

ANNUAL NUTRIENT AND SUSPENDED-SEDIMENT LOADS AND YIELDS

Nutrient and suspended-sediment loads were computed for total nitrogen (TN), dissolved nitrogen (DN), total phosphorus (TP), dissolved phosphorus (DP), suspended sediment (SS), total ammonia (TNH), dissolved ammonia (DNH), total organic nitrogen (TON), dissolved organic nitrogen (DON), total nitrite plus nitrate (TNO23), dissolved nitrite plus nitrate (DNO23), dissolved orthophosphate (DOP), and total organic carbon (TOC). The minimum variance unbiased estimator described by Cohn and others (1989) was used to compute the loads. This estimator relates constituent concentration to water discharge, seasonal effects, and long-term trends, and computes the best-fit regression equation. Daily loads of the constituents were then calculated from the daily mean water discharge records. The loads were reported, along with the estimates of accuracy.

Tables 5 through 17 list the computed loads, in pounds per year (lb/yr), and corresponding yields, in pounds per acre per year (lb/ac/yr), of the constituents measured at each of the sites. Loads and yields are discussed together because they are mathematically the same values, with different connotations. Load values are equated to the quantity of material carried past a given point during a specific time period. Yield values are equated to the quantity of material derived from a unit of area over a specific time period. Therefore, yield values can be compared between subbasins, regardless of differences in watershed size.

The calendar year 2001 and the long-term mean annual loads and yields of TN are shown in Figures 4A and 4B, respectively. The 2001 annual loads and yields of TN were lower than the long-term mean at all sites. The greatest TN loads were measured at Marietta, followed by Danville.

The Conestoga River at Conestoga had the smallest TN loads.

The Conestoga River Watershed, with 62.7 percent agricultural and 22.4 percent forest lands (Ott and others, 1991), had the highest yield of TN, 19.38 lb/ac/yr. Annual yields of TN, shown in Figure 4B and Table 5, indicate that the Susquehanna River at Danville yielded more nitrogen per unit area than the West Branch Susquehanna River at Lewisburg. The West Branch Susquehanna River Watershed consists of 81 percent forest and 13.9 percent agricultural lands, as compared to 59.8 percent forest and 26.9 percent agricultural lands above Danville. The long-term mean yield indicates that the Susquehanna River at Danville normally yields more nitrogen per unit area.

The 2001 annual loads and yields of TP were lower than the long-term mean loads and yields at all sites, as illustrated in Figures 5A and 5B. The annual TP load was greatest at Marietta, followed by Danville, and the smallest annual TP load was measured at Conestoga. The greatest yield of TP occurred at Conestoga, followed by Marietta.

The annual loads and yields of SS are illustrated in Figures 6A and 6B, respectively. The 2001 loads and yields were lower than the respective long-term mean loads and yields at all sites. The highest 2001 SS loads were measured at Marietta, followed by Towanda. The Conestoga River had the smallest 2001 SS load and the highest yield.

Annual loads of TNH, DNH, TNO23, DNO23, TON, DON, DN, DP, DOP, and TOC were greatest at Marietta. Annual loads of TNH, DNH, TNO23, DNO23, DP, DOP, TON, DON, DN, and TOC were greater at Danville than at Lewisburg. The Conestoga River had the highest yields of all parameters except TOC, which was highest at Danville.

Table 5. Annual Water Discharges and Annual Loads and Yields of Total Nitrogen, Calendar Year 2001

Site Short Name	Annual Discharge cfs	Total Nitrogen as N 2001		
		Annual Load thousands of pounds	Prediction Error percent	Annual Yield pounds per acre per year
		Towanda	7,727	18,461
Danville	11,067	28,725	12.28	4.00
Lewisburg	6,749	13,196	14.74	3.01
Newport	2,499	8,240	9.58	3.84
Marietta	24,378	74,547	12.1	4.48
Conestoga	367	5,828	9.79	19.38

Table 6. Annual Water Discharges and Annual Loads and Yields of Total Phosphorus, Calendar Year 2001

Site Short Name	Annual Discharge cfs	Total Phosphorus as P 2001		
		Annual Load thousands of pounds	Prediction Error percent	Annual Yield pounds per acre per year
		Towanda	7,727	1,799
Danville	11,067	2,307	38.63	0.32
Lewisburg	6,749	901	43.23	0.21
Newport	2,499	664	39.17	0.31
Marietta	24,378	6,774	32.42	0.41
Conestoga	367	305	46.02	1.01

