

# **SNY MAGILL WATERSHED MONITORING PROJECT: BASELINE DATA**

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## **SUSPENDED SEDIMENT AND STREAM DISCHARGE IN BLOODY RUN AND SNY MAGILL WATERSHEDS: WATER YEAR 1992**

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### **ABSTRACT**

Hydrologic data were collected in the Bloody Run and Sny Magill watersheds in Clayton County, Iowa during the 1992 Water Year (October 1, 1991 to September 30, 1992) to provide data on suspended sediment and stream discharge from these watersheds. Suspended-sediment samples were collected daily during normal flow and several times during rainstorms. Stream stage was recorded continuously and stream-discharge measurements were made monthly to develop a stage-discharge relation. Data on drainage-basin morphology and precipitation were quantified to help understand the variability in sediment and stream discharge. The total suspended-sediment discharge for Water Year 1992 was 2,720 tons at site BR1 on Bloody Run and 1,940 tons at site SN1 on Sny Magill Creek. The daily median suspended-sediment discharge was 1.1 tons at both sites BR1 and SN1. The maximum daily mean stream discharge (205 cubic feet per second) at site BR1 on Bloody Run occurred on November 1, 1991. The median daily discharge at site BR1 for the 1992 Water Year was 24 cubic feet per second or 0.70 cubic feet per second per square mile ( $\text{ft}^3/\text{s}/\text{mi}^2$ ). The maximum daily mean stream discharge at site SN1 on Sny Magill Creek was 90 cubic feet per second which occurred on April 20, 1992. The median daily discharge at site SN1 for the 1992 Water Year was 15 cubic feet per second or 0.54  $\text{ft}^3/\text{s}/\text{mi}^2$ .



## INTRODUCTION

Suspended sediment originates principally from unconsolidated material that has formed by the chemical and physical weathering of rocks at the Earth's surface. The unconsolidated material is then transported to the stream by water and/or wind. The amount of sediment moving in a stream at a given location and time is a function of a complicated set of active and passive processes acting on the land surface of the drainage basin and throughout the channel system upstream from the location (Guy, 1970). Several factors that affect the amount of suspended sediment include the timing and intensity of precipitation and the volume and rate of runoff into the stream. The rate of runoff is influenced by the morphology and land use of the drainage basin (described later in this report).

Not all material eroded in a watershed is transported to the stream. The amount of eroded material discharged from the watershed in relation to the gross erosion (the sediment delivery ratio) depends on the areal distribution and intensity of runoff, and the size and morphology of the watershed. Suspended-sediment discharge is related directly to the amount and particle sizes of sediment delivered to the stream and the ability of the water in the stream to carry suspended material. Channel slope and sinuosity, physical factors that affect the velocity of water in the stream, indirectly affect sediment discharge.

The purpose of this chapter is to present the suspended-sediment and stream-discharge data collected during Water Year 1992 (October 1991 through September 1992) for the Bloody Run and Sny Magill Creek watersheds. These data include daily mean sediment concentrations and daily mean discharge at primary monitoring sites which are located near where the two streams discharge into the Mississippi River. Data on drainage-basin morphology and precipitation, two factors that affect suspended-sediment concentrations and stream discharge, also are presented. Additional stream-discharge data are reported for supplementary monitoring sites on tributaries of Bloody Run and Sny Magill creeks. Detailed analyses of these data will be presented in later reports.

## METHODS

Suspended sediment was sampled and stream stage was monitored continually at site BR1 on Bloody Run and at site SN1 on Sny Magill Creek (Figure 1). These sites are located far enough upstream from the stream mouths to avoid backwater conditions from the Mississippi River. Data also were collected at supplemental sites BRSC, BR2, SN3, SNWF, NCC, SNT, and SN2.

### Suspended Sediment

Suspended-sediment concentrations were determined from samples collected daily at site BR1 on Bloody Run and at site SN1 on Sny Magill Creek. Water samples for the determination of suspended-sediment concentrations were generally collected with a hand-held, depth-integrating sampler by field personnel and local observers. When the streams were too deep to wade, samples were collected from a bridge with a depth-integrating sampler attached to a handline. Because there were no major tributaries for several hundred feet upstream of the monitoring sites and because the streams were assumed to have stable cross sections and a rather uniform lateral suspended-sediment distribution, samples were collected in a single vertical profile. A sample was collected by lowering the sampler to the streambed and then raising the sampler to the surface at a constant transit rate. Occasionally, multiple verticals were sampled to determine lateral variability. Suspended-sediment sampled at the multiple verticals also were composited to determine the sand and silt-clay fractions.

