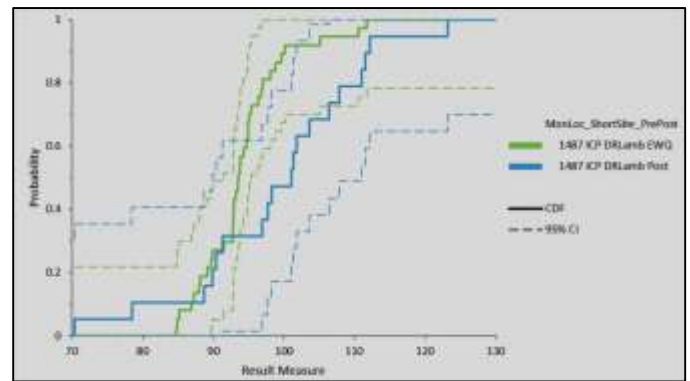
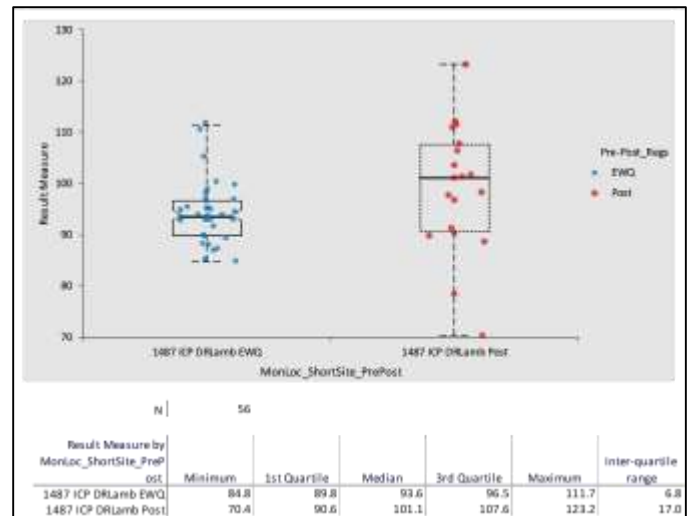
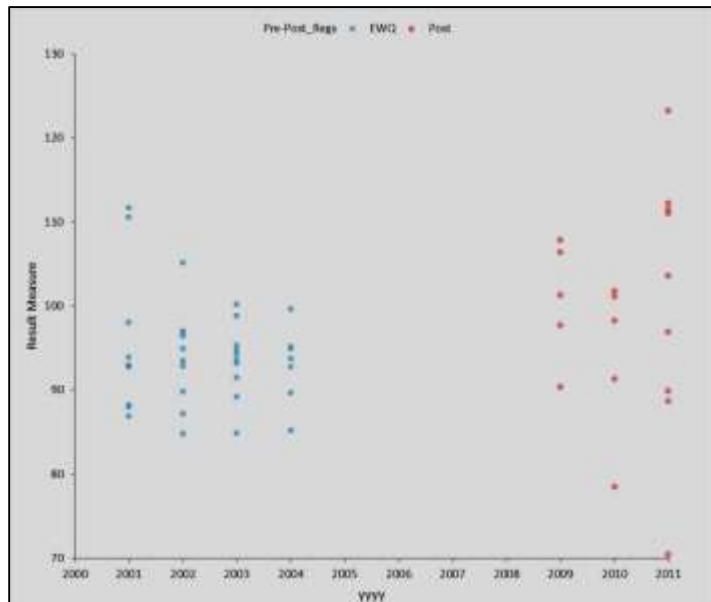
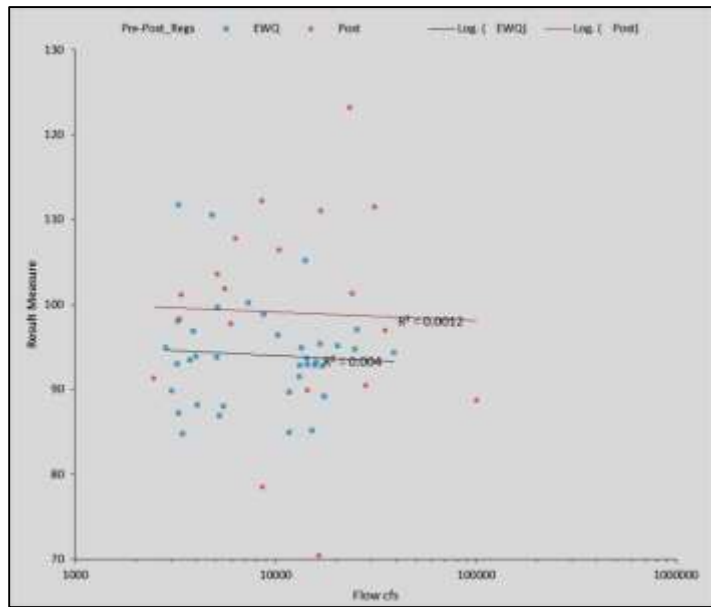
Dissolved Oxygen Saturation %

Existing Water Quality (Table 2W):

Median 94%

Lower 95% Confidence Interval 93%

Upper 95% Confidence Interval 95%



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PreP	n	Rank sum	Mean rank
1487 ICP DR Lamb EYW	37	439.4	11.87
1487 ICP DR Lamb Post	19	855.6	45.03

H statistic 4.87
 X² approximation 4.87
 DF 1
 p-value 0.0274¹

H0: $\theta_1 = \theta_2 = \theta_3 = \dots$
 The median of the populations are all equal.
 H1: $\theta_i \neq \theta_j$ for at least one i, j
 The median of the populations are not all equal.

¹ Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

No water quality degradation is evident. Dissolved Oxygen Saturation increased between the EYW and post-EYW periods. The main driver of the change was that DO saturation ranged widely in 2011, indicating higher than usual primary productivity by algae and plant activity that summer. Post-EYW median DO saturation rose above the EYW upper 95% confidence interval. Post-EYW minimum DO saturation, at 70%, indicates unusually high oxygen demand during one of the sampling events. Overall post-EYW DO saturation rose to “normal” levels for a wide, shallow, highly productive river. Dissolved Oxygen Saturation is unrelated to flow. Flow is plotted on a logarithmic scale.

Chapter 4: 1487 ICP

Delaware River at Lambertville/New Hope Bridge, NJ/PA

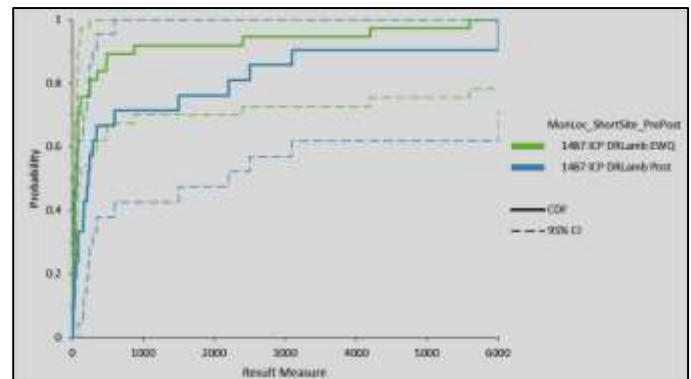
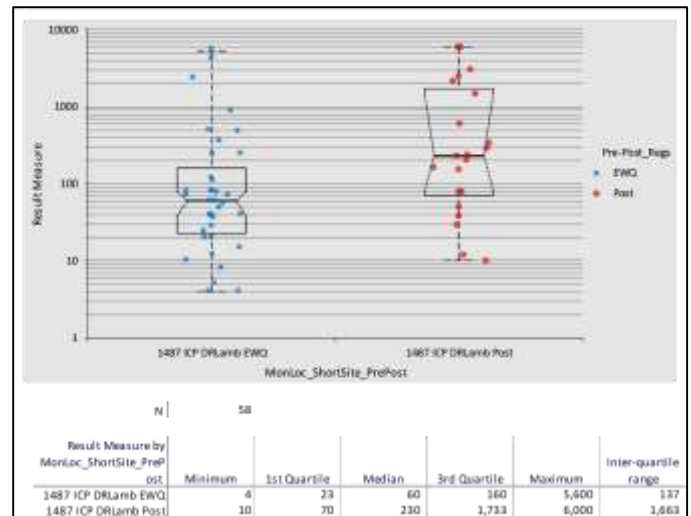
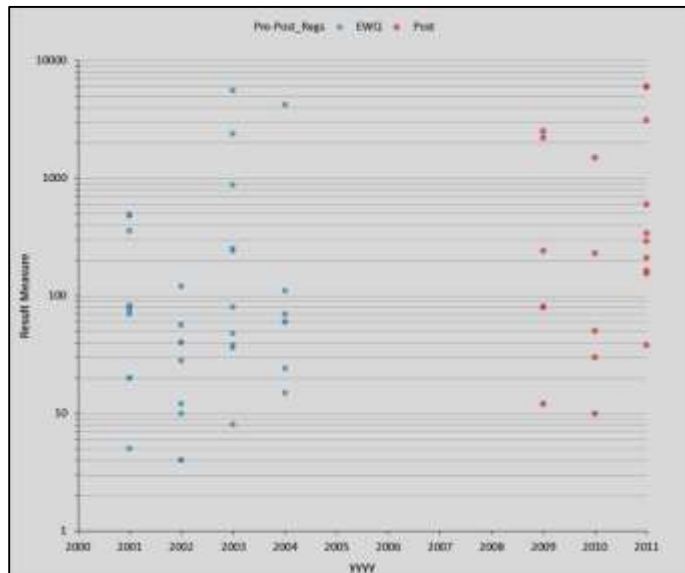
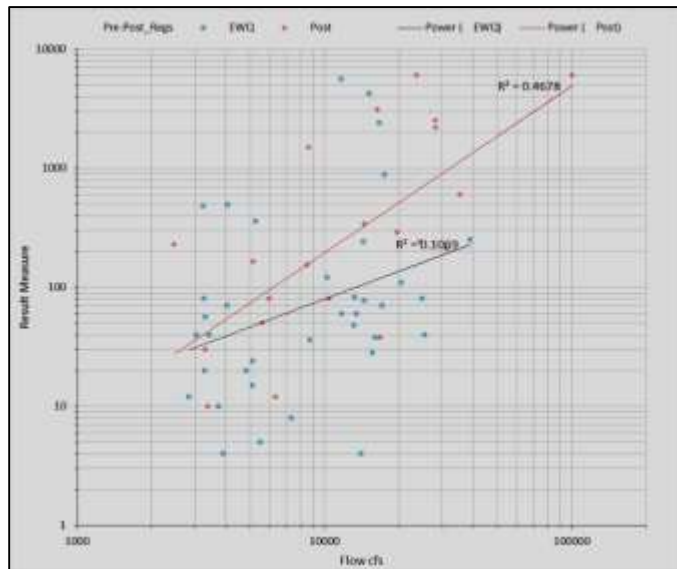
Enterococcus colonies/100 ml

Existing Water Quality (Table 2W):

Median 60/100 ml

Lower 95% Confidence Interval 38/100 ml

Upper 95% Confidence Interval 80/100 ml



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DRLamb EWQ	37	653.5	17.66
1487 ICP DRLamb Post	21	1151.4	54.83

H statistic	6.33
χ^2 approximation	6.33
DF	1
p-value	0.0118 ¹

H0: $\theta_1 = \theta_2 = \theta_3 = \dots$

The median of the populations are all equal.

H1: $\theta_i \neq \theta_j$ for at least one i, j

The median of the populations are not all equal.

¹ Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

Weak evidence of degradation exists. Enterococci apparently rose between the two periods, and the post-EWQ median was higher than the EWQ upper 95% confidence interval. Sources of analytical uncertainty included potential laboratory artifacts and insufficient post-EWQ sampling (n=21). Enterococcus concentrations are positively related to flow in the post-EWQ data set, but the regression is driven by a single outlier sample taken during flood conditions. Note that concentrations and flows are plotted on a logarithmic scale.

