

non-tidal monitoring network for the entire Bay watershed.

## **Purpose of Report**

The purpose of this report is to present basic information on annual and seasonal loads and yields of nutrients and SS measured during calendar year 2005. Comparisons are made to: LTM; baseline data calculated from the 1985-89 study; baseline data calculated from the first half of the dataset; baseline data calculated from the second half of the dataset; and data from similar flow years. Seasonal and annual variations in loads are discussed, as well as the results of flow-adjusted trend analyses for the period January 1985 through December 2005 for various forms of nitrogen and phosphorus, SS, TOC, and discharge.

## **DESCRIPTION OF THE SUSQUEHANNA RIVER BASIN**

The Susquehanna River (Figure 1) drains an area of 27,510 square miles (Susquehanna River Basin Study Coordination Committee, 1970) and is the largest tributary to the Bay. The Susquehanna River originates in the Appalachian Plateau of southcentral New York, flows into the Valley and Ridge and Piedmont Provinces of Pennsylvania and Maryland, and

joins the Bay at Havre de Grace, Md. The climate in the Susquehanna River Basin varies considerably from the low lands adjacent to the Bay in Maryland to the high elevations, above 2,000 feet, of the northern headwaters in central New York State. The annual mean temperature ranges from 53° F (degrees Fahrenheit) near the Pennsylvania-Maryland border to 45° F in the northern part of the basin. Annual precipitation in the basin averages 40.4 inches and is fairly well distributed throughout the year.

Land use in the Susquehanna River Basin, shown in Table 1, is predominantly rural with woodland accounting for 69 percent; agriculture, 21 percent; and urban, 7 percent. Woodland occupies the higher elevations of the northern and western parts of the basin and much of the mountain and ridge land in the Juniata and Lower Susquehanna Subbasins. Woods and grasslands occupy areas in the lower part of the basin that are unsuitable for cultivation because the slopes are too steep, the soils are too stony, or the soils are poorly drained. The Lower Susquehanna Subbasin contains the highest density of agriculture operations within the watershed. However, extensive areas are cultivated along the river valleys in southern New York and along the West Branch Susquehanna River from Northumberland, Pa., to Lock Haven, Pa., including the Bald Eagle Creek Valley.



Figure 1. The Susquehanna River Basin, Subbasins, and Population Centers

**Table 1. 2000 Land Use Percentages for the Susquehanna River Basin and Selected Tributaries**

Site Location	Waterbody	Water/Wetland	Urban	Agricultural			Forest	Other
				Row Crops	Pasture/Hay	Total		
Towanda	Susquehanna	2	5	17	5	22	71	0
Danville	Susquehanna	2	6	16	5	21	70	1
Lewisburg	West Branch Susquehanna	1	5	8	2	10	84	0
Newport	Juniata	1	6	14	4	18	74	1
Marietta	Susquehanna	2	7	14	5	19	72	1
Conestoga	Conestoga	1	24	12	36	48	26	1
Wilkes-Barre	Susquehanna	2	6	16	5	21	71	0
Karthaus	West Branch Susquehanna	1	6	11	1	12	80	1
Castanea	Bald Eagle	1	8	11	3	14	76	1
Jersey Shore	West Branch Susquehanna	1	4	6	1	7	87	1
Penns Creek	Penns	1	3	16	4	20	75	1
Saxton	Raystown Branch Juniata	< 0.5	6	18	5	23	71	0
Dromgold	Shermans	1	4	15	6	21	74	0
Hogestown	Conodoguinet	1	11	38	6	44	43	1
Hershey	Swatara	2	14	18	10	28	56	0
Manchester	West Conewago	2	13	12	36	48	36	1
Martic Forge	Pequea	1	12	12	48	60	25	2
Richardsmere	Octoraro	1	10	16	47	63	24	2
Campbell	Cohocton	3	4	13	6	19	74	0
Rockdale	Unadilla	3	2	22	6	28	66	0
Conklin	Susquehanna	3	3	18	4	22	71	1
Smithboro	Susquehanna	3	5	17	5	22	70	0
Chemung	Chemung	2	5	15	5	20	73	0
Entire Basin	Susquehanna River Basin	2	7	14	7	21	69	1

Major urban areas in the Lower Susquehanna Subbasin include York, Lancaster, Harrisburg, and Sunbury, Pa. Most of the urban areas in the northern part of the basin are located along river valleys, including Binghamton, Elmira, and Corning, N.Y. Urban areas in the Middle Susquehanna subbasin include Scranton and Wilkes-Barre, Pa. The major urban areas in the West Branch Susquehanna Subbasin are Williamsport, Renovo, and Clearfield, Pa. Lewistown and Altoona are the major urban areas within the Juniata Subbasin.