An automatic sampler was installed at site BR1 on Bloody Run and site SN1 on Sny Magill Creek to sample the stream during rapidly changing stages when personnel were not present. Because the automatic sampler pumps water from a fixed point in the stream, sediment concentrations determined from these samples were correlated to manually collected samples to determine representative concentrations in the stream. Correlation was accomplished by manually collecting depth-integrated samples at three verticals in a cross section of the stream at the intake of the automatic sampler while

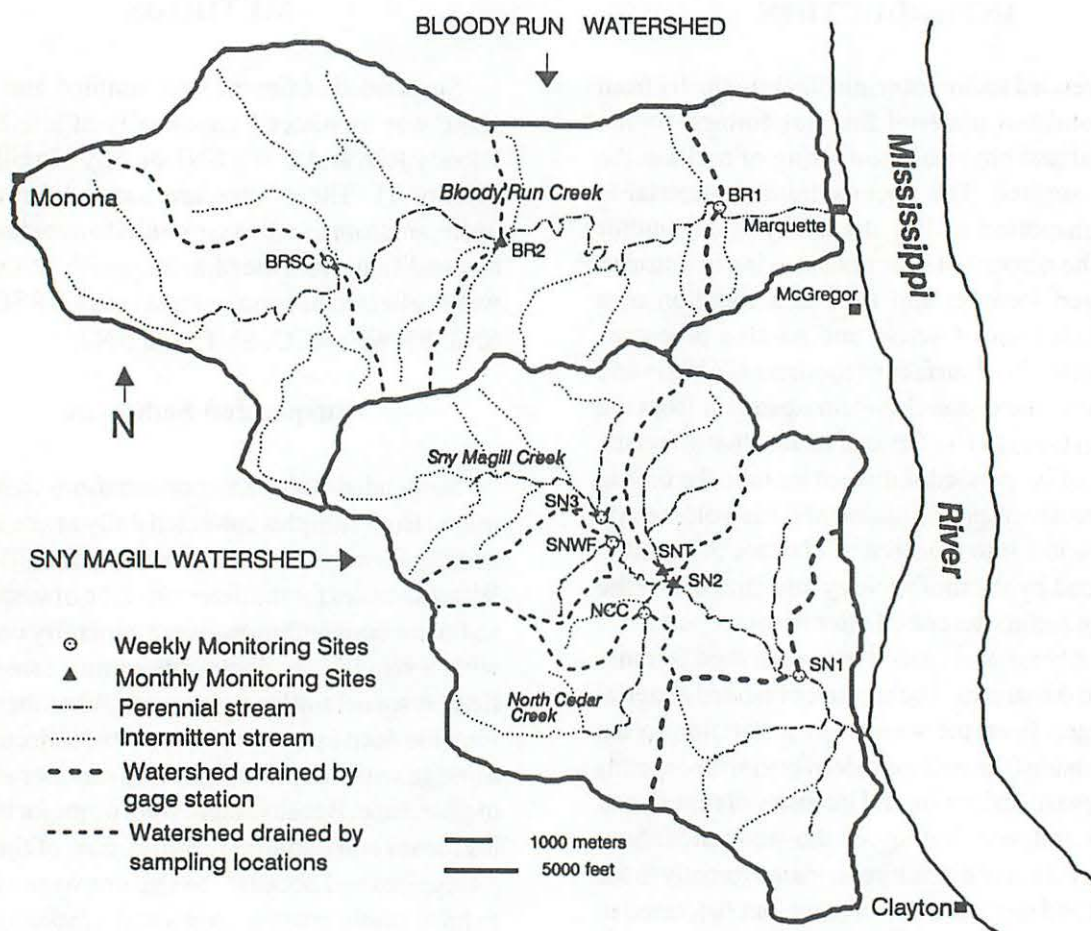


Figure 1. Location of monitoring sites on Sny Magill and Bloody Run creeks.

simultaneously sampling with the automatic sampler. The concentrations determined from the manually collected samples were related to the concentration in samples collected by the automatic samplers. Sediment concentrations in samples collected by the automatic samplers were adjusted on the basis of this relation.

Suspended-sediment concentrations were determined by the U.S. Geological Survey (USGS) sediment laboratory in Iowa City, Iowa using standard filtration and evaporation techniques (Guy, 1969). The wet-sieve method was used to determine the sand and silt-clay fractions (Guy, 1969; Matthes et al., 1992).

Suspended-sediment discharge was computed using the following equation:  $Q_s = Q_w * C_s * k$

where  $Q_s$  is the daily suspended-sediment discharge in tons per day,  $Q_w$  is the mean daily stream discharge in cubic feet per second,  $C_s$  is the suspended-sediment concentration in milligrams per liter (mg/L), and  $k$  is a coefficient. The coefficient  $k$  is 0.0027 if the sediment concentration is less than 16,000 mg/L (Porterfield, 1972). If sediment concentrations are greater than 16,000 mg/L,  $k$  is calculated using techniques described by Porterfield (1972).