Table 7. Annual Water Discharges and Annual Loads and Yields of Suspended Sediment, Calendar Year 2001

Site Short Name	Annual Discharge cfs	Suspended Sediment 2001		
		Annual Load thousands of pounds	Prediction Error percent	Annual Yield pounds per acre per year
		Towanda	7,727	1,307,225
Danville	11,067	1,146,902	64.22	159.72
Lewisburg	6,749	253,169	62.99	57.77
Newport	2,499	245,733	78.15	114.48
Marietta	24,378	3,171,338	44.79	190.66
Conestoga	367	86,056	123.47	286.09

Table 8. Annual Water Discharges and Annual Loads and Yields of Total Ammonia, Calendar Year 2001

Site Short Name	Annual Discharge	Total Ammonia as N		
		2001		
	cfs	Annual Load thousands of pounds	Prediction Error percent	Annual Yield pounds per acre per year
Towanda	7,727	746	36.9	0.15
Danville	11,067	978	38.8	0.14
Lewisburg	6,749	573	41.06	0.13
Newport	2,499	112	41.88	0.05
Marietta	24,378	2,005	34.38	0.12
Conestoga	367	55	49.3	0.18

Table 9. Annual Water Discharges and Annual Loads and Yields of Total Nitrite Plus Nitrate Nitrogen, Calendar Year 2001

Site Short Name	Annual Discharge	Total Nitrite Plus Nitrate as N		
		2001		
	cfs	Annual Load thousands of pounds	Prediction Error percent	Annual Yield pounds per acre per year
Towanda	7,727	10,119	13.96	2.03
Danville	11,067	17,310	14.7	2.41
Lewisburg	6,749	7,722	14.95	1.76
Newport	2,499	5,603	9.41	2.61
Marietta	24,378	46,599	14.02	2.80
Conestoga	367	4,864	13.56	16.17

Table 10. Annual Water Discharges and Annual Loads and Yields of Total Organic Nitrogen, Calendar Year 2001

Site Short Name	Annual Discharge	Total Organic Nitrogen as N		
		2001		
	cfs	Annual Load thousands of pounds	Prediction Error percent	Annual Yield pounds per acre per year
Towanda	7,727	7,810	23.32	1.57
Danville	11,067	11,277	25.87	1.57
Lewisburg	6,749	5,206	32.98	1.19
Newport	2,499	2,563	24.35	1.19
Marietta	24,378	31,040	27.73	1.87
Conestoga	367	1,023	41.66	3.40

Table 11. Annual Water Discharges and Annual Loads and Yields of Dissolved Phosphorus, Calendar Year 2001

Site Short Name	Annual Discharge	Dissolved Phosphorus as P		
		2001		
	cfs	Annual Load thousands of pounds	Prediction Error percent	Annual Yield pounds per acre per year
Towanda	7,727	797	31.54	0.16
Danville	11,067	873	34.23	0.12
Lewisburg	6,749	380	33.87	0.09
Newport	2,499	380	40.23	0.18
Marietta	24,378	3,278	30.26	0.20
Conestoga	367	148	23.56	0.49

Table 12. Annual Water Discharges and Loads and Yields of Dissolved Orthophosphate, Calendar Year 2001

Site Short Name	Annual Discharge	Dissolved Orthophosphate as P		
		2001		
	cfs	Annual Load thousands of pounds	Prediction Error percent	Annual Yield pounds per acre per year
Towanda	7,727	952	58.53	0.19
Danville	11,067	1,070	59.35	0.15
Lewisburg	6,749	382	62.59	0.09
Newport	2,499	433	73.72	0.20
Marietta	24,378	5,383	64.63	0.32
Conestoga	367	161	34.53	0.54

Table 13. Annual Water Discharges and Annual Loads and Yields of Dissolved Ammonia, Calendar Year 2001

Site Short Name	Annual Discharge	Dissolved Ammonia as N		
		2001		
	cfs	Annual Load thousands of pounds	Prediction Error percent	Annual Yield pounds per acre per year
Towanda	7,727	886	33.7	0.18
Danville	11,067	1,290	35.72	0.18
Lewisburg	6,749	643	35.08	0.15
Newport	2,499	158	31.97	0.07
Marietta	24,378	2,254	25.9	0.14
Conestoga	367	58	46.45	0.19

