Fact Sheet
U.S. Department of the Interior, U.S. Geological Survey

FS-140-96

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January 1996 Floods Deliver Large Loads of Nutrients and Sediment to the Chesapeake Bay

Susquehanna River at Conowingo Dam, Md., during the January flood.

The *Blizzard of 1996* struck the Mid-Atlantic region in January, depositing a record amount of snowfall. Within two weeks of the paralyzing blizzard, warm and extremely humid air entered the region, followed by a major rainstorm. The combination of warm, humid air and heavy rainfall melted the snow at an unprecedented rate. In just over one day, two to five inches of water from snowmelt combined with two to five inches of rainfall, resulting in widespread major flooding throughout the Mid-Atlantic region, including the Chesapeake Bay watershed **(Figure 1)**.

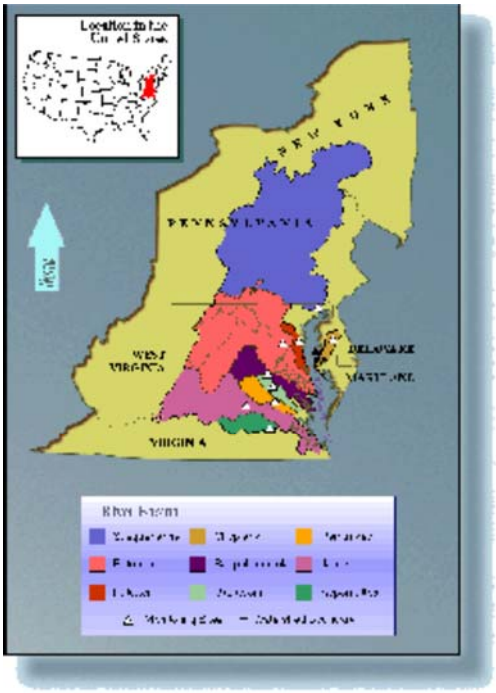


Figure 1. Chesapeake Bay watershed and location of its major tributaries.

The January 1996 storm caused severe flooding on many Chesapeake Bay tributaries. As a result of the flooding, large amounts of nutrients and sediment entered the Bay. The U.S. Geological Survey (USGS) monitored the amount of streamflow, nutrients, and sediment that entered the Chesapeake Bay as a result of the flood. This information is used to evaluate the effect of hydrologic events of this magnitude on the Bay's health and living resources.

WHAT ARE NUTRIENTS AND SEDIMENT, AND HOW DO THEY HARM THE CHESAPEAKE BAY?

Nutrients are defined as something that nourishes. Two primary nutrients, nitrogen and phosphorus, occur naturally in the environment as a result of decomposition of plant material, deposition of atmospheric nitrogen, and erosion of phosphorus-containing rocks. They have always been present in the Bay, providing nourishment to plants and animals.

An excessive amount of nutrients can harm the Chesapeake Bay. Excess nutrients enter the Bay from

"nonpoint" sources such as airborne pollution and runoff from city streets and fertilizer-laden farmlands, as well as from "point" sources such as sewage-treatment plants. When an excess amount of nutrients exists in the Bay, algae grow at a very fast rate. An abundance of algae results in cloudy water, which prevents Bay grasses from receiving the sunlight they need to live. Additionally, when the algae die, they are decomposed by bacteria that use up the oxygen dissolved in the water. Dissolved oxygen is very important to the survival of living resources in the Chesapeake Bay, and if it is depleted, the plants and animals that make their home in the Bay may die.

Sediment is fragmental material derived primarily from the physical degradation and chemical decomposition of rocks. Sediment also is present naturally in the environment, and is transported to the Chesapeake Bay by its tributaries.

Sediment harms the Bay when present in excessive amounts. Excess sediment enters the Bay from the erosion of farmland and construction sites, as well as in runoff from cities and suburbs. Excess sediment clouds the water and coats the leaves of plants, both of which deprive them of sunlight needed for growth. In addition, phosphorus and toxic contaminants, such as trace metals and pesticides, attach to sediment particles that are carried downstream and deposited into the Bay.