### Stream Discharge

Current meter measurements of stream discharge were made monthly and during runoff events. Stream discharge was measured monthly at sites

BR1 and SN1 by measuring the stream velocity in about 20 sections across the channel. The velocity for each section was then multiplied by the cross-sectional area of the section to obtain the discharge in that section. Discharge for each section was summed to obtain the total stream discharge. Stream stages were measured continuously with a bubble-gage sensor and were recorded by data-collection platforms (DCP) and analog recorders. Stage data were referenced to direct water-surface readings with a staff plate placed in the streambed or to a type-A wire-weight gage attached to a nearby bridge. Stream stage and rainfall data were transmitted at 4-hour intervals from the DCP via satellite to the USGS office in Iowa City for computer storage.

To determine stream discharge for the two primary monitoring sites, stage-discharge curves (rating curves) were developed that relate current-meter, stream-discharge measurements to stream stage (Kennedy, 1984). Stream stage at the time of measurement was plotted on logarithmic graph paper as a function of the measured stream discharge. When sufficient measurements were made to cover the entire range of stream stage, a curve that best defined the points was drawn. Rating curves were recalculated as new discharge measurements became available to determine if shifts had occurred because of changing stream-channel conditions caused by erosional scour or sediment deposition.

Monthly stream discharge measurements also were made at seven supplemental sites on Bloody Run and Sny Magill creeks and their tributaries (Figure 1). Discharge measurements were made as previously described. Stream stages at these sites were measured with a steel tape as the distance from a permanent reference mark on a bridge to the water surface.

### **Drainage Basin Morphology**

Drainage-basin characteristics, quantified using a Geographic Information System (GIS) procedure (Majure and Eash, 1991; Eash, 1993), were used to compare the morphology of the Bloody Run and Sny Magill watersheds. Morphologic characteristics that significantly influence the magnitude

and frequency of surface-water runoff for streams in Iowa include contributing drainage area, relative relief, and drainage frequency (an indication of the spacing of streams in the drainage network). A detailed description of the GIS procedures used to calculate the drainage basin characteristics is given in Eash (1993), and a brief summary follows.

The GIS procedure included three main processing steps. In the first step, four GIS digital maps were created that represented selected aspects of the drainage basin. The drainage-divide digital map was created by delineating and digitizing the surface-water drainage-divide boundary from 1:250,000-scale U.S. Defense Mapping Agency (DMA) topographic maps. The drainage-network digital map was created by selecting the drainage network for the watershed from 1:100,000-scale USGS digital line graph data. The elevation-contour digital map was created from 1:250,000-scale DMA digital elevation model data. The basin-length digital map was created by delineating and digitizing the basin length from 1:250,000-scale DMA topographic maps. In the second processing step, attributes were assigned to specific polygon, line-segment, and point features in the first three digital maps. In the final step, 24 morphologic characteristics were quantified for a drainage watershed by using a set of programs that accessed the information automatically maintained by the GIS for each of the digital maps as well as the previously described attribute information. Selected basin characteristics that were quantified for Bloody Run and Sny Magill watersheds are listed in Table 1, and basin characteristics quantified for subbasins in the Bloody Run and Sny Magill watersheds are listed in Table 2. Many of the basin characteristics listed in Tables 1 and 2 are defined by Strahler (1964).

### **Precipitation**

Rainfall was measured at sites BR1 and SN1 using standard tipping-bucket rain gages. Rainfall was recorded by the DCP and transmitted to the Iowa City office of the USGS by satellite for computer storage. Data collection began on March 12, 1992 at site BR1 and on April 5, 1992 at site SN1. To provide a complete year of rainfall data for

**Table 1.** Selected morphologic characteristics for the Bloody Run and Sny Magill watersheds.

| Characteristic                            | Site   |        |
|-------------------------------------------|--------|--------|
|                                           | BR1    | SN1    |
| Total drainage area (square miles)        | 34.30  | 27.60  |
| Contributing drainage area (square miles) | 33.00  | 27.60  |
| Basin length (mi)                         | 12.00  | 7.80   |
| Basin perimeter (mi)                      | 29.00  | 25.00  |
| Basin relief (ft)                         | 570.00 | 496.00 |
| Relative relief (ft/mi)                   | 20.00  | 20.00  |
| Main channel length (mi)                  | 15.50  | 9.40   |
| Total stream length (mi)                  | 61.50  | 43.00  |
| Main-channel slope (ft/mi)                | 28.00  | 50.00  |
| Main-channel sinuosity ratio              | 1.30   | 1.20   |
| Stream density (mi/miles squared)         | 1.90   | 1.60   |
| Number of first order streams             | 25.00  | 17.00  |
| Drainage frequency (fos/miles squared)    | 0.76   | 0.62   |

Water Year 1992, rainfall data from a climatic station located in Prairie du Chien, Wisconsin, was used. Rainfall at this site was 38.03 inches (966 mm) for Water Year 1992 (Harry Hillaker, personal communication). The maximum recorded daily rainfall at site BR1 was 1.92 inches (49 mm) on July 13, 1992. This rain was part of the maximum monthly rainfall (6.97 inches during July; 177 mm) recorded at site BR1 for the 1992 Water Year. The maximum recorded daily rainfall at site SN1 was 2.26 inches (57 mm) on September 14, 1992. The maximum recorded monthly precipitation at site SN1 was 5.57 inches (141 mm) during September 1992 (Table 3).