Table 14. Annual Water Discharges and Annual Loads and Yields of Dissolved Nitrogen, Calendar Year 2001

Site Short Name	Annual Discharge	Dissolved Nitrogen as N		
		2001		
		Annual Load	Prediction Error	Annual Yield
cfs	thousands of pounds	percent	pounds per acre per year	
Towanda	7,727	17,125	11.55	3.43
Danville	11,067	26,893	12.62	3.75
Lewisburg	6,749	12,018	13.33	2.74
Newport	2,499	7,685	9.38	3.58
Marietta	24,378	67,406	12.59	4.05
Conestoga	367	5,507	10.95	18.31

Table 15. Annual Water Discharges and Annual Loads and Yields of Dissolved Nitrite Plus Nitrate Nitrogen, Calendar Year 2001

Site Short Name	Annual Discharge	Dissolved Nitrite Plus Nitrate Nitrogen as N		
		2001		
		Annual Load	Prediction Error	Annual Yield
cfs	thousands of pounds	percent	pounds per acre per year	
Towanda	7,727	10,203	14.26	2.04
Danville	11,067	17,491	14.92	2.44
Lewisburg	6,749	7,688	14.6	1.75
Newport	2,499	5,641	9.48	2.63
Marietta	24,378	46,722	14.29	2.81
Conestoga	367	4,846	13.9	16.11

Table 16. Annual Water Discharges and Annual Loads and Yields of Dissolved Organic Nitrogen, Calendar Year 2001

Site Short Name	Annual Discharge	Dissolved Organic Nitrogen as N		
		2001		
		Annual Load	Prediction Error	Annual Yield
cfs	thousands of pounds	percent	pounds per acre per year	
Towanda	7,727	6,227	22.58	1.25
Danville	11,067	8,716	21.59	1.21
Lewisburg	6,749	3,851	22.62	0.88
Newport	2,499	1,993	19.94	0.93
Marietta	24,378	20,355	24.06	1.22
Conestoga	367	611	36.15	2.03

Table 17. Annual Water Discharges and Annual Loads and Yields of Total Organic Carbon, Calendar Year 2001

Site Short Name	Annual Discharge	Total Organic Carbon		
		2001		
	cfs	Annual Load thousands of pounds	Prediction Error percent	Annual Yield pounds per acre per year
Towanda	7,727	49,512	8.90	9.92
Danville	11,067	65,492	9.32	13.12
Lewisburg	6,749	27,757	13.00	6.33
Newport	2,499	15,357	12.07	7.15
Marietta	24,378	149,819	11.15	9.00
Conestoga	367	3,378	19.71	11.23