Chapter 4: 1487 ICP

Delaware River at Lambertville/New Hope Bridge, NJ/PA

Escherichia coli colonies/100 ml

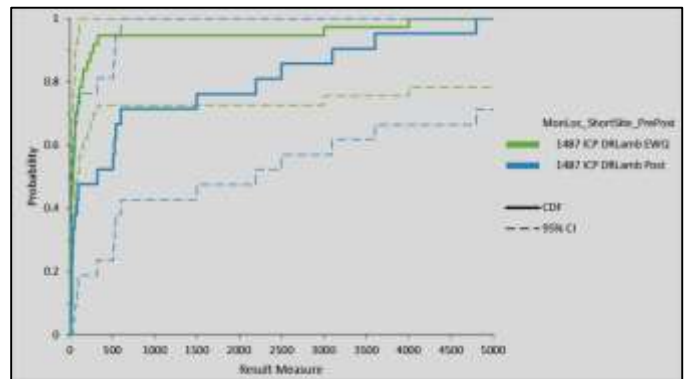
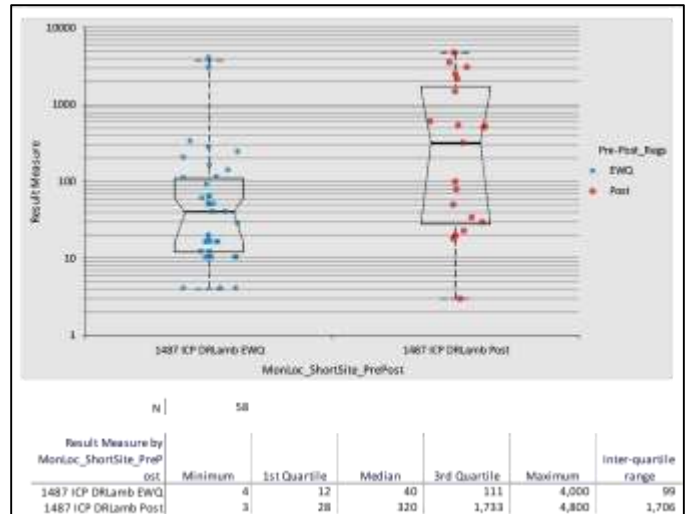
Existing Water Quality (Table 2W):

Median 40/100 ml

Lower 95% Confidence Interval 16/100 ml

Upper 95% Confidence Interval 62/100 ml

Defined in regulations as a flow-related parameter



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DR/Lamb EWQ	37	832.4	22.50
1487 ICP DR/Lamb Post	21	1466.7	69.84

H statistic 8.08
 X² approximation 8.08
 DF 1
 p-value 0.0045¹

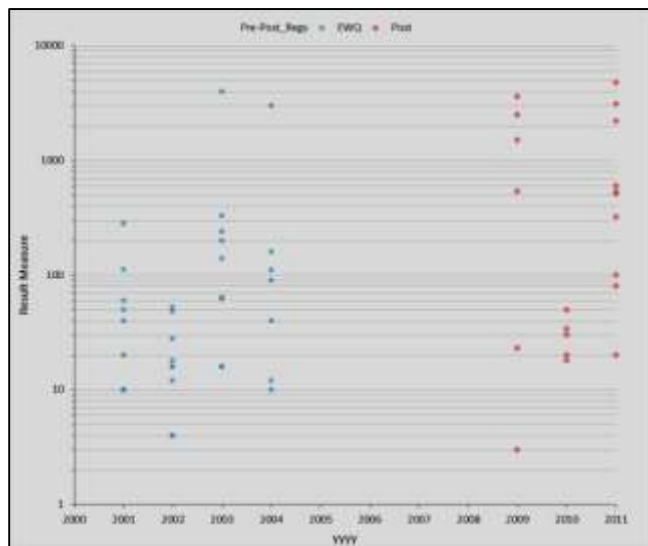
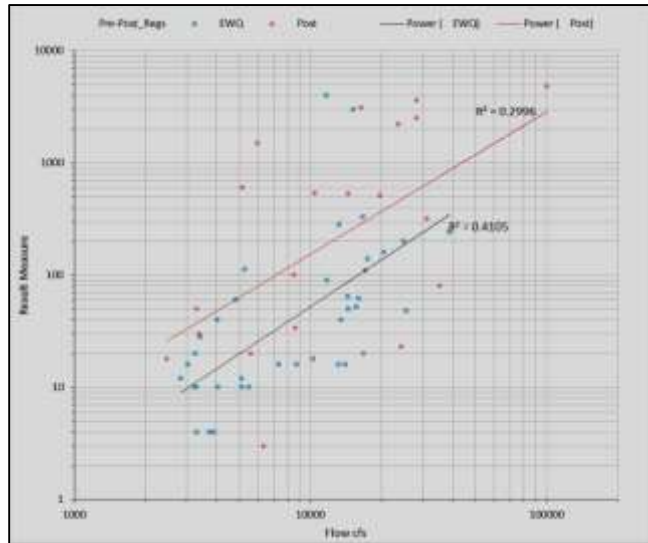
H0: $\theta_1 = \theta_2 = \dots$

The median of the populations are all equal.

H1: $\theta_i \neq \theta_j$ for at least one i, j

The median of the populations are not all equal.

¹ Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.



Weak evidence of water quality degradation exists. E. coli concentrations apparently rose above the EWQ upper 95% confidence interval. Sources of analytical uncertainty included potential laboratory artifacts and insufficient post-EWQ sampling (n=21).

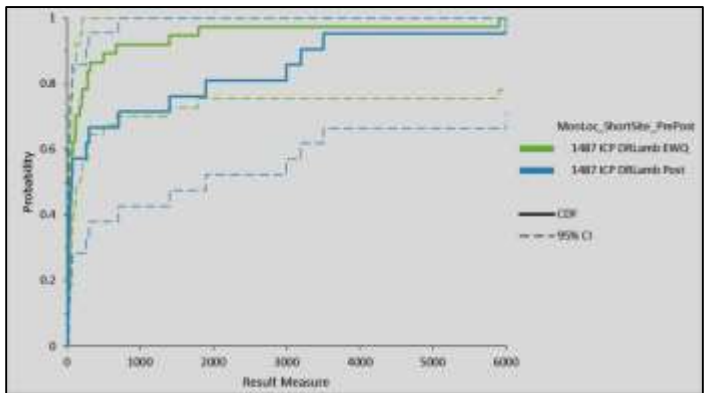
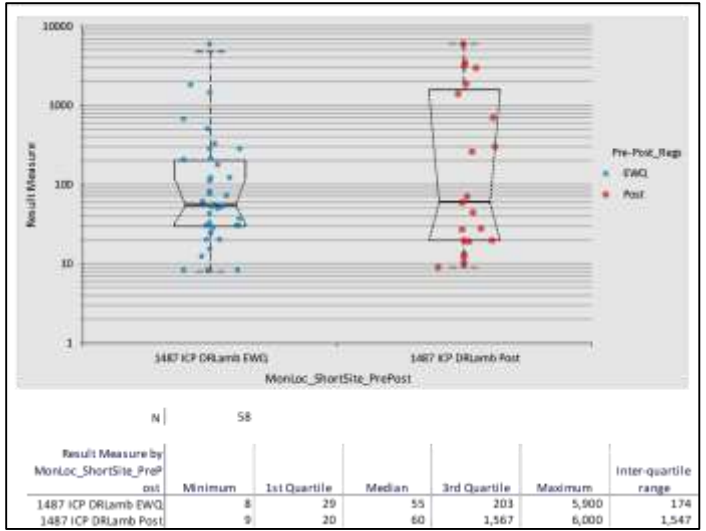
E. coli concentrations are positively related to flow, but the relationship is weak in the post-EWQ data. No independent data from other agencies were available at this site to validate DRBC's conclusion. The reason for the increase remains unexplained other than the prevalence of higher flow conditions in the post-EWQ period.

Chapter 4: 1487 ICP
 Delaware River at Lambertville/New Hope Bridge, NJ/PA

Fecal coliform colonies/100 ml

Existing Water Quality (Table 2W):

- Median 55/100 ml
- Lower 95% Confidence Interval 32/100 ml
- Upper 95% Confidence Interval 120/100 ml

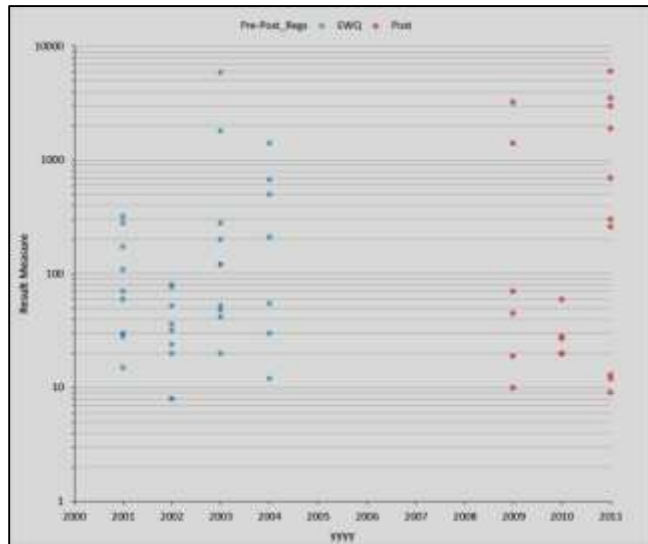
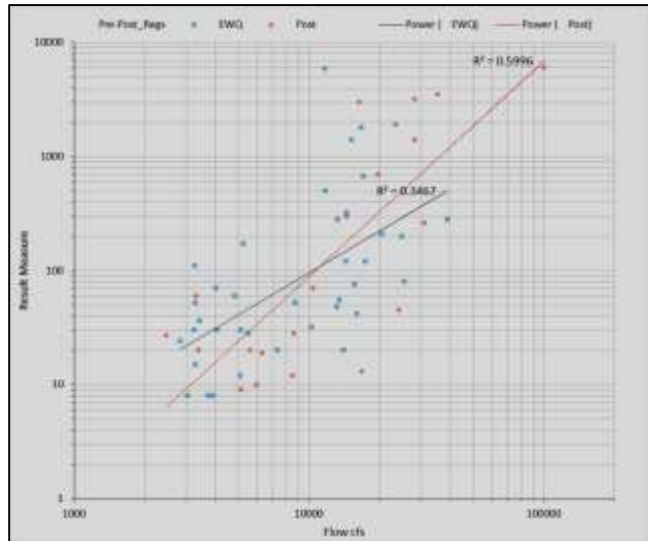


Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DR Lamb EWQ	37	14.3	0.39
1487 ICP DR Lamb Post	21	25.2	1.20

H statistic	0.14
χ^2 approximation	0.14
DF	1
p-value	0.7097 ¹

H0: $\theta_1 = \theta_2 = \theta...$
 The median of the populations are all equal.
 H1: $\theta_i \neq \theta_j$ for at least one i,j
 The median of the populations are not all equal.
¹ Do not reject the null hypothesis at the 5% significance level.



No water quality degradation is evident. Fecal coliform concentrations apparently did not measurably change between the EWQ and post-EWQ periods. Sources of analytical uncertainty included potential laboratory artifacts and insufficient post-EWQ sampling (n=21). Fecal coliform concentrations are positively related to flow. Post-EWQ median concentrations fell within the EWQ 95% confidence intervals. As with the EWQ data set in 2003-2004, post-EWQ high concentrations are most likely during wet weather conditions as seen in 2009 and 2011. Note that both concentrations and flows are presented on a logarithmic scale.