## **SUSPENDED SEDIMENT**

Daily suspended-sediment concentrations and loads for monitoring sites BR1 and SN1 are listed in Tables 4 and 5. The daily suspended-sediment loads are plotted in relation to the daily mean discharge in Figure 2.

### **Bloody Run**

The largest daily mean suspended sediment concentration at site BR1 was 1,110 mg/L on November 1, 1991. The maximum daily stream discharge was also measured on November 1. The variability in sediment concentrations is shown in

Figure 3. At site BR1, the greatest monthly median sediment concentration was 25 mg/L in March 1992 and the smallest monthly median concentration was 12 mg/L in January 1992. The silt-clay sized fraction of the suspended sediment ranged from 14% on December 5, 1991 and April 10, 1992, when the instantaneous discharge was 26 and 23 ft<sup>3</sup>/s (cubic feet per second), respectively, to 95% on September 14, 1992 when the instantaneous discharge was 73 ft<sup>3</sup>/s (Table 6). The total suspended-sediment discharge at site BR1 for Water Year 1992 was about 2,720 tons. The greatest monthly discharge (1,250 tons) occurred in April 1992 and the smallest suspended-sediment discharge (20 tons) occurred in October 1991. The maximum daily suspended-sediment discharge was 916 tons on April 20, 1992. Mean daily suspended-sediment discharge exceeded 0.52 tons about 90% of the year; exceeded 1.1 tons about 50% of the year; and exceeded 3.2 tons about 10% of the year in Water Year 1992 (Figure 4).

### **Sny Magill Creek**

The largest daily mean suspended-sediment concentration was 2,390 mg/L at site SN1 was recorded on April 20, 1992. At site SN1, the maximum-monthly median sediment concentration was 41 mg/L in May 1992 and the smallest monthly median concentration was 9 mg/L in January 1992

**Table 2.** Selected morphologic characteristics for subbasins in the Bloody Run and Sny Magill watersheds.

| Characteristic                                          | Supplemental sites |        |        |        |        |        |        |
|---------------------------------------------------------|--------------------|--------|--------|--------|--------|--------|--------|
|                                                         | BRSC               | BR2    | SN3    | SNWF   | NCC    | SNT    | SN2    |
| Total drainage area: square miles                       | 10.50              | 24.50  | 7.20   | 3.10   | 6.00   | 3.20   | 22.50  |
| Contributing drainage area: square miles                | 9.30               | 23.20  | 7.20   | 3.10   | 6.00   | 3.20   | 22.50  |
| Basin length: mi                                        | 4.80               | 8.30   | 4.00   | 3.30   | 4.70   | 3.40   | 5.50   |
| Basin perimeter: mile                                   | 16.50              | 22.20  | 11.40  | 8.10   | 11.10  | 7.40   | 21.90  |
| Basin relief: feet                                      | 300.00             | 423.00 | 390.00 | 396.00 | 413.00 | 376.00 | 463.00 |
| Relative relief: ft/mi                                  | 18.10              | 19.00  | 34.00  | 49.00  | 37.10  | 51.10  | 21.20  |
| Main channel length: mile                               | 5.90               | 9.10   | 4.50   | 3.40   | 5.30   | 3.60   | 6.50   |
| Total stream length: mile                               | 13.70              | 41.20  | 12.70  | 5.10   | 8.00   | 6.20   | 35.90  |
| Main channel slope: ft/mi                               | 37.50              | 35.60  | 88.40  | 121.00 | 83.40  | 100.00 | 72.50  |
| Main channel sinuosity ratio                            | 1.20               | 1.10   | 1.10   | 1.00   | 1.10   | 1.10   | 1.20   |
| Stream density: mi/mile squared                         | 1.50               | 1.80   | 1.80   | 1.60   | 1.30   | 1.90   | 1.60   |
| Number of first order streams                           | 4.00               | 16.00  | 6.00   | 2.00   | 3.00   | 3.00   | 15.00  |
| Drainage frequency:<br>first order streams/mile squared | 0.43               | 0.69   | 0.83   | 0.64   | 0.50   | 0.93   | 0.67   |

(Figure 3). The silt-clay sized fraction of the suspended sediment ranged from 33% on December 6, 1991, when the instantaneous discharge was 16 ft<sup>3</sup>/s, to 99% on September 14, 1992, when the instantaneous discharge was 55 ft<sup>3</sup>/s.