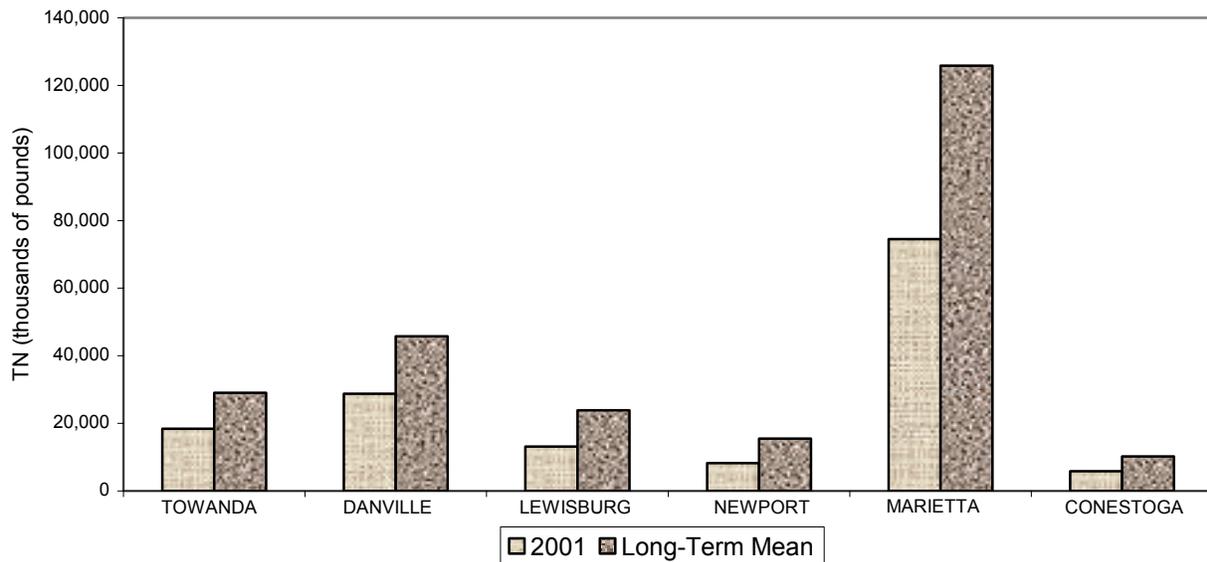


Figure 4A. Annual Loads of Total Nitrogen (TN) at Towanda, Danville, Lewisburg, Newport, Marietta, and Conestoga, Pa., Calendar Year 2001

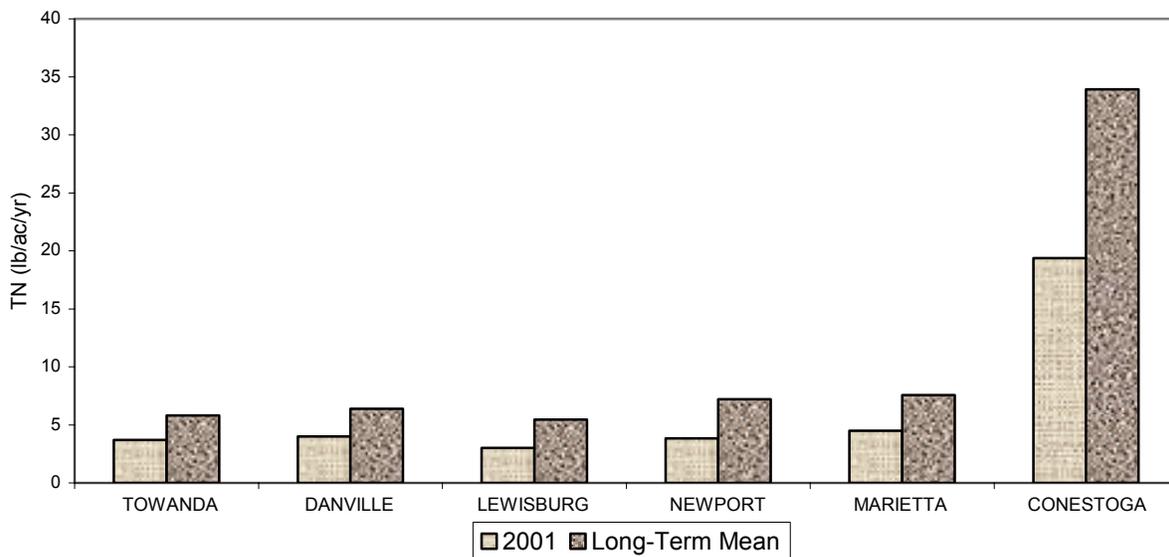


Figure 4B. Total Nitrogen (TN) Yields at Towanda, Danville, Lewisburg, Newport, Marietta, and Conestoga, Pa., Calendar Year 2001