Chapter 4: 1487 ICP

Delaware River at Lambertville/New Hope Bridge, NJ/PA

Hardness as CaCO₃, Total mg/l

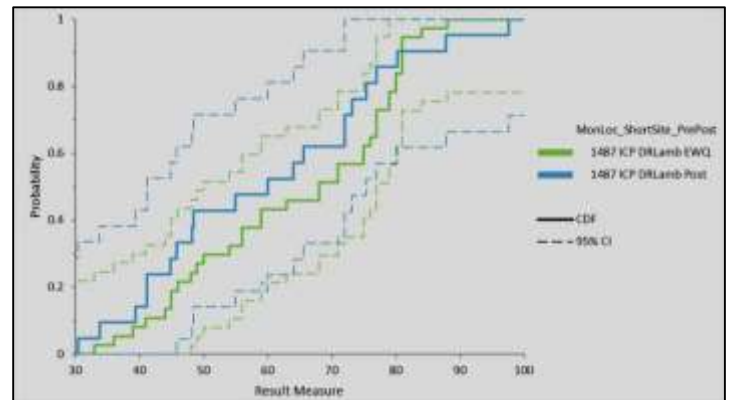
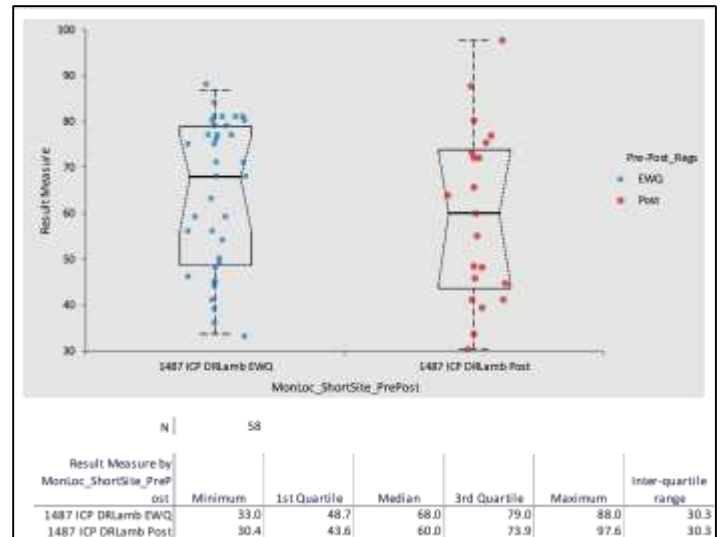
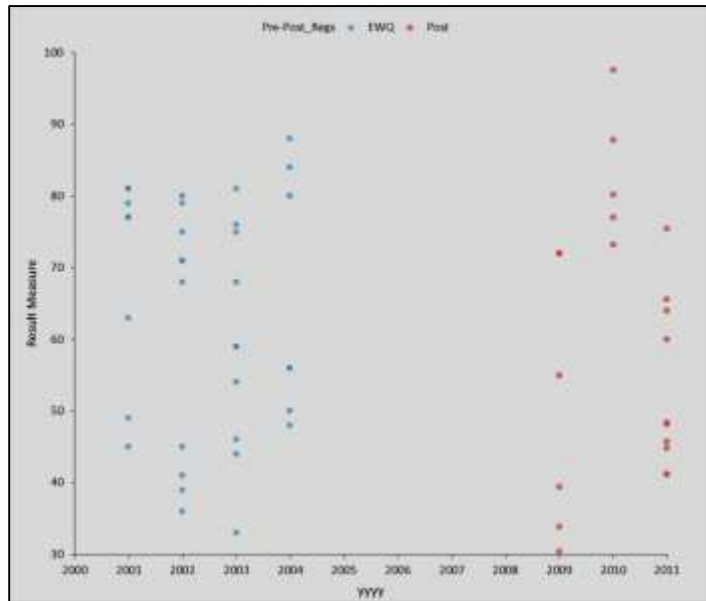
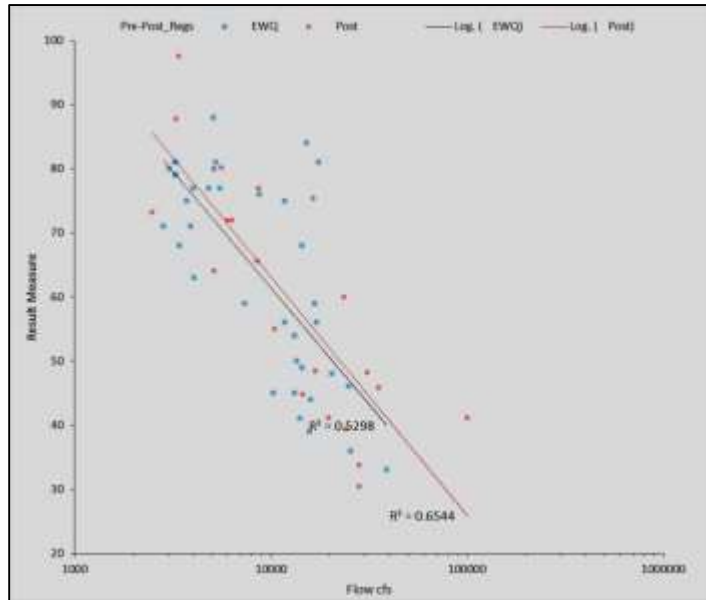
Existing Water Quality (Table 2W):

Median 68 mg/l

Lower 95% Confidence Interval 56 mg/l

Upper 95% Confidence Interval 77 mg/l

Defined in regulations as a flow-related parameter



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DR/Lamb EWQ	37	128.7	3.48
1487 ICP DR/Lamb Post	21	226.7	10.80

H statistic 1.25
 X² approximation 1.25
 DF 1
 p-value 0.2640¹
 H0: $\theta_1 = \theta_2 = 0...$
 The median of the populations are all equal.
 H1: $\theta_i \neq \theta_j$ for at least one i, j
 The median of the populations are not all equal.
¹ Do not reject the null hypothesis at the 5% significance level.

No water quality degradation is indicated. Hardness did not measurably change between the EWQ and post-EWQ periods. Sources of analytical uncertainty included potential laboratory artifacts and insufficient post-EWQ sampling (n=21). Hardness is inversely related to flow. Post-EWQ median hardness fell within the EWQ 95% confidence intervals. Flow is plotted on a logarithmic scale.

Chapter 4: 1487 ICP

Delaware River at Lambertville/New Hope Bridge, NJ/PA

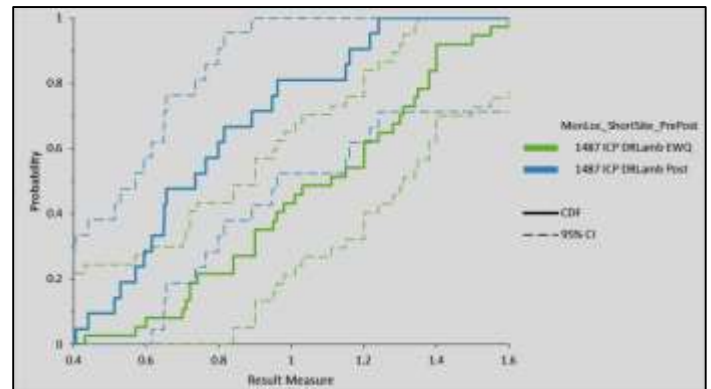
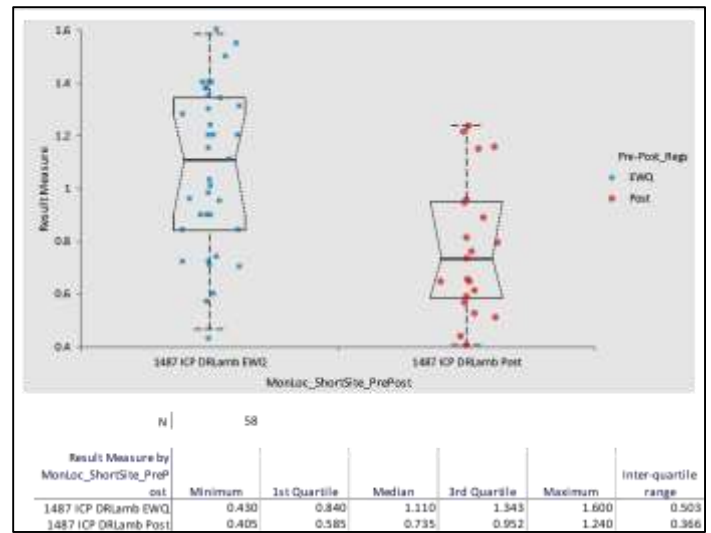
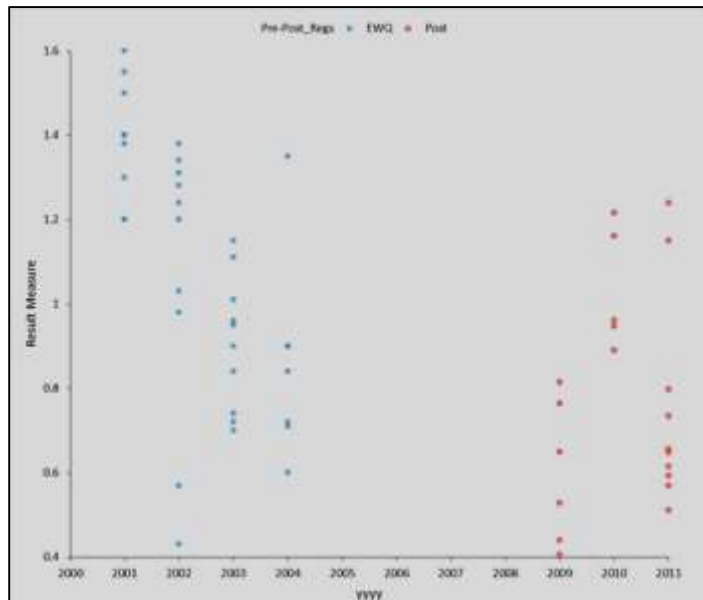
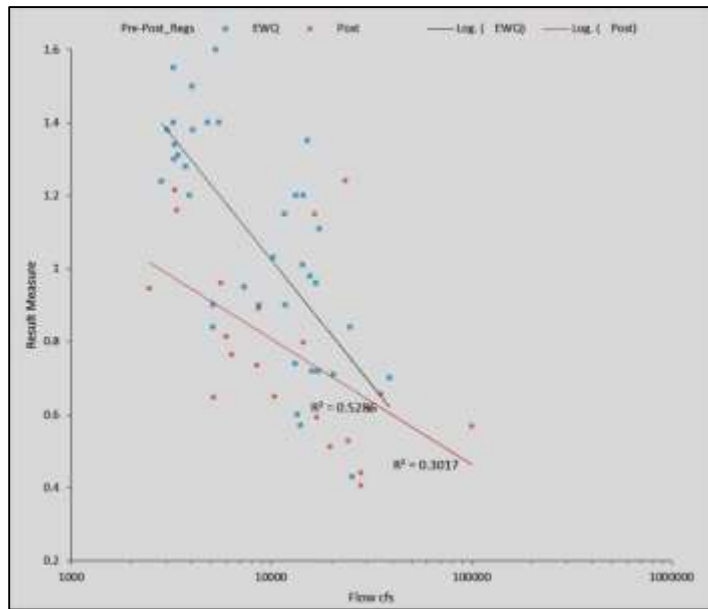
Nitrate + Nitrite as N, Total mg/l

Existing Water Quality (Table 2W):

Median 1.11 mg/l

Lower 95% Confidence Interval 0.90 mg/l

Upper 95% Confidence Interval 1.28 mg/l



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DR/Lamb EWQ	37	1243.5	33.61
1487 ICP DR/Lamb Post	21	2191.0	104.33

H statistic: 12.05
 χ^2 approximation: 12.05
 DF: 1
 p-value: 0.0005¹

H0: $\theta_1 = \theta_2 = \dots$
 The median of the populations are all equal.
 H1: $\theta_i \neq \theta_j$ for at least one i, j.
 The median of the populations are not all equal.
¹ Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

The annual plot shows a declining trend in concentration within the EWQ period that appears to stabilize into the post-EWQ period. 2002-2004 EWQ nitrates appear to match with post-EWQ nitrate + nitrite. Nitrate + Nitrite concentrations were assumed equivalent with EWQ nitrate alone, since EWQ nitrite concentrations were never detected at this site. Note that flow is plotted on a logarithmic scale. Independent data were not available for comparison. Post-EWQ median nitrate + nitrite concentrations fell below the EWQ lower 95% confidence interval. There were no undetected results in either data set.