The total suspended-sediment discharge at site SN1 during Water Year 1992 was about 1,940 tons. The greatest monthly discharge (1,320 tons) occurred in April 1992 and the smallest monthly discharge (17 tons) occurred in January 1992. The maximum daily suspended-sediment discharge was 1,190 tons on April 20, 1992. Mean daily suspended-sediment discharge exceeded 0.38 tons 90% of the year; exceeded 1.1 tons, 50% of the year; and exceeded 3.3 tons, 10% of the year in Water Year 1992 (Figure 4).

## STREAM DISCHARGE

### Bloody Run

Daily mean discharges for Bloody Run at site BR1 are listed in Table 7 and illustrated in Figure 2. The median discharge at site BR1 for the 1992 Water Year was 24 ft<sup>3</sup>/s or 0.70 ft<sup>3</sup>/s/mi<sup>2</sup>. The maximum daily mean discharge (205 ft<sup>3</sup>/s) occurred on November 1, 1991 and the minimum-daily mean discharge (13 ft<sup>3</sup>/s) was recorded on

October 3, 1991. The maximum recorded instantaneous discharge of 476 ft<sup>3</sup>/s occurred at 10:00 am on November 1, 1991. Stream discharge duration is shown in Figure 4. Daily mean discharge exceeded 18 ft<sup>3</sup>/s about 90% of the year and exceeded 36 ft<sup>3</sup>/s about 10% of the year.

### Sny Magill Creek

Daily mean discharges for Sny Magill Creek at site SN1 are listed in Table 5 and are illustrated in Figure 2. The median discharge at site SN1 for the 1992 Water Year was 15 ft<sup>3</sup>/s or 0.54 ft<sup>3</sup>/s/mi<sup>2</sup>. The maximum-daily mean discharge (90 ft<sup>3</sup>/s) occurred on April 20, 1992 and the minimum mean daily discharge (8.5 ft<sup>3</sup>/s) occurred on October 1, 1991. The greatest recorded instantaneous discharge of 390 ft<sup>3</sup>/s occurred at 6:00 pm on April 20, 1992. Flow duration is shown in Figure 4. Daily mean discharge exceeded 12 ft<sup>3</sup>/s about 90% of the year and exceeded 24 ft<sup>3</sup>/s about 10% of the year.

### Supplemental Sites

Stream discharges were measured periodically at seven supplemental sites in the Bloody Run and Sny Magill Creek watersheds during Water Year 1992 (Table 8). The maximum measured discharge

(11.0 ft<sup>3</sup>/s) at supplementary sites in the Bloody Run watershed occurred at site BR2 on June 4, 1992. At supplemental sites in the Sny Magill Creek watershed, the maximum stream discharge (15.8 ft<sup>3</sup>/s) was measured at site SN2 on March 5, 1992 and on May 8, 1992.

## ACKNOWLEDGMENTS

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Table 3. Daily precipitation (in inches) in the Bloody Run and Sny Magill watersheds; Water Year 1992.