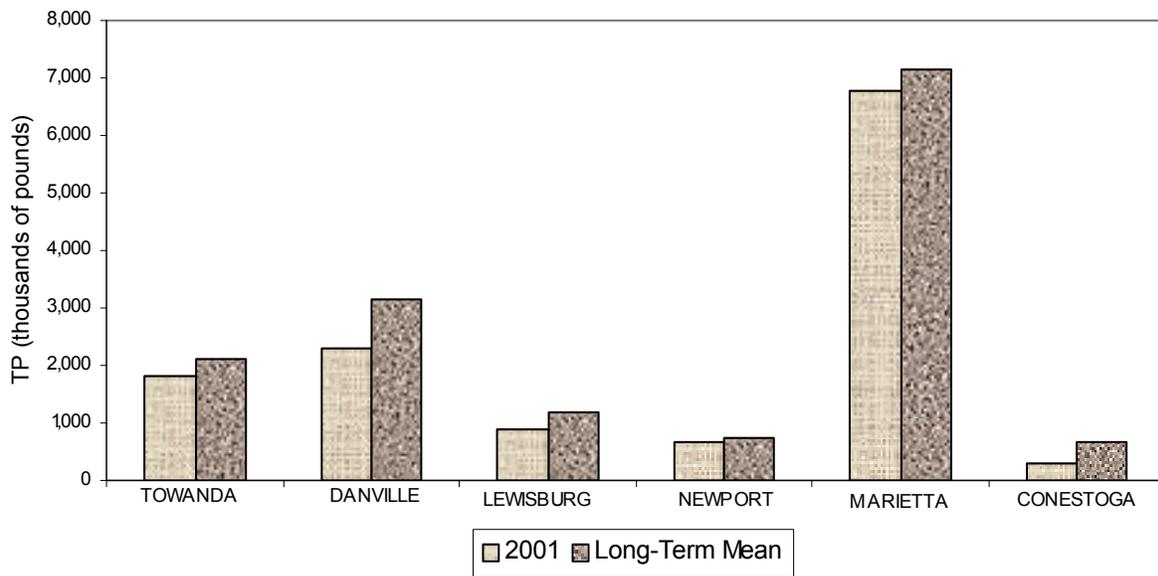


Figure 5A. Annual Loads of Total Phosphorus (TP) at Towanda, Danville, Lewisburg, Newport, Marietta, and Conestoga, Pa., Calendar Year 2001

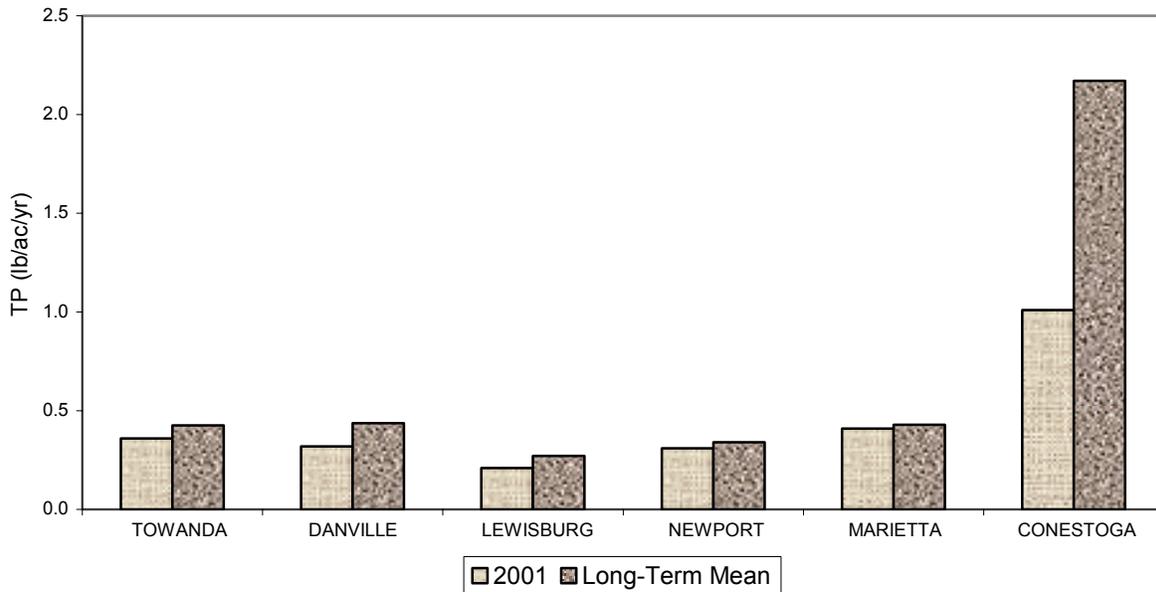


Figure 5B. Total Phosphorus (TP) Yields at Towanda, Danville, Lewisburg, Newport, Marietta, and Conestoga, Pa., Calendar Year 2001