Chapter 4: 1487 ICP
 Delaware River at Lambertville/New Hope Bridge, NJ/PA

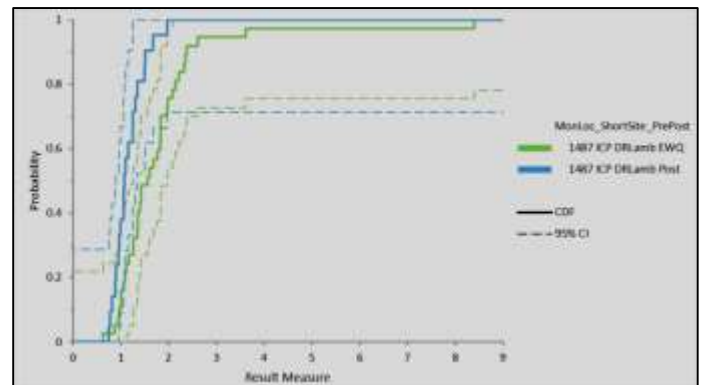
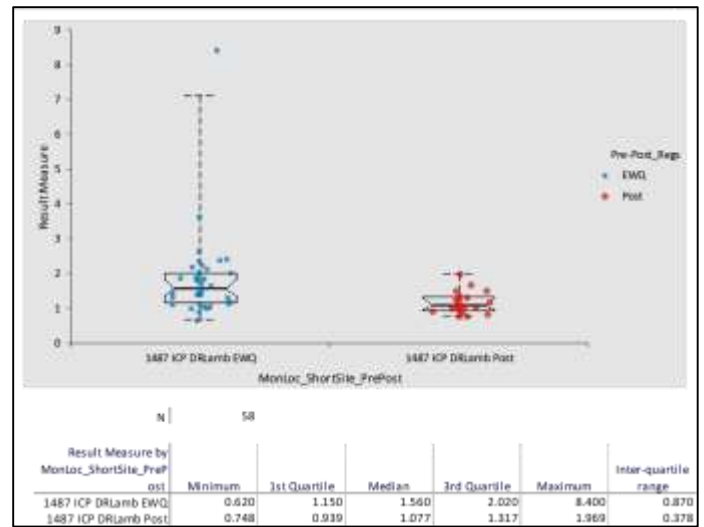
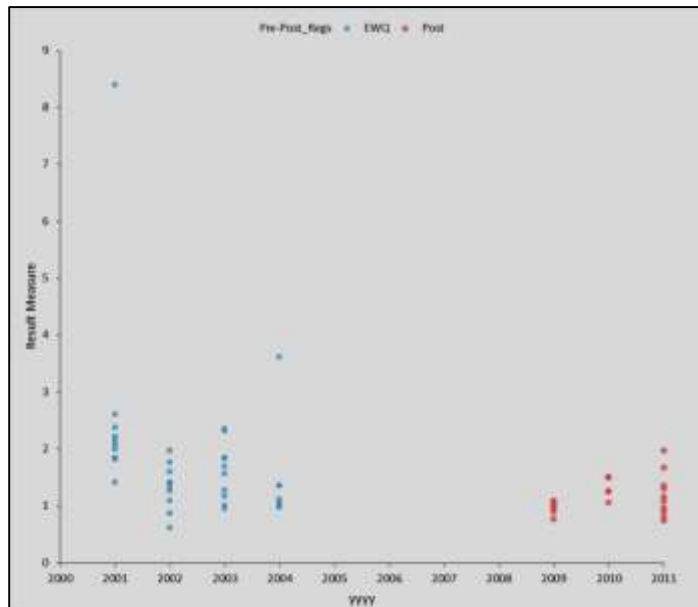
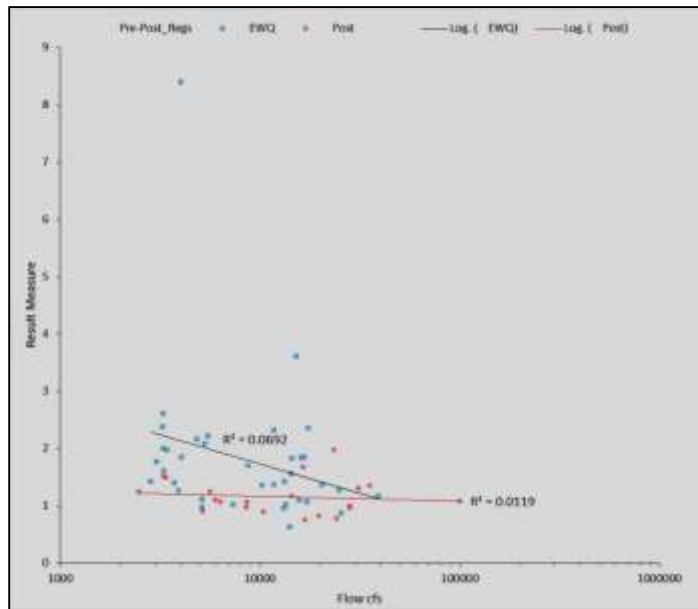
Nitrogen as N, Total (TN) mg/l

Existing Water Quality (Table 2W):

Median 1.56 mg/l

Lower 95% Confidence Interval 1.36 mg/l

Upper 95% Confidence Interval 1.84 mg/l



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DR Lamb EWQ	37	1174.9	31.75
1487 ICP DR Lamb Post	21	2070.1	98.58

H statistic 11.38
 X² approximation 11.38
 DF 1
 p-value 0.0007¹

H0: $\theta_1 = \theta_2 = \theta_3 = \dots$

The median of the populations are all equal.

H1: $\theta_i \neq \theta_j$ for at least one i,j

The median of the populations are not all equal.

¹ Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

No water quality degradation is evident. Total Nitrogen concentrations apparently declined between the EWQ and post-EWQ periods. However, potential laboratory artifacts weaken the conclusion. TN is unrelated to flow in both periods. The EWQ data overall are more variable than the post-EWQ data. DRBC results could not be independently validated.

Post-EWQ median TN concentrations fell below the EWQ lower 95% confidence interval, which may indicate a water quality improvement.

Chapter 4: 1487 ICP

Delaware River at Lambertville/New Hope Bridge, NJ/PA

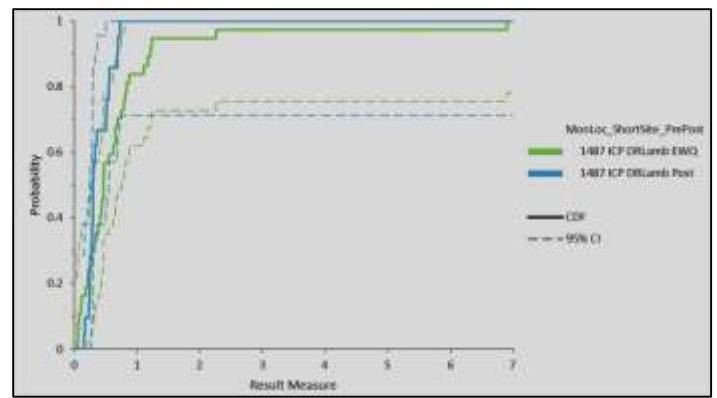
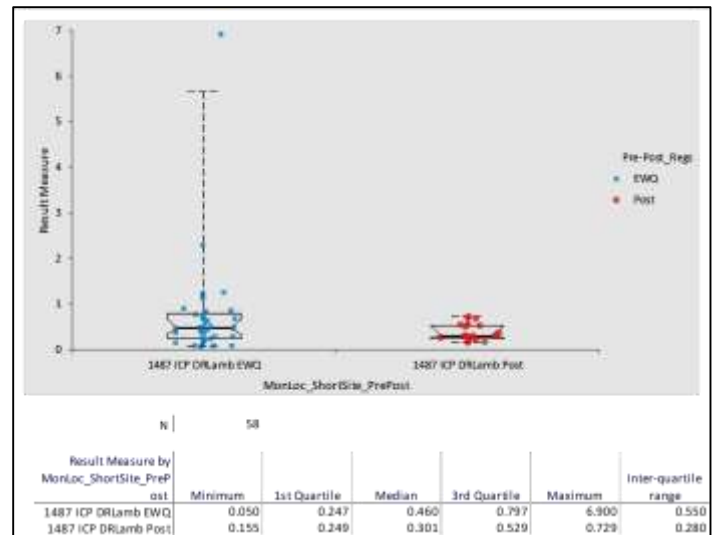
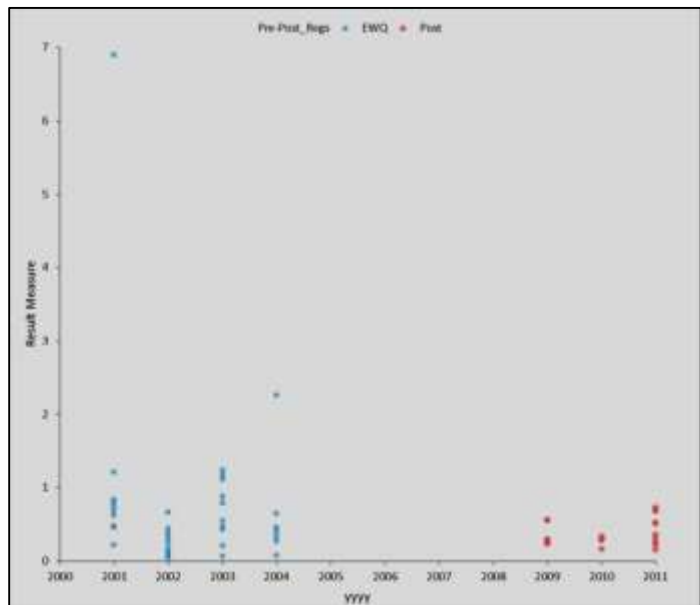
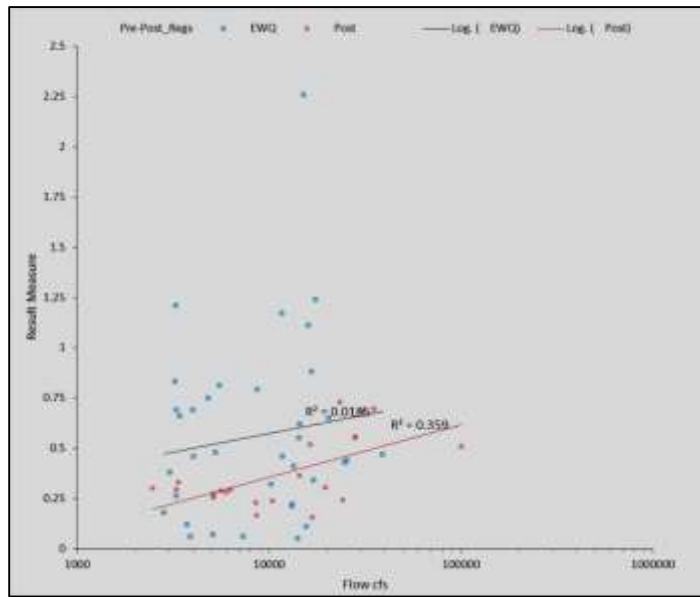
Nitrogen, Kjeldahl as N, Total (TKN) mg/l

Existing Water Quality (Table 2W):

Median 0.46 mg/l

Lower 95% Confidence Interval 0.34 mg/l

Upper 95% Confidence Interval 0.66 mg/l



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DR/Lamb EWQ	37	202.2	5.47
1487 ICP DR/Lamb Post	21	356.3	16.97

H statistic 1.96
 X² approximation 1.96
 DF 1
 p-value 0.1617¹
 H0: $\theta_1 = \theta_2 = \dots$
 The median of the populations are all equal.
 H1: $\theta_i \neq \theta_j$ for at least one i, j
 The median of the populations are not all equal.
¹ Do not reject the null hypothesis at the 5% significance level.

No water quality degradation is evident. No apparent measurable change occurred in TKN concentrations between the EWQ and post-EWQ periods. However, potential laboratory artifacts and insufficient post-EWQ sampling produced analytical uncertainty. TKN concentration is unrelated to flow in EWQ data, but positively related in post-EWQ data. Post-EWQ TKN was less variable than EWQ TKN. The plots look strange due to an unusually high unexplained measurement taken in 2001 (6.9 mg/l, removed in the flow relationship plot for better visibility of all other data). Post-EWQ median TKN fell below the EWQ lower 95% confidence interval.