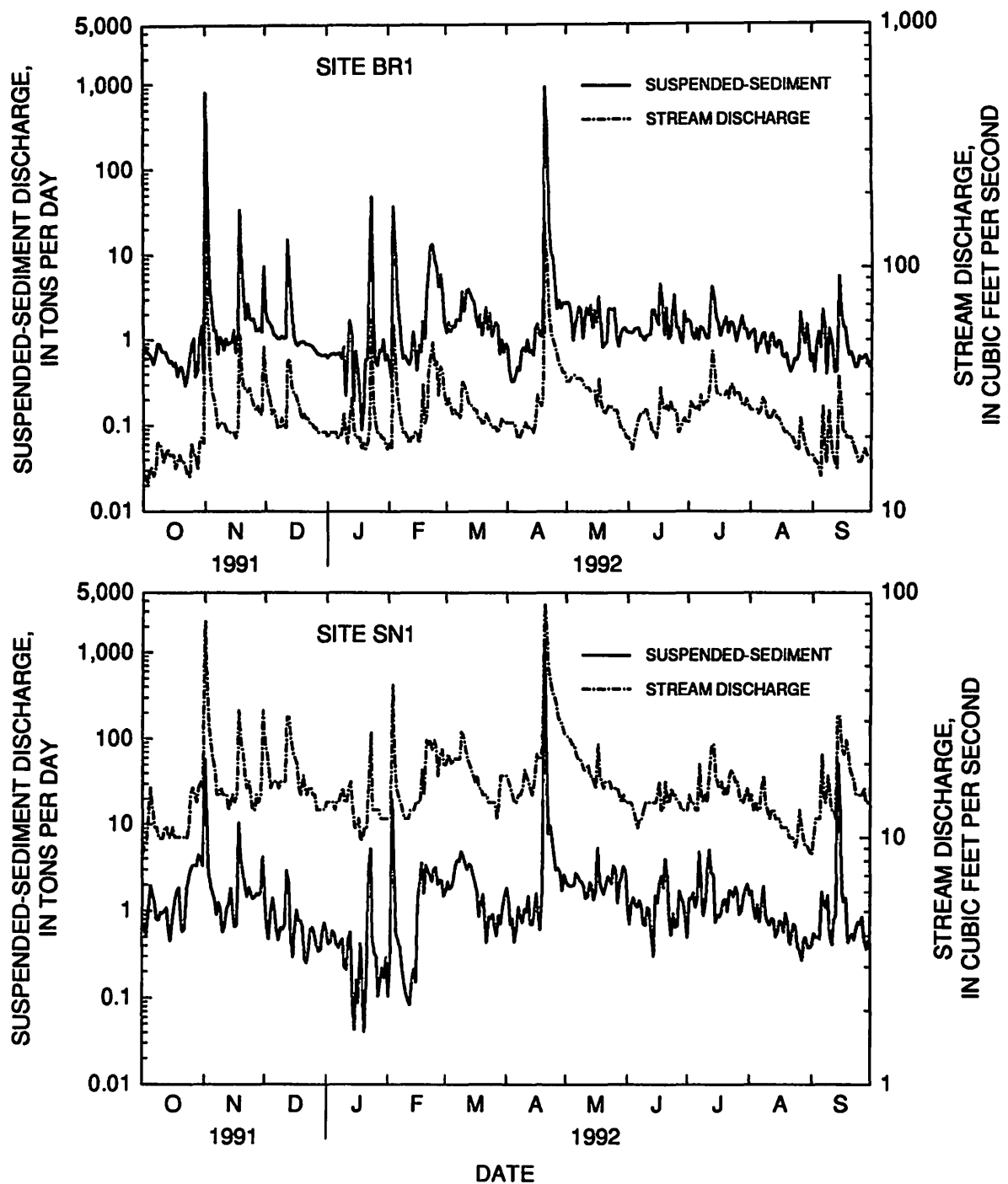
| Day      | Oct | Nov | Dec | Jan | Feb | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  |
|----------|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|
| Site BR1 |     |     |     |     |     |      |      |      |      |      |      |      |
| 1        |     |     |     |     |     |      | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2        |     |     |     |     |     |      | 0.00 | 0.00 | 0.00 | 0.22 | 0.11 | 0.43 |
| 3        |     |     |     |     |     |      | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.01 |
| 4        |     |     |     |     |     |      | 0.00 | 0.02 | 0.00 | 0.08 | 0.01 | 0.00 |
| 5        |     |     |     |     |     |      | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.82 |
| 6        |     |     |     |     |     |      | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.24 |
| 7        |     |     |     |     |     |      | 0.01 | 0.00 | 0.00 | 0.51 | 0.81 | 0.04 |
| 8        |     |     |     |     |     |      | 0.44 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 |
| 9        |     |     |     |     |     |      | 0.01 | 0.00 | 0.00 | 0.16 | 0.00 | 0.80 |
| 10       |     |     |     |     |     |      | 0.12 | 0.00 | 0.00 | 0.27 | 0.18 | 0.00 |
| 11       |     |     |     |     |     |      | 0.00 | 0.10 | 0.00 | 0.48 | 0.00 | 0.00 |
| 12       |     |     |     |     |     | 0.00 | 0.00 | 0.01 | 0.00 | 0.74 | 0.31 | 0.00 |
| 13       |     |     |     |     |     | 0.00 | 0.00 | 0.00 | 0.00 | 1.92 | 0.00 | 0.00 |
| 14       |     |     |     |     |     | 0.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.65 |
| 15       |     |     |     |     |     | 0.00 | 0.91 | 0.05 | 0.00 | 0.07 | 0.01 | 0.00 |
| 16       |     |     |     |     |     | 0.10 | 0.23 | 0.55 | 0.55 | 0.18 | 0.00 | 0.54 |
| 17       |     |     |     |     |     | 0.00 | 0.00 | 0.52 | 0.68 | 0.24 | 0.08 | 0.02 |
| 18       |     |     |     |     |     | 0.00 | 0.21 | 0.00 | 0.00 | 0.01 | 0.00 | 0.27 |
| 19       |     |     |     |     |     | 0.00 | 0.85 | 0.00 | 0.32 | 0.26 | 0.01 | 0.00 |
| 20       |     |     |     |     |     | 0.10 | 1.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 21       |     |     |     |     |     | 0.00 | 0.05 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| 22       |     |     |     |     |     | 0.16 | 0.02 | 0.34 | 0.13 | 0.88 | 0.00 | 0.00 |
| 23       |     |     |     |     |     | 0.00 | 0.08 | 0.00 | 0.06 | 0.01 | 0.00 | 0.00 |
| 24       |     |     |     |     |     | 0.00 | 0.03 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| 25       |     |     |     |     |     | 0.20 | 0.00 | 0.00 | 0.00 | 0.48 | 0.07 | 0.00 |
| 26       |     |     |     |     |     | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.43 |
| 27       |     |     |     |     |     | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 28       |     |     |     |     |     | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 29       |     |     |     |     |     | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| 30       |     |     |     |     |     | 0.01 | 0.00 | 0.00 | 0.01 | 0.34 | 0.00 | 0.00 |
| 31       |     |     |     |     |     | 0.00 |      | 0.00 |      | 0.01 | 0.00 |      |
