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# NUTRIENTS AND SUSPENDED SEDIMENT TRANSPORTED IN THE SUSQUEHANNA RIVER BASIN, 2005, AND TRENDS, JANUARY 1985 THROUGH DECEMBER 2005

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## **ABSTRACT**

Nutrient and suspended-sediment (SS) samples were collected under base flow, fixed date, and stormflow conditions during calendar year 2005 for Group A sites listed in Table 2. Fixed date and storm samples also were collected at sites listed in Group B. All samples were analyzed for nitrogen and phosphorus species, total organic carbon (TOC), and SS.

Precipitation for 2005 was above average at all Group A sites except Lewisburg and Newport. The highest departure from the long-term precipitation average was recorded at Towanda with 16.49 inches above the long-term mean (LTM). Highest departure from LTM for discharge was 115 percent above LTM at both Danville and Conestoga. Precipitation and flows were above LTM largely due to heavy rainfalls in January and April. Lowest departure from the mean was at Newport with 3.43 inches below LTM for rainfall and flows at 91 percent of the LTM. Low rainfall during the spring and summer months in the western part of the basin led to below LTM rainfall and flows at Lewisburg and Newport.

This report utilizes four methods to analyze nutrient and SS loads and yields: (1) comparison with the LTM; (2) comparison with dataset baseline yields; (3) comparison to similar flow years; and (4) flow-adjusted trend analysis through 2005. Comparison with the LTM showed increases in total phosphorus (TP) and SS for Towanda and Danville. All sites showed decreases in total nitrogen (TN) and total organic nitrogen, except for TN at Newport. Baseline comparisons showed decreases in TN at Towanda and Danville when the second half

of the dataset was compared to the first half. Additionally, improvements were found at Conestoga for TP and SS for 2005 when compared to all baselines. Trends in flow-adjusted concentrations (FACs) were found to be decreasing for TN, TP, and SS at all sites except for TP at Marietta, which showed no significant trends and SS at Lewisburg, which had greater than 20 percent of the values below the method detection limit. No significant trends were found for flow.

## **INTRODUCTION**

Nutrients and SS entering the Chesapeake Bay (Bay) from the Susquehanna River Basin contribute to nutrient enrichment problems in the Bay (USEPA, 1982). The Pennsylvania Department of Environmental Protection (PADEP) Bureau of Laboratories, the U.S. Environmental Protection Agency (USEPA), the U.S. Geological Survey (USGS), and the Susquehanna River Basin Commission (SRBC) conducted a 5-year intensive study at 12 sites from 1985-89 to quantify nutrient and SS transported to the Bay via the Susquehanna River Basin. In 1990, the number of sampling sites was reduced to five long-term monitoring stations. An additional site was added in 1994.

In October 2004, 13 additional sites (two in New York and eleven in Pennsylvania) were added as part of the Chesapeake Bay Program's Non-tidal Water Quality Monitoring Network. In October 2005, four more sites (three in New York and one in Maryland) were added to the existing network. This project involves an effort conducted by all six Bay state jurisdictions, the USEPA, USGS, and SRBC to create a uniform

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.