

COMPARISON OF THE 2006 LOADS AND YIELDS OF TOTAL NITROGEN, TOTAL PHOSPHORUS, AND SUSPENDED SEDIMENT WITH THE BASELINES

Annual fluctuations of nutrient and SS loads and water discharge create difficulties in determining whether the changes observed were related to land use, nutrient availability, or simply annual water discharge. Ott and others (1991) used the relationship between annual loads and annual water discharge to provide a method to reduce the variability of loadings due to discharge. This was accomplished by plotting the annual yields against the water-discharge ratio. This water-discharge ratio is the ratio of the annual mean discharge to the LTM discharge. Data from the initial five year study (1985-89) were used to provide a best-fit linear regression line to be used as the baseline relationship between annual yields and water discharge. It was hypothesized that, as future yields and water-discharge ratios were plotted against the baseline, any significant deviation from the baseline would indicate that some change in the annual yield had occurred, and that further evaluations to determine the reason for the change were warranted.

Several different baselines were developed for this report. The data collected in 2006 were compared with the 1985-89 baselines, where possible. Monitoring at some of the stations was started after 1987; therefore, a baseline was established for the five year period following the

start of monitoring. Additionally, annual 2006 yield values were plotted against baselines developed from the first half of the dataset, the second half of the data set, and the entire dataset. The results of these analyses are shown in Table 27. The R^2 value represents the strength of the correlation that each specific regression shows, with an R^2 of one meaning that there is perfect correlation between the two variables—flow and the individual parameter. The closer the R^2 is to a value of one, the better the regression line is for accurately using one variable (flow) to predict the other. R^2 values less than 0.5 have poor predictive value (< 50 percent) and have been noted with an asterisk (*) in Tables 27 and 28. The Y' value is the yield value that the regression line predicts for 2006. The Y corresponds to the actual 2006 yield. R^2 values for TN tend to be close to one as the relationship between TN and flow is very consistent through various ranges of flows. R^2 values for TP and SS tend to vary more, especially towards higher flows. Thus, when regression graphs include high flow events, the resulting correlation tends to be less perfect. This is an indication that single high flow events, and not necessarily a high flow year, are the highest contributors to high loads in TP and SS. As has been evident in the last few years, the high loads that have occurred at Towanda and Danville can be linked directly to high flow events, specifically Tropical Storm Ernesto in 2006 and Hurricane Ivan in 2004. Seasonal baselines also were found for the initial five years of data at each site. Figure 28 compares these baselines to the 2006 seasonal yields.

Table 27. Comparison of 2006 TN, TP, and SS Yields with Baseline Yields at Towanda, Pa.

Site/Parameter/Discharge Ratio			Initial Baseline		First Half Baseline		Full Baseline		Second Half Baseline		2006
			R ²	Y'	R ²	Y'	R ²	Y'	R ²	Y'	Y
Towanda	TN	1.31	0.81	8.58	0.87	8.15	0.75	7.34	0.93	6.48	5.68
	TP	1.31	0.75	0.78	0.87	0.78	0.84	0.73	0.87	0.67	0.83
	SS	1.31	0.46*	982	0.65	1,341	0.55	1,069	0.61	788	1,384
Danville	TN	1.33	0.99	10.50	0.86	8.94	0.68	7.91	0.83	7.34	5.79
	TP	1.33	0.91	0.80	0.84	0.80	0.81	0.78	0.85	0.76	1.09
	SS	1.33	0.99	926	0.70	649	0.72	699	0.74	714	1,364
Lewisburg	TN	0.98	0.83	6.20	0.91	5.78	0.83	5.43	0.95	4.90	4.24
	TP	0.98	0.86	0.30	0.82	0.32	0.87	0.30	0.91	0.29	0.33
	SS	0.98	0.75	238	0.71	204	0.41*	227	0.44*	253	104
Newport	TN	0.79	0.85	6.60	0.86	6.24	0.97	6.01	1.00	5.80	5.99
	TP	0.79	0.93	0.33	0.81	0.31	0.83	0.28	0.86	0.25	0.14
	SS	0.79	0.94	172	0.68	150	0.83	140	0.86	135	56
Marietta	TN	1.14	1.00	10.53	0.94	9.75	0.94	10.67	0.99	8.58	7.83
	TP	1.14	0.96	0.54	0.93	0.57	0.92	0.60	0.93	0.61	0.38
	SS	1.14	0.63	451	0.79	474	0.77	591	0.80	641	386
Conestoga	TN	1.31	1.00	45.25	0.97	43.06	0.96	41.40	0.97	40.45	39.97
	TP	1.31	0.30*	2.75	0.70	3.00	0.67	2.77	0.70	2.60	1.43
	SS	1.31	0.92	1,875	0.83	1,892	0.61	1,600	0.56	1,458	785