HOW MUCH WATER, NUTRIENTS, AND SEDIMENT ENTER THE BAY DURING AN AVERAGE JANUARY?

The USGS monitors the amount of freshwater that enters the Chesapeake Bay each month. During an average January, approximately 1.7 trillion gallons of water enters the Bay **(Figure 2)**. Most of this water comes from the Bay's three largest tributaries-the Susquehanna (53 percent), the Potomac (18 percent), and the James (12 percent) Rivers.

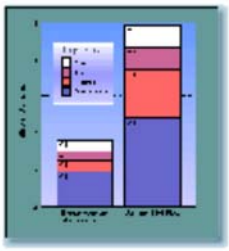
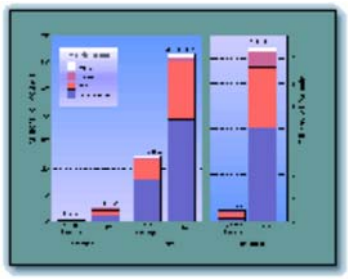


Figure 2. Relation of 46-year average January flow to January 1996 flow into the Chesapeake Bay.

The USGS also monitors the amount of nutrients and sediment that enter the Chesapeake Bay each month from nine of its major tributaries. During an average January, these tributaries carry 0.9 million pounds of phosphorus, 24.7 million pounds of nitrogen, and 454 million pounds of sediment into Chesapeake Bay **(Figure 3)**. Of that amount, 99 percent of the nitrogen, 92 percent of the phosphorus, and 93 percent of the sediment comes from the Susquehanna, Potomac and James Rivers, combined.

Figure 3. Relation of January 6-year average to January 1996 loads of phosphorus, nitrogen, and sediment to the Chesapeake Bay.



HOW MUCH WATER, NUTRIENTS, AND SEDIMENT ENTERED THE BAY DURING THE JANUARY 1996 FLOOD?

During the January 1996 flood, 4.9 trillion gallons of water entered the Chesapeake Bay (Figure 2). Most of this water came from the Susquehanna, Potomac, and James Rivers, which contributed 49, 27, and 12 percent of the freshwater flow, respectively.

As a result of the flood, 5.3 million pounds of phosphorus, 63 million pounds of nitrogen, and 7.5 billion pounds of sediment entered the Chesapeake Bay from its nine major tributaries (Figure 3). The majority of the nutrients and sediment that entered the Bay during the January 1996 flood came from the Susquehanna, Potomac, and James Rivers. These three major tributaries combined transported 94 percent of the phosphorus load, 97 percent of the nitrogen load, and 97 percent of the sediment load to the Bay.

HOW MUCH ABOVE NORMAL WAS THE JANUARY 1996 FLOOD?

The January flood transported roughly three times the amount of freshwater, six times the amount of phosphorus, three times the amount of nitrogen, and 17 times the amount of sediment to the Chesapeake Bay than is transported during an average January. Nearly one-half of the phosphorus, one-quarter of the nitrogen, and all of the sediment that is typically transported to the Bay in an average year entered the Bay during the January 1996 flood.

WHAT EFFECTS WILL THE EXCESSIVE AMOUNT OF WATER, NUTRIENTS, AND SEDIMENT HAVE ON THE CHESAPEAKE BAY?

Although the January 1996 flood was one of the largest ever recorded on the Chesapeake Bay, its impact is expected to be minimal because of the time of year it occurred. The flood occurred in the winter, a time when grasses and many living organisms were dormant in the Bay and when farmland, rich in nutrients, was frozen, thereby preventing the rain from causing excessive runoff of nutrients into the Bay. The high amount of sediment transported to the Bay during the flood came from streambank and river-channel erosion.

Monitoring streamflow and water quality during this event and other major hydrologic events on the Bay is important in understanding how natural processes such as floods affect the health and living resources of the Chesapeake Bay.

As part of the Chesapeake Bay River Input Monitoring Program, the USGS, in cooperation with the Maryland Department of Natural Resources and the Virginia Department of Environmental Quality, continues to monitor the amount of water, nutrients, and sediment entering the Chesapeake Bay and thereby contributes to the information needed to restore its health and productivity.

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