
NUTRIENTS AND SUSPENDED SEDIMENT TRANSPORTED IN THE SUSQUEHANNA RIVER BASIN, 2008, AND TRENDS, JANUARY 1985 THROUGH DECEMBER 2008

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ABSTRACT

Nutrient and suspended-sediment (SS) samples were collected under base flow and stormflow conditions during calendar year 2008 for Group A sites listed in Table 2. Fixed date samples also were collected at these sites as well as at Group B sites listed in Table 2. All samples were analyzed for nitrogen and phosphorus species, total organic carbon (TOC), and SS.

Precipitation for 2008 was above average at all Group A sites. Largest departure from the long-term mean (LTM) for precipitation was recorded at Danville, Pa., with 6.82 inches above the LTM. Highest precipitation months occurred during January through March at all sites with an average of 3.5 inches above the LTM. Discharge values were below the LTM at Towanda, Lewisburg, and Conestoga and above the LTM at Danville, Newport, and Lewisburg. Highest departures from the LTM were at Newport with 110.3 percent of the LTM and at Lewisburg with 93.3 percent of the LTM. Flow levels were highest at all sites during February and March with additional high flow levels in May and December 2008.

This report utilizes several methods to compare nutrient and SS loads and yields including: (1) comparison with the LTM; (2) comparison with baseline data; and (3) flow adjusted concentration trend analysis.

Annual loads for all nitrogen species were below LTM at all sites except for Newport. All nitrogen species were either at or above the LTM at Newport except for dissolved organic nitrogen (DON), which was below the LTM.

All phosphorus species had above LTM loads at Towanda and Danville including near double LTM values of dissolved orthophosphate (DOP). Additionally, Lewisburg had above LTM levels of dissolved phosphorus (DP) and DOP, while Newport had above LTM levels of total phosphorus (TP) and DOP. TOC was above or at LTM levels for Newport and Marietta, respectively. 2008 SS values were below LTM including dramatically lower values at Conestoga, which also had lower than LTM values for all other parameters. 2008 loads of TN, TP, and SS were highest during March, which accounted for 10 percent of the annual flow and 26 percent, 40 percent, and 57 percent of the TN, TP, and SS annual loads, respectively.

Lower than predicted yields in TN, TP, and SS were found in 2008 for all baseline comparisons at all sites except for TP at Towanda and TP at Danville for the second half baseline comparison. Seasonal yields at Towanda were higher than baseline predictions for both spring and winter for TP and during winter for SS. 2008 annual yields were dramatically lower than baseline predictions at Conestoga for TN, TP, and SS. Although 2008 annual TP at Lewisburg was below baseline predictions, both fall and winter yields were higher.

TN, TP, and SS trends were improving at all sites during 2008 except for TP at Towanda, which had no significant trend. Upward trends were found at Towanda and Newport for DOP. The most southern site, Marietta, showed downward trends for all parameters except DOP, which had no significant trend due to more than 20 percent of the values being below the method

detection limit (BMDL). This also occurred for dissolved ammonia nitrogen (DNH_3) at Towanda, Danville, Lewisburg, and Newport. No significant trends were found for flow for the time period.

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 included in 1994.

In October 2004, 13 additional sites (two in New York and 11 in Pennsylvania) were added as part of the Chesapeake Bay Program's Nontidal 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 monitoring efforts conducted by all six Bay state jurisdictions, 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 2008. Comparisons are made to LTM and to various baselines, including baselines created from the initial five years of data, the first half of the dataset, the second half of the dataset, and those created from the entire dataset for each site. Additionally, seasonal baselines were created using the initial five years of data from each site. 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 2008 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 Chesapeake 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 39.15 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.