Chapter 4: 1487 ICP

Delaware River at Lambertville/New Hope Bridge, NJ/PA

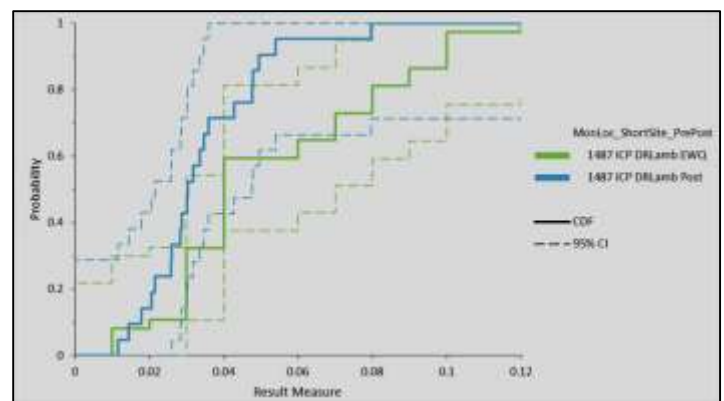
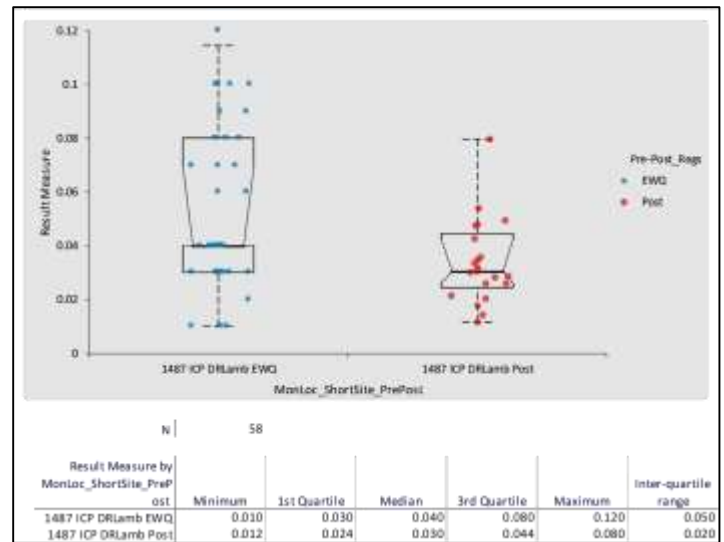
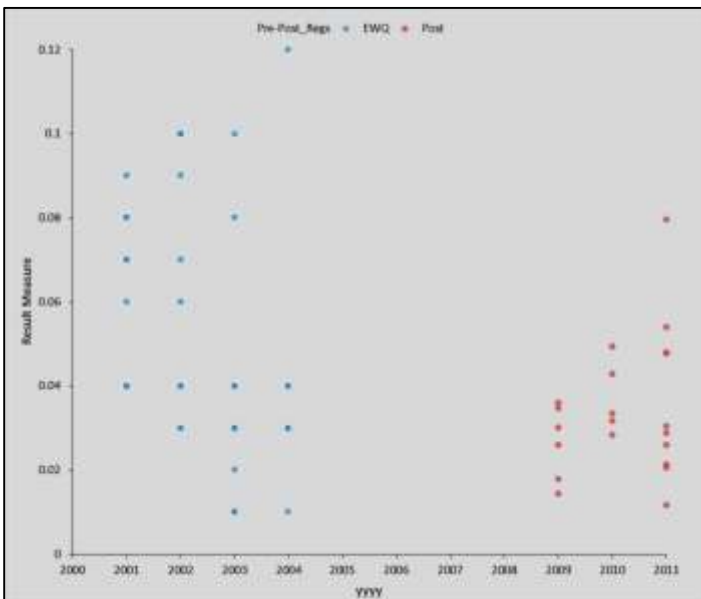
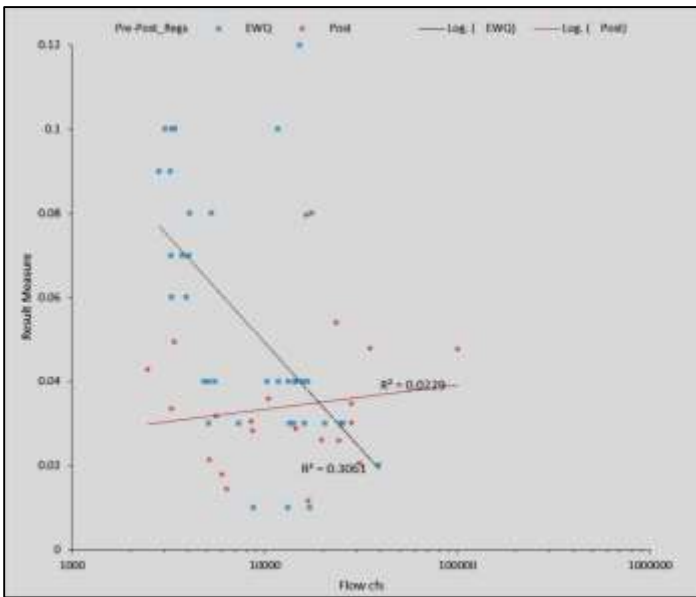
Orthophosphate as P, Total mg/l (OP)

Existing Water Quality (Table 2W):

Median 0.04 mg/l

Lower 95% Confidence Interval 0.04 mg/l

Upper 95% Confidence Interval 0.07 mg/l



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DRLamb EWQ	37	580.1	15.68
1487 ICP DRLamb Post	21	1022.0	48.67

H statistic 5.67
 X² approximation 5.67
 DF 1
 p-value 0.0173¹

H0: $\theta_1 = \theta_2 = \theta...$

The median of the populations are all equal.

H1: $\theta_i \neq \theta_j$ for at least one i,j

The median of the populations are not all equal.

¹ Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

No water quality degradation is evident. OP concentrations appeared to decline between the EWQ and post-EWQ periods. However, differences in detection limits and potential laboratory artifacts produced uncertainty. Post-EWQ median OP fell below the EWQ lower 95% confidence interval, though that interval was established around the detection limit. Orthophosphate is unrelated to flow in the post-EWQ data, but inversely and weakly related to flow in the EWQ data set. Flow is plotted on a logarithmic scale. There were no independent data to confirm DRBC results.

Chapter 4: 1487 ICP

Delaware River at Lambertville/New Hope Bridge, NJ/PA

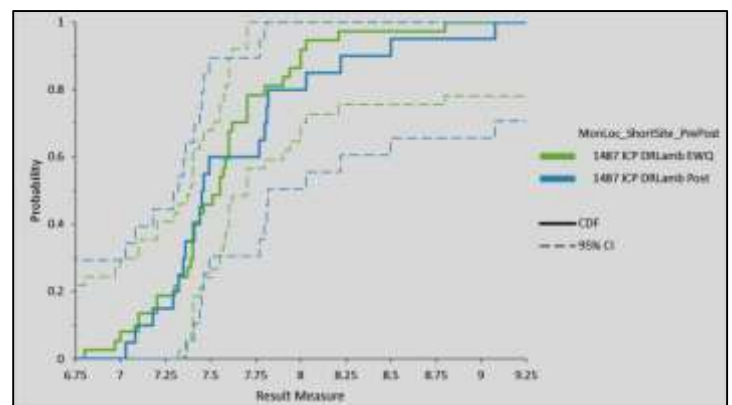
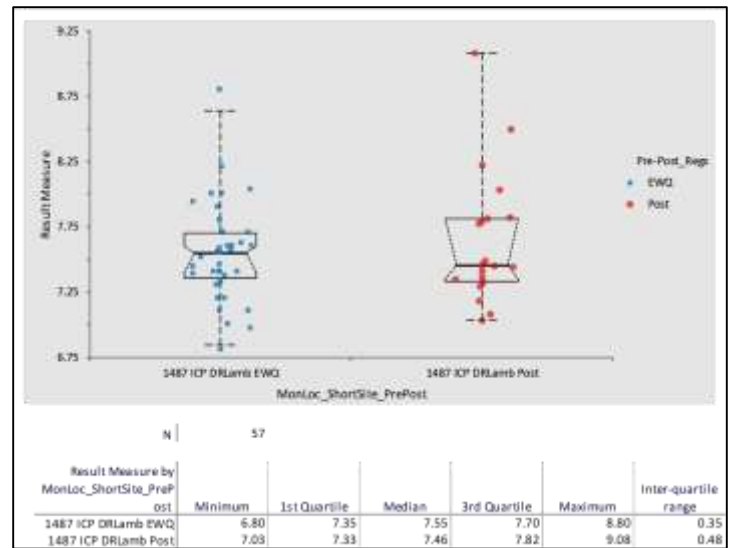
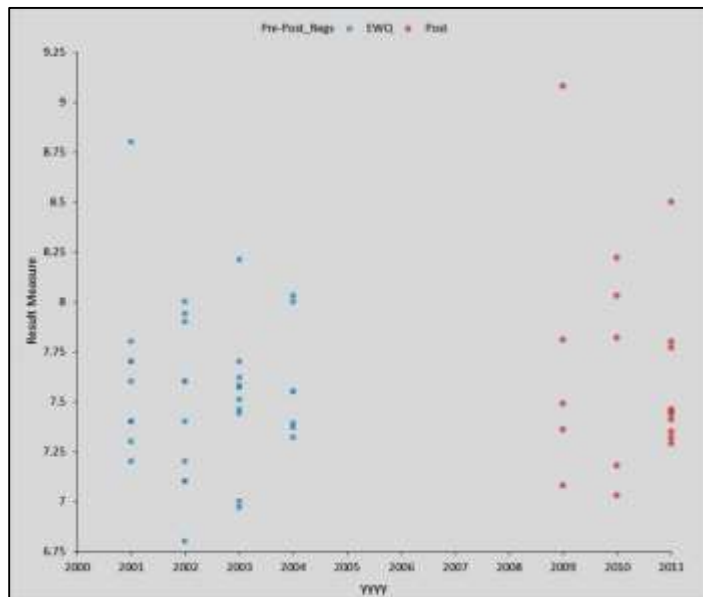
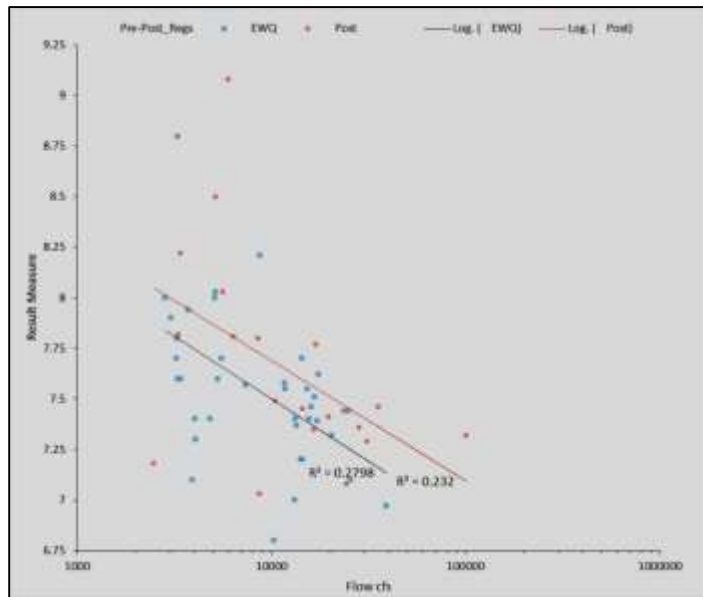
pH

Existing Water Quality (Table 2W):

Median 7.55 standard units

Lower 95% Confidence Interval 7.40 standard units

Upper 95% Confidence Interval 7.60 standard units



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DRLamb EWQ	37	7.4	0.20
1487 ICP DRLamb Post	20	13.6	0.68

H statistic 0.08
 X² approximation 0.08
 DF 1
 p-value 0.7825¹
 H0: $\theta_1 = \theta_2 = \dots$
 The median of the populations are all equal.
 H1: $\theta_i \neq \theta_j$ for at least one i, j
 The median of the populations are not all equal.
¹ Do not reject the null hypothesis at the 5% significance level.

No water quality degradation is evident. pH did not measurably change between the EWQ and post-EWQ periods. Post-EWQ median pH fell between the EWQ 95% confidence intervals. Under higher flow conditions, pH tends toward neutral. During low flow and high primary productivity periods, pH criteria are occasionally exceeded at this location. Flow is plotted on a logarithmic scale.