#### NUTRIENT MONITORING SITES

Data were collected from six sites on the Susquehanna River, three sites on the West Branch Susquehanna River, and fourteen sites on smaller tributaries in the basin. These 23 sites, selected for long-term monitoring of nutrient and SS transport in the basin, are listed in Table 2, and their general locations are shown in Figure 2.

**Table 2. Data Collection Sites and Their Drainage Areas**

USGS ID Number	Original Sites (Group A)	Subbasin	Short Name	Drainage Area (Sq Mi)
01531500	Susquehanna River at Towanda, Pa.	Middle Susquehanna	Towanda	7,797
01540500	Susquehanna River at Danville, Pa.	Middle Susquehanna	Danville	11,220
01553500	West Branch Susquehanna River at Lewisburg, Pa.	W Branch Susquehanna	Lewisburg	6,847
01567000	Juniata River at Newport, Pa.	Juniata	Newport	3,354
01576000	Susquehanna River at Marietta, Pa.	Lower Susquehanna	Marietta	25,990
01576754	Conestoga River at Conestoga, Pa.	Lower Susquehanna	Conestoga	470
	<b>Enhanced Sites (Group B)</b>			
01502500	Unadilla River at Rockdale, NY	Upper Susquehanna	Rockdale	520
01503000	Susquehanna River at Conklin, NY	Upper Susquehanna	Conklin	2,232
01515000	Susquehanna River at Smithboro, NY	Upper Susquehanna	Smithboro	4,631
01529500	Cohocton River at Campbell, NY	Chemung	Campbell	470
01531000	Chemung River at Chemung, NY	Chemung	Chemung	2,506
01536500	Susquehanna River near Wilkes-Barre, Pa.	Middle Susquehanna	Wilkes-Barre	9,960
01542500	West Branch Susquehanna River near Karthaus, Pa.	W Branch Susquehanna	Karthaus	1,462
01548085	Bald Eagle Creek near Castanea, Pa.	W Branch Susquehanna	Castanea	420
01549760	West Branch Susquehanna River at Jersey Shore, Pa.	W Branch Susquehanna	Jersey Shore	5,225
01555000	Penns Creek at Penns Creek, Pa.	Lower Susquehanna	Penns Creek	301
01562000	Raystown Branch Juniata River at Saxton, Pa.	Juniata	Saxton	756
01568000	Shermans Creek near Dromgold, Pa.	Lower Susquehanna	Dromgold	200
01570000	Conodoguinet Creek near Hogestown, Pa.	Lower Susquehanna	Hogestown	470
01573560	Swatara Creek near Hershey, Pa.	Lower Susquehanna	Hershey	483
01574000	West Conewago Creek near Manchester, Pa.	Lower Susquehanna	Manchester	510
01576787	Pequea Creek near Martic Forge, Pa.	Lower Susquehanna	Martic Forge	155
01578475	Octoraro Creek at Richardsmere, Md.	Lower Susquehanna	Richardsmere	177

## SAMPLE COLLECTION AND ANALYSIS

Samples were collected to measure nutrient and SS concentrations during various flows in 2005. For Group A sites, two samples were collected per month: one near the twelfth of the month and one during monthly base flow conditions. Additionally, at least four high flow events were sampled, targeting one per season. When possible, a second high flow event was sampled after spring planting in the basin. During high flow sampling events, samples were collected daily during the rise and fall of the hydrograph. The goal was to gather a minimum of three samples on the rise and three samples on the fall, with one sample as close to peak flow as possible. Sampling continued until flows returned to near pre-storm levels. All samples

were collected by hand with USGS depth integrating samplers. At each site between 3 and 10 depth integrated verticals were collected across the water column and then composited to obtain a representative sample of the entire waterbody. For Group B sites, fixed date monthly samples also were collected near the twelfth of each month during 2005, except for Rockdale, Campbell, Conklin, and Richardsmere, where samples were collected only during the last three months of 2005. Additionally, four storms were sampled (one storm/season and two samples/storm) at all enhanced sites except for those beginning in October, which had two storm samples collected during that season. Samples were collected using the same protocols as at Group A sites.