R² = correlation coefficient

* indicates a R² that is low and thus is less accurate at predicting Y

Table 28. Comparison of 2006 Seasonal TN, TP, and SS Yields with Baseline Yields at Towanda, Pa.

Site/Parameter		Winter				Spring				Summer				Fall			
		Q	R ²	Y'	Y06	Q	R ²	Y'	Y06	Q	R ²	Y'	Y06	Q	R ²	Y'	Y06
Towanda	TN	1.15	0.94	2.87	1.94	0.91	0.94	2.04	1.28	2.59	0.99	1.41	0.99	1.48	0.98	2.33	1.47
	TP	1.15	0.63	0.17	0.16	0.91	0.93	0.14	0.28	2.59	0.98	0.11	0.19	1.48	0.96	0.21	0.20
	SS	1.15	0.06*	130	94	0.91	0.92	157	872	2.59	0.94	65	244	1.48	0.85	210	174
Danville	TN	1.20	1.00	3.36	2.01	0.94	1.00	2.30	1.24	2.48	1.00	1.74	0.96	1.49	1.00	2.97	1.58
	TP	1.20	0.97	0.25	0.22	0.94	0.99	0.17	0.36	2.48	0.83	0.15	0.23	1.49	0.98	0.22	0.28
	SS	1.20	0.89	332	89	0.94	0.98	419	872	2.48	0.73	75	236	1.49	0.95	159	167
Lewisburg	TN	0.98	0.98	2.34	1.62	0.62	0.98	1.22	0.73	1.38	0.99	0.89	0.62	1.24	0.99	1.91	1.26
	TP	0.98	0.98	0.11	0.11	0.62	1.00	0.06	0.05	1.38	0.80	0.05	0.06	1.24	0.97	0.09	0.12
	SS	0.98	0.91	94	33	0.62	0.96	13	12	1.38	0.40*	15	17	1.24	0.91	59	42
Newport	TN	0.94	0.95	2.90	2.74	0.61	0.98	1.50	1.18	0.83	1.00	0.74	0.62	0.84	0.99	1.65	1.46
	TP	0.94	0.93	0.13	0.06	0.61	0.99	0.08	0.03	0.83	1.00	0.05	0.02	0.84	0.97	0.08	0.03
	SS	0.94	0.94	77	26	0.61	0.95	22	14	0.83	1.00	32	6	0.84	0.86	42	11
Marietta	TN	1.10	0.99	3.48	2.79	0.76	0.99	2.02	1.38	1.83	0.99	1.80	1.32	1.34	1.00	3.07	2.33
	TP	1.10	0.93	0.15	0.10	0.76	0.91	0.11	0.11	1.83	0.92	0.10	0.08	1.34	1.00	0.19	0.09
	SS	1.10	0.94	84	55	0.76	0.90	96	199	1.83	0.87	66	67	1.34	0.98	139	65
Conestoga	TN	1.05	0.99	14.02	12.61	1.13	1.00	11.84	8.59	1.30	0.98	7.94	7.91	1.29	0.99	11.04	10.85
	TP	1.05	0.43*	0.86	0.21	1.13	0.99	0.79	0.81	1.30	0.11*	0.80	0.15	1.29	0.80	0.88	0.27
	SS	1.05	0.15*	270	62	1.13	0.97	596	595	1.30	0.11*	717	34	1.29	0.92	262	94

Q = discharge ratio

R² = correlation coefficient

* indicates a R² that is low and thus is less accurate at predicting Y