Chapter 4: 1487 ICP

Delaware River at Lambertville/New Hope Bridge, NJ/PA

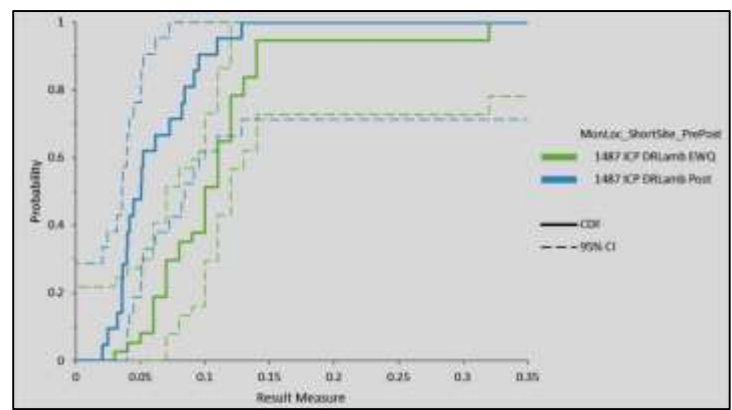
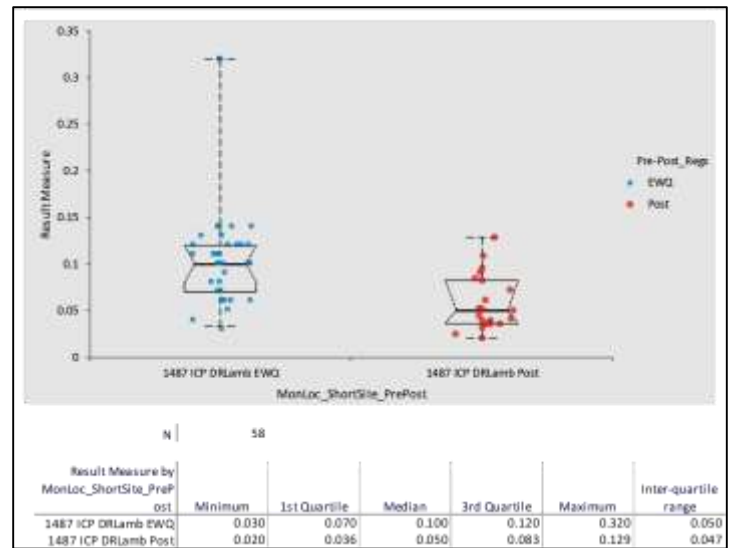
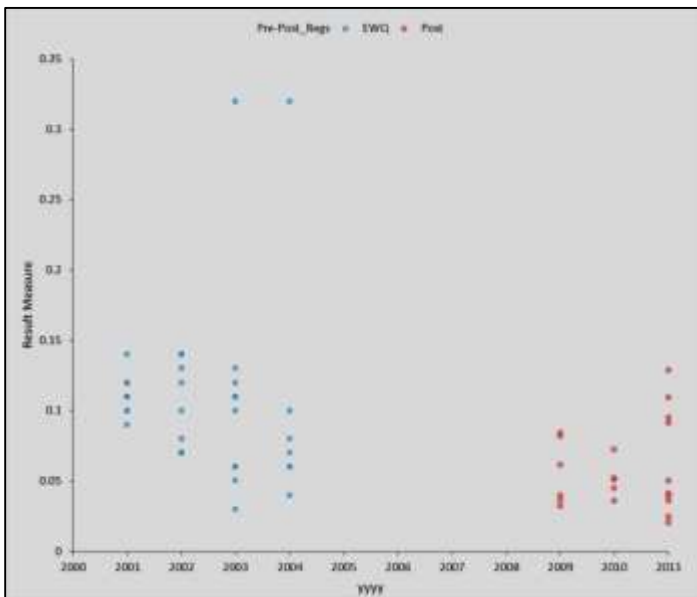
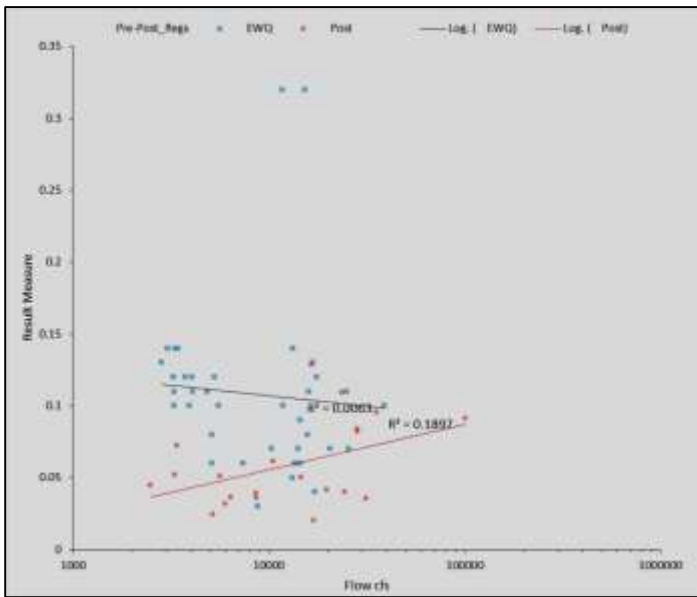
Phosphorus as P, Total (TP) mg/l

Existing Water Quality (Table 2W):

Median 0.10 mg/l

Lower 95% Confidence Interval 0.08 mg/l

Upper 95% Confidence Interval 0.12 mg/l



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DRLamb EWQ	37	1675.7	45.29
1487 ICP DRLamb Post	21	2952.4	140.59

H statistic 16.28
 X² approximation 16.28
 DF 1
 p-value <0.0001¹

H₀: θ₁ = θ₂ = θ...
 The median of the populations are all equal.
 H₁: θ_i ≠ θ_j for at least one i, j.
 The median of the populations are not all equal.

¹ Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

No water quality degradation is evident. Total Phosphorus (TP) concentrations apparently declined between the EWQ and post-EWQ periods. However, differences in detection limits and potential laboratory artifacts introduced uncertainty. Post-EWQ median TP fell below the EWQ lower 95% confidence interval. TP is unrelated to flow in both data sets. No independent data were available to confirm these results.

Chapter 4: 1487 ICP

Delaware River at Lambertville/New Hope Bridge, NJ/PA

Specific Conductance $\mu\text{mho/cm}$

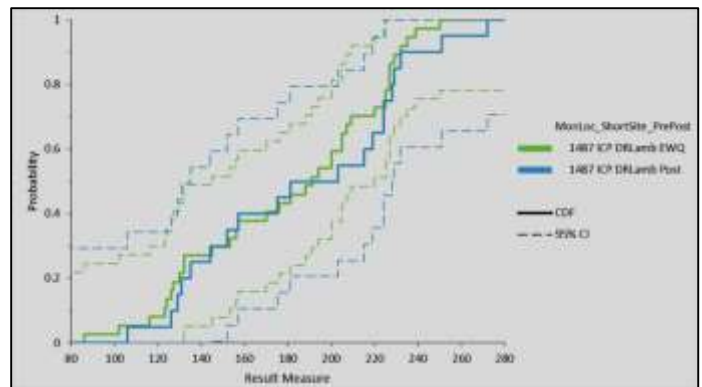
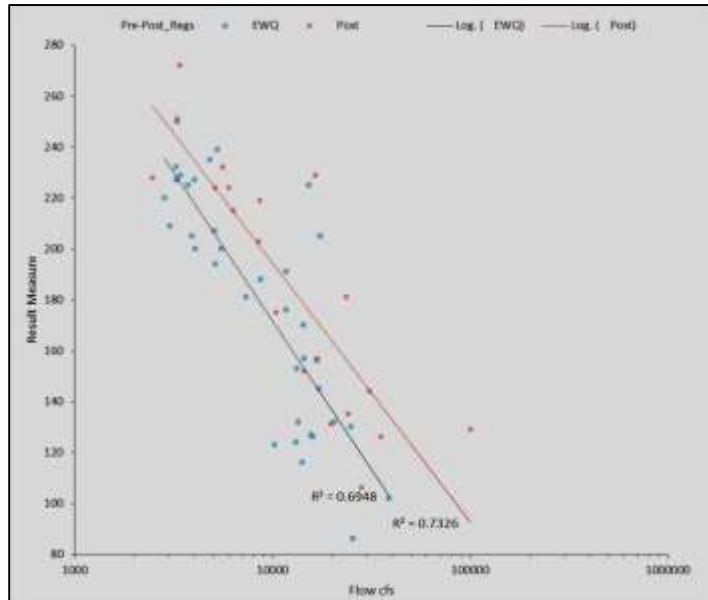
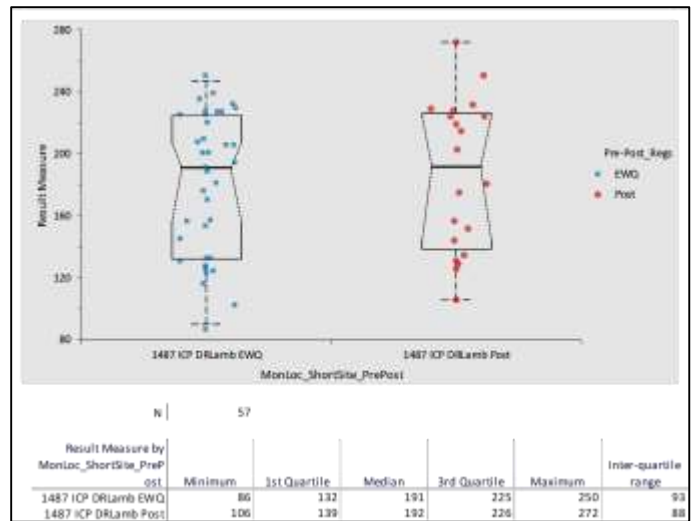
Existing Water Quality (Table 2W):

Median 191 $\mu\text{mho/cm}$

Lower 95% Confidence Interval 156 $\mu\text{mho/cm}$

Upper 95% Confidence Interval 207 $\mu\text{mho/cm}$

Defined in regulations as a flow-related parameter

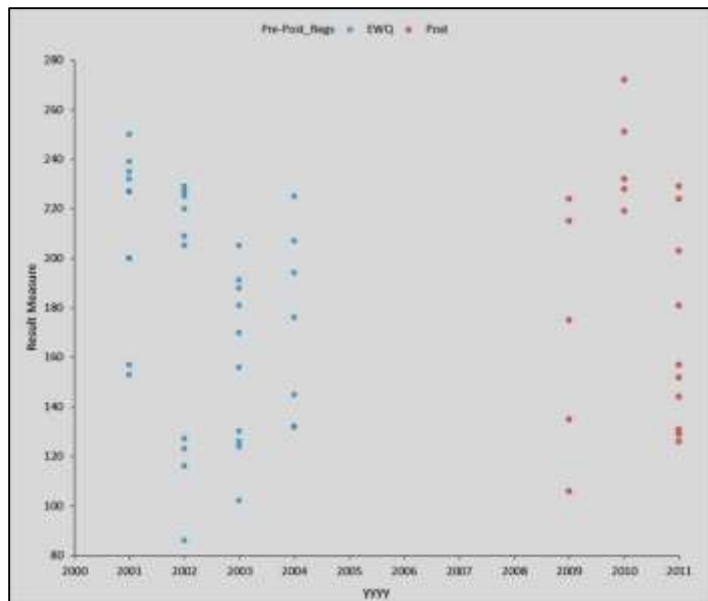


Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DRLamb EWQ	37	22.0	0.59
1487 ICP DRLamb Post	20	40.6	2.03

H statistic	0.23
χ^2 approximation	0.23
DF	1
p-value	0.6336 ¹

H0: $\theta_1 = \theta_2 = \theta...$
 The median of the populations are all equal.
 H1: $\theta_i \neq \theta_j$ for at least one i,j.
 The median of the populations are not all equal.
¹ Do not reject the null hypothesis at the 5% significance level.



No water quality degradation is evident. Specific conductance did not measurably change between the EWQ and post-EWQ periods. Cumulative frequency distributions of both data sets are nearly identical. In both data sets, specific conductance is inversely related to flow. Post-EWQ median specific conductance fell within the EWQ 95% confidence intervals. Flow is plotted on a logarithmic scale.