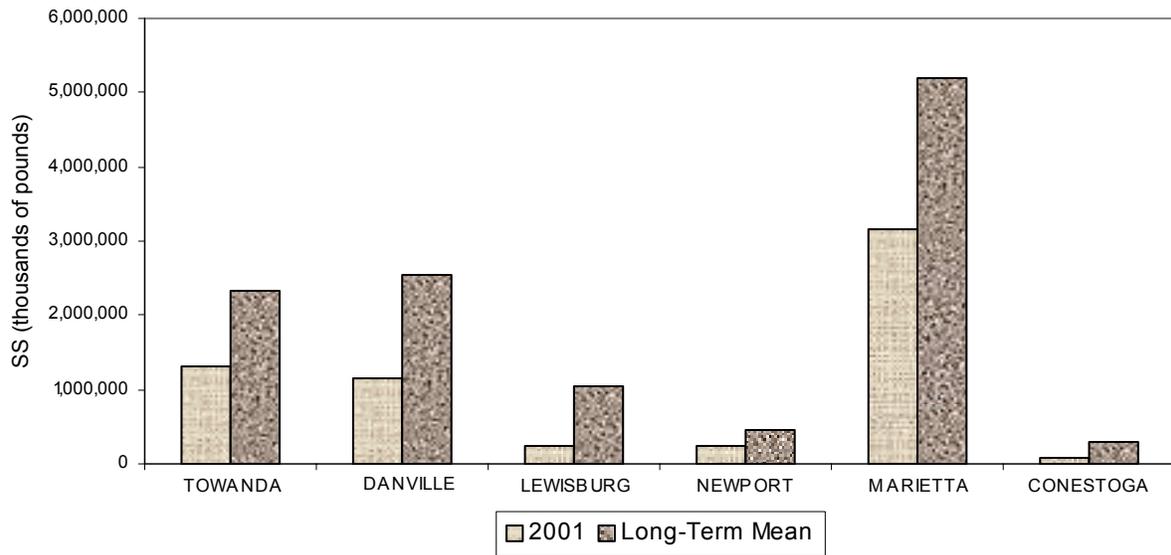


Figure 6A. Annual Loads of Suspended Sediment (SS) at Towanda, Danville, Lewisburg, Newport, Marietta, and Conestoga, Pa., Calendar Year 2001

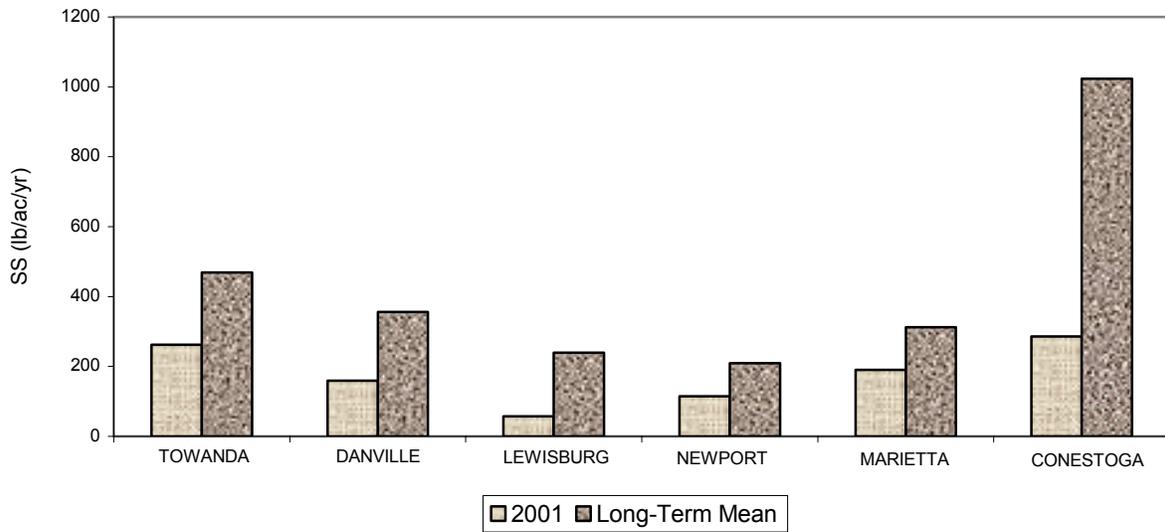


Figure 6B. Suspended Sediment (SS) Yield at Towanda, Danville, Lewisburg, Newport, Marietta, and Conestoga, Pa., Calendar Year 2001