| Total    |     |     |     |     |     |      | 4.16 | 1.75 | 1.76 | 6.97 | 1.66 | 5.26 |
| Site SN1 |     |     |     |     |     |      |      |      |      |      |      |      |
| 1        |     |     |     |     |     |      |      | 0.00 |      | 0.00 | 0.00 | 0.00 |
| 2        |     |     |     |     |     |      |      | 0.00 | 0.00 | 0.27 | 0.13 | 0.46 |
| 3        |     |     |     |     |     |      |      | 0.00 | 0.00 | 0.00 | 0.05 | 0.01 |
| 4        |     |     |     |     |     |      |      | 0.04 | 0.00 | 0.27 | 0.01 | 0.00 |
| 5        |     |     |     |     |     |      | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.64 |
| 6        |     |     |     |     |     |      | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.46 |
| 7        |     |     |     |     |     |      | 0.00 | 0.00 | 0.00 | 1.06 | 0.73 | 0.09 |
| 8        |     |     |     |     |     |      | 0.32 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 |
| 9        |     |     |     |     |     |      | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.48 |
| 10       |     |     |     |     |     |      | 0.14 | 0.00 | 0.00 | 0.07 | 0.44 | 0.01 |
| 11       |     |     |     |     |     |      | 0.00 | 0.09 | 0.00 | 0.02 | 0.00 | 0.00 |
| 12       |     |     |     |     |     |      | 0.00 | 0.00 | 0.00 | 0.83 | 0.26 | 0.00 |
| 13       |     |     |     |     |     |      | 0.00 | 0.00 | 0.00 | 1.05 | 0.00 | 0.00 |
| 14       |     |     |     |     |     |      | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 2.26 |
| 15       |     |     |     |     |     |      | 0.69 | 0.03 | 0.00 | 0.08 | 0.00 | 0.00 |
| 16       |     |     |     |     |     |      | 0.11 | 0.03 | 0.23 | 0.17 | 0.00 | 0.29 |
| 17       |     |     |     |     |     |      | 0.00 | 0.03 | 0.35 | 0.16 | 0.10 | 0.01 |
| 18       |     |     |     |     |     |      | 0.19 | 0.00 | 0.00 | 0.01 | 0.00 | 0.50 |
| 19       |     |     |     |     |     |      | 1.03 | 0.00 | 0.40 | 0.07 | 0.00 | 0.00 |
| 20       |     |     |     |     |     |      | 1.08 | 0.00 | 0.00 | 0.01 | 0.00 | 0.03 |
| 21       |     |     |     |     |     |      | 0.04 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| 22       |     |     |     |     |     |      | 0.01 | 0.00 | 0.12 | 0.49 | 0.01 | 0.00 |
| 23       |     |     |     |     |     |      | 0.04 | 0.01 | 0.12 | 0.04 | 0.00 | 0.00 |
| 24       |     |     |     |     |     |      | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 25       |     |     |     |     |     |      | 0.00 | 0.00 | 0.00 | 0.27 | 0.72 | 0.00 |
| 26       |     |     |     |     |     |      | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.31 |
| 27       |     |     |     |     |     |      | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| 28       |     |     |     |     |     |      | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 29       |     |     |     |     |     |      | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| 30       |     |     |     |     |     |      | 0.00 | 0.00 | 0.00 | 0.53 | 0.00 | 0.00 |
| 31       |     |     |     |     |     |      |      | 0.00 |      | 0.01 | 0.00 |      |
| Total    |     |     |     |     |     |      | 3.78 | 0.26 | 1.25 | 5.55 | 2.45 | 5.57 |