Chapter 4: 1487 ICP

Delaware River at Lambertville/New Hope Bridge, NJ/PA

Total Dissolved Solids (TDS) mg/l

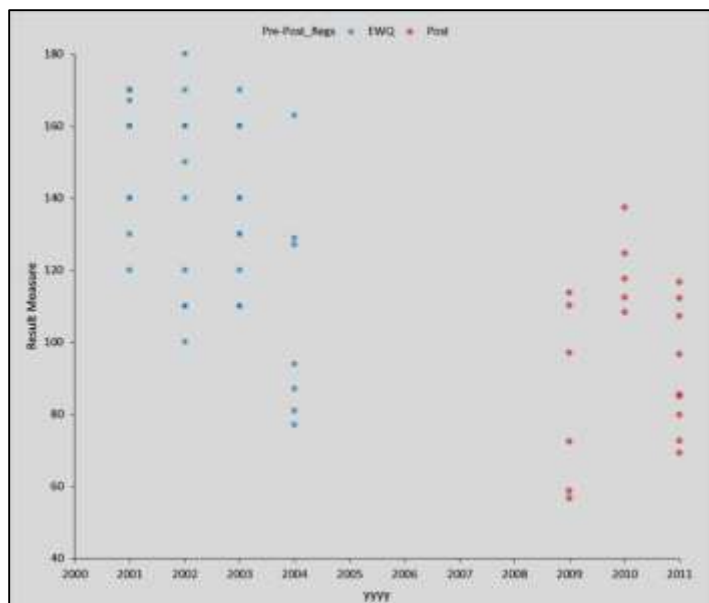
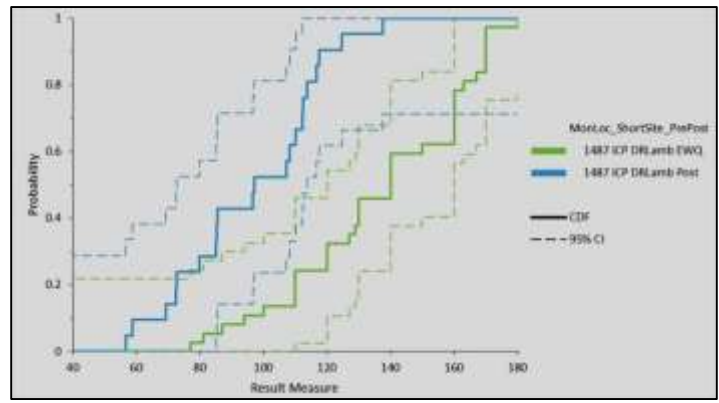
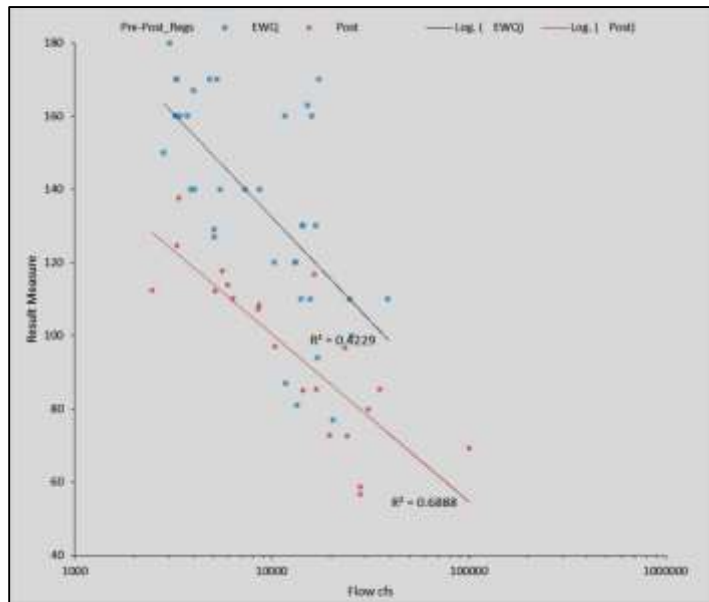
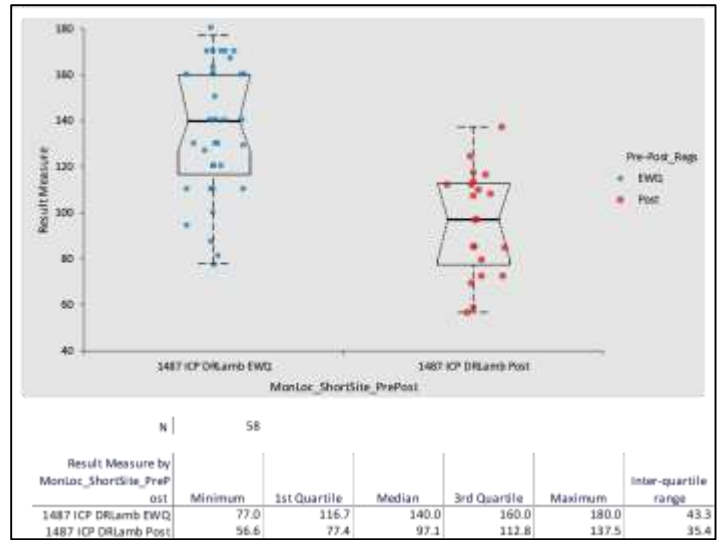
Existing Water Quality (Table 2W):

Median 140 mg/l

Lower 95% Confidence Interval 127 mg/l

Upper 95% Confidence Interval 160 mg/l

Defined in regulations as a flow-related parameter



Kruskal-Wallis test

Result Measure by MontLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DRLamb EWQ	37	2126.5	57.47
1487 ICP DRLamb Post	21	3746.7	178.41

H statistic: 20.65
 X² approximation: 20.65
 DF: 1
 p-value: <0.0001¹

H0: $\theta_1 = \theta_2 = \theta_3 = \dots$
 The median of the populations are all equal.
 H1: $\theta_i \neq \theta_j$ for at least one i, j
 The median of the populations are not all equal.

¹ Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

No water quality degradation is evident. TDS apparently declined between the EWQ and post-EWQ periods. However, flow condition differences and potential laboratory artifacts introduced uncertainty. TDS is inversely related to flow, which is plotted on a logarithmic scale. As fewer post-EWQ samples were low-flow samples, the decline in TDS may be explained partly by flow effects. Post-EWQ median TDS was below the EWQ 95% lower confidence interval. There were no undetected results in either data set.

Chapter 4: 1487 ICP

Delaware River at Lambertville/New Hope Bridge, NJ/PA

Total Suspended Solids (TSS) mg/l

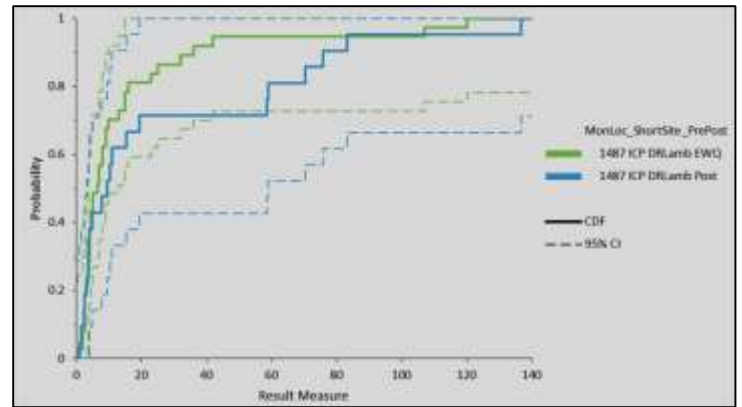
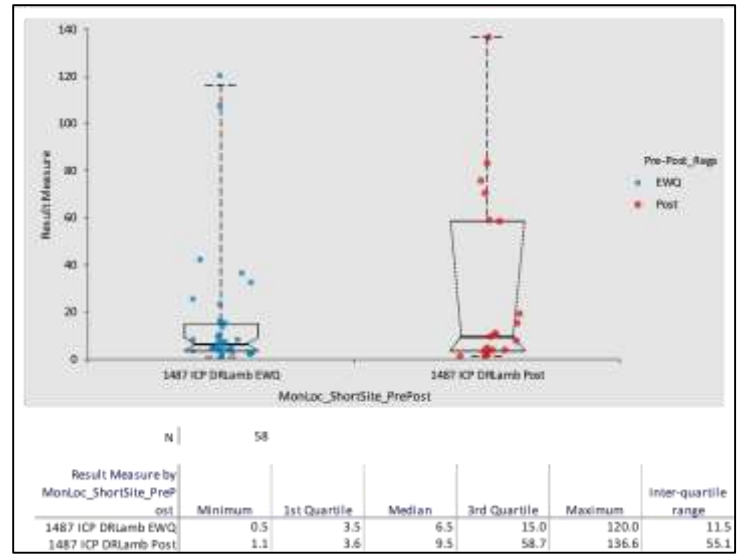
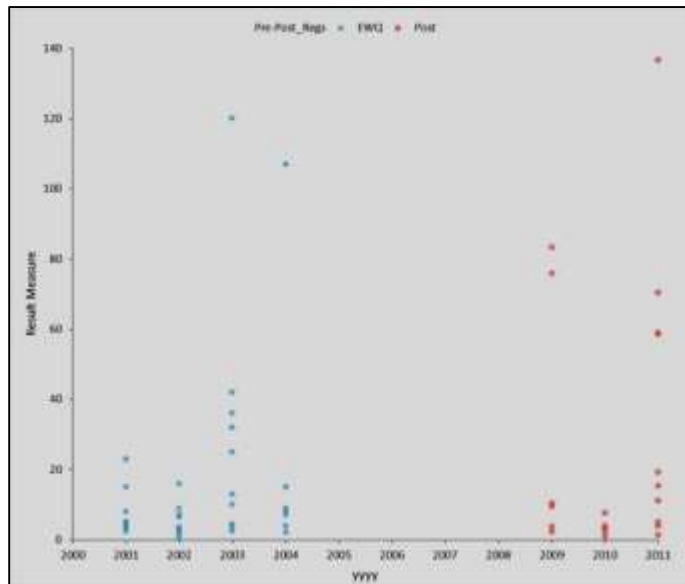
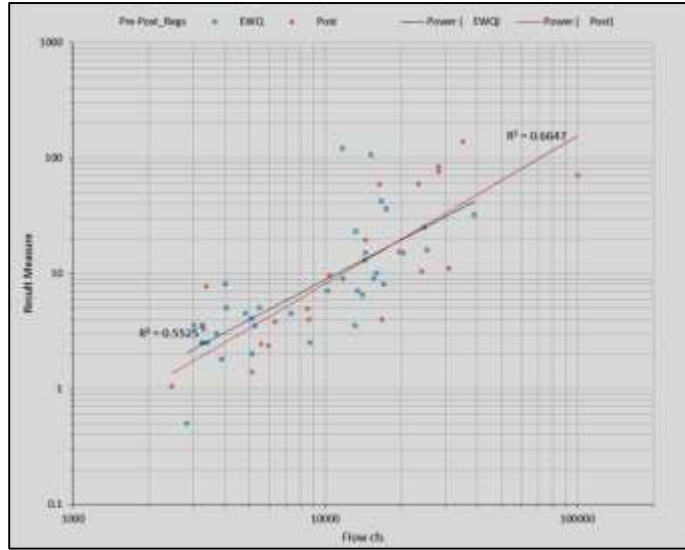
Existing Water Quality (Table 2W):

Median 6.5 mg/l

Lower 95% Confidence Interval 3.5 mg/l

Upper 95% Confidence Interval 9.0 mg/l

Defined in regulations as a flow-related parameter



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DRLamb EWQ	37	71.7	1.94
1487 ICP DRLamb Post	21	126.3	6.01

H statistic | 0.70
 X² approximation | 0.70
 DF | 1
 p-value | 0.4045¹

H0: $\theta_1 = \theta_2 = \theta_3 = \dots$
 The median of the populations are all equal.
 H1: $\theta_i \neq \theta_j$ for at least one i, j
 The median of the populations are not all equal.

¹ Do not reject the null hypothesis at the 5% significance level.

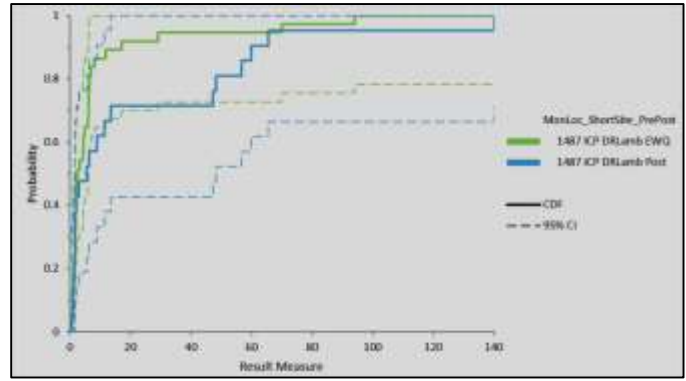
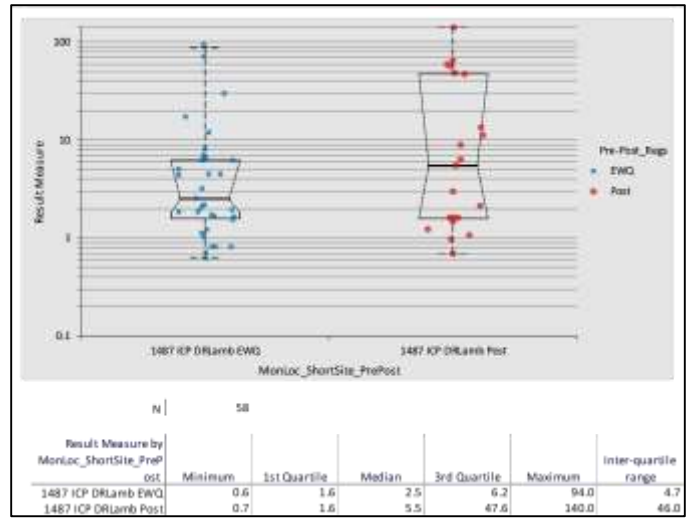
No water quality degradation is evident. TSS did not measurably change between the EWQ and post-EWQ periods. However, potential laboratory artifacts and insufficient post-EWQ sampling produced analytical uncertainty. TSS is positively related to flow in both data sets. Post-EWQ median TSS was above the EWQ upper 95% confidence interval, but the differences appear to be flow-related, as there were fewer dry weather samples in the post-EWQ data set. Flow and concentrations are plotted on a logarithmic scale.

Chapter 4: 1487 ICP
 Delaware River at Lambertville/New Hope Bridge, NJ/PA

Turbidity NTU

Existing Water Quality (Table 2W):

- Median 2.5 NTU
- Lower 95% Confidence Interval 1.8 NTU
- Upper 95% Confidence Interval 6.0 NTU
- Defined in regulations as a flow-related parameter



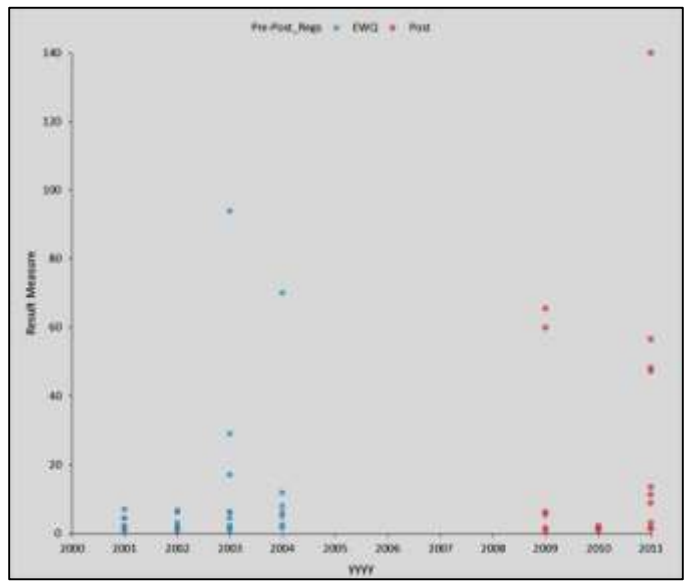
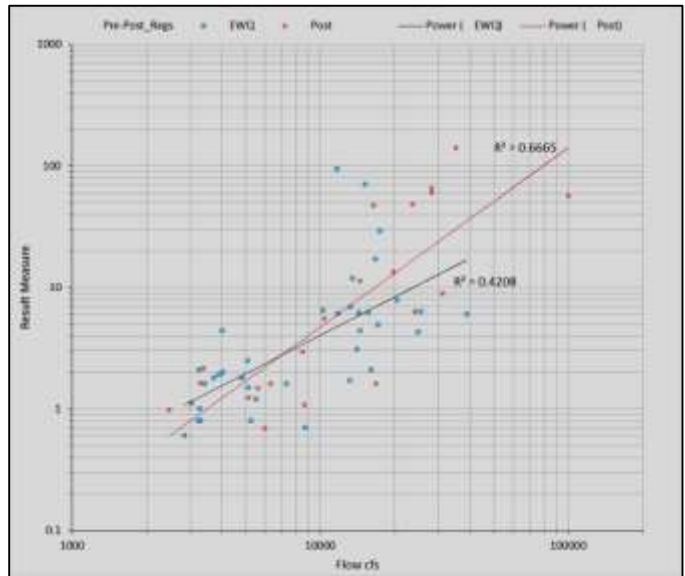
Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DR Lamb EWQ	37	136.2	3.68
1487 ICP DR Lamb Post	21	240.0	11.43

H statistic: 1.32
 X² approximation: 1.32
 DF: 1
 p-value: 0.2506¹

H0: $\theta_1 = \theta_2 = \theta_3 \dots$
 The median of the populations are all equal.
 H1: $\theta_i \neq \theta_j$ for at least one i,j
 The median of the populations are not all equal.
¹ Do not reject the null hypothesis at the 5% significance level.

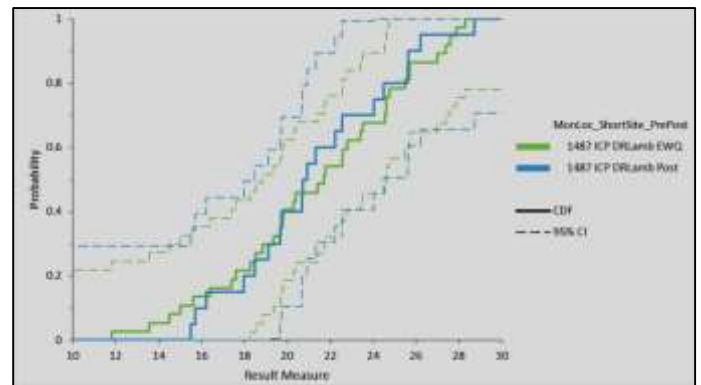
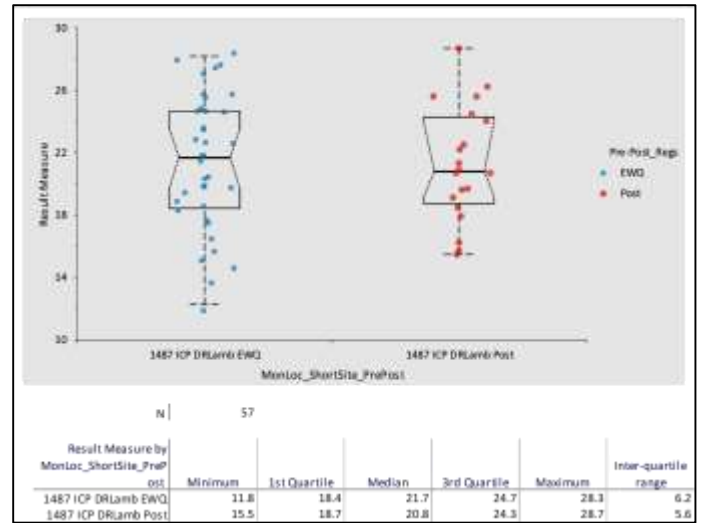
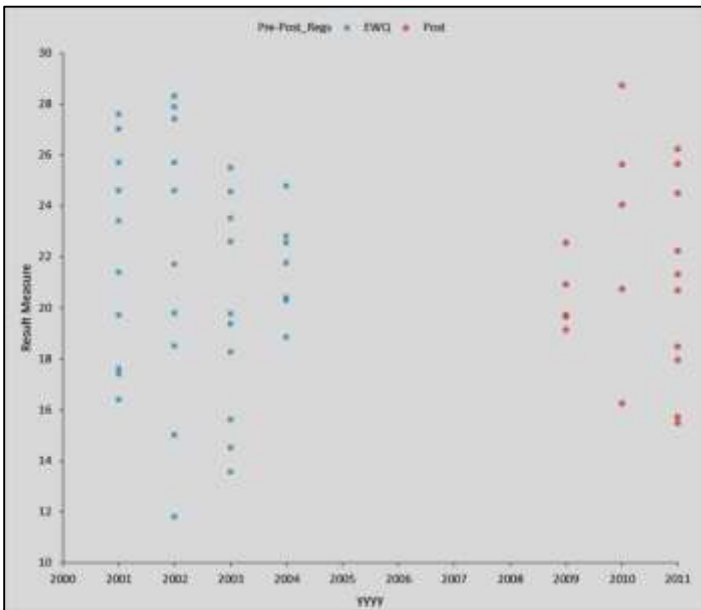
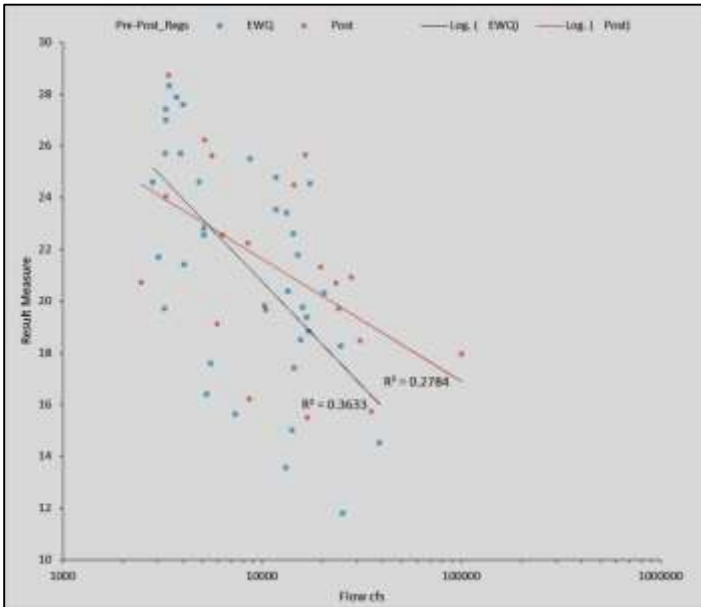
No water quality degradation is evident. All but five post-EWQ turbidity results were within the expected EWQ range of 0-15. All five were taken during high flow conditions. The post-EWQ median turbidity was within but near the EWQ upper 95% confidence interval, but overall turbidity did not measurably change. Turbidity is positively related to flow. Post-EWQ N was far less than EWQ N, and dry-weather samples were under-represented in the post-EWQ data set. Both concentration and flow are represented on a logarithmic scale.



Chapter 4: 1487 ICP
 Delaware River at Lambertville/New Hope Bridge, NJ/PA

Water Temperature, degrees C

Not included in DRBC Existing Water Quality rules



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1487 ICP DRLamb EWQ	37	6.5	0.18
1487 ICP DRLamb Post	20	12.0	0.60

H statistic	0.07
χ^2 approximation	0.07
DF	1
p-value	0.7955 ¹

H0: $\theta_1 = \theta_2 = \theta...$
 The median of the populations are all equal.
 H1: $\theta_i \neq \theta_j$ for at least one i,j.
 The median of the populations are not all equal.
¹ Do not reject the null hypothesis at the 5% significance level.

No water quality degradation is evident. Water temperature did not measurably change between the EWQ and post-EWQ periods. Water temperature is inversely related to flow, though the relationship is weak. The distributions were almost identical, except post-EWQ minimum and maximum temperatures were higher than EWQ temperatures.