**Table 4. Daily mean suspended sediment concentration and daily suspended-sediment load at site BR1 on Bloody Run; Water Year 1992.**

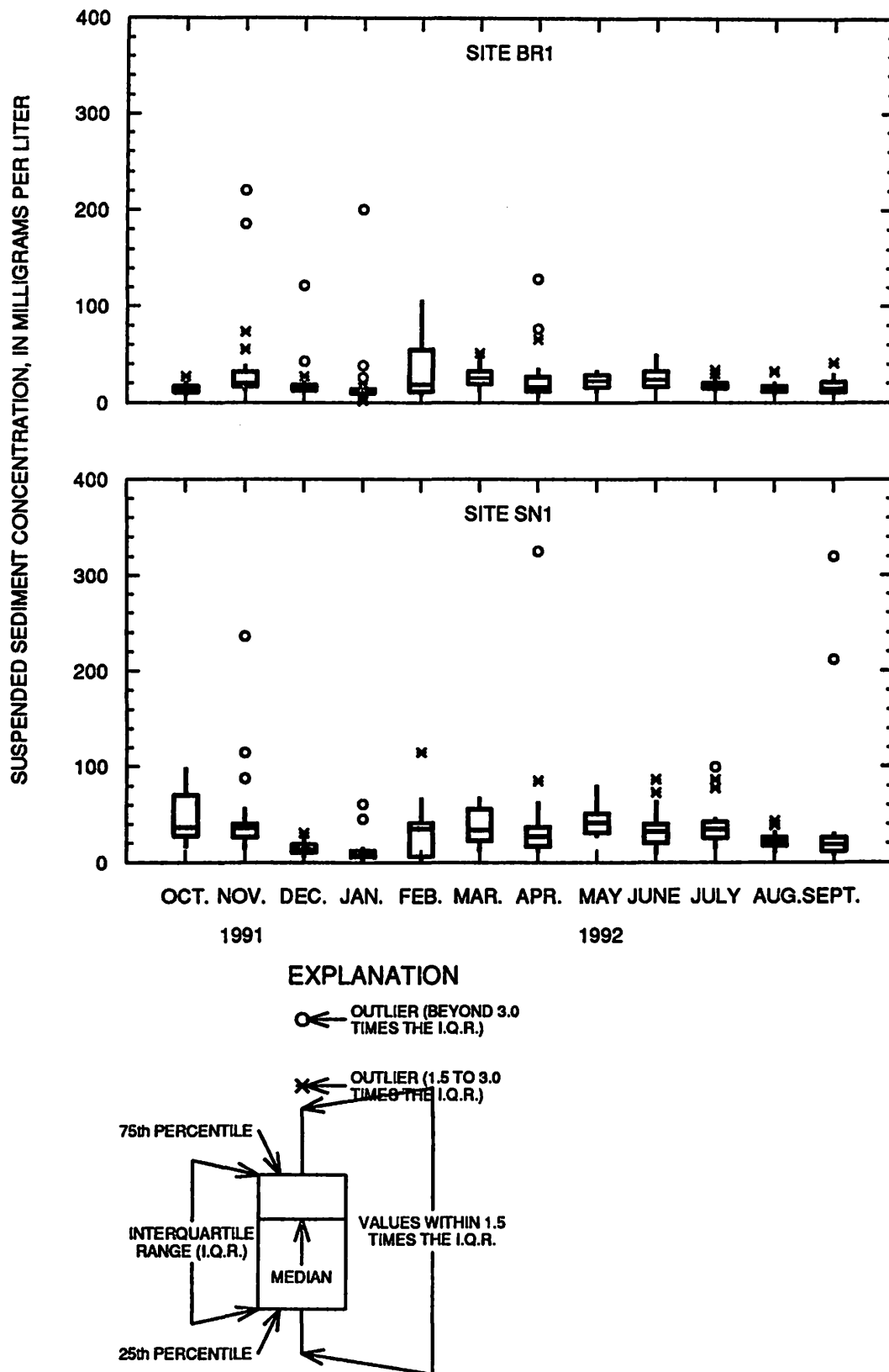
| Day                                                                  | Oct   | Nov     | Dec    | Jan    | Feb    | Mar   | Apr     | May   | Jun   | Jul  | Aug   | Sep   |
|----------------------------------------------------------------------|-------|---------|--------|--------|--------|-------|---------|-------|-------|------|-------|-------|
| Mean daily suspended-sediment concentration, in milligrams per liter |       |         |        |        |        |       |         |       |       |      |       |       |
| 1                                                                    | 19.00 | 1110.00 | 22.00  | 11.00  | 11.00  | 16.00 | 13.00   | 30.00 | 23.00 | 27.0 | 16.00 | 15.00 |
| 2                                                                    | 22.00 | 185.00  | 20.00  | 12.00  | 8.00   | 20.00 | 7.00    | 29.00 | 24.00 | 21.0 | 17.00 | 10.00 |
| 3                                                                    | 20.00 | 39.00   | 20.00  | 12.00  | 103.00 | 17.00 | 5.00    | 22.00 | 24.00 | 15.0 | 18.00 | 21.00 |
| 4                                                                    | 17.00 | 27.00   | 21.00  | 12.00  | 107.00 | 22.00 | 5.00    | 10.00 | 24.00 | 14.0 | 10.00 | 30.00 |
| 5                                                                    | 15.00 | 17.00   | 17.00  | 12.00  | 42.00  | 20.00 | 7.00    | 16.00 | 23.00 | 18.0 | 13.00 | 21.00 |
| 6                                                                    | 14.00 | 19.00   | 17.00  | 12.00  | 26.00  | 25.00 | 9.00    | 18.00 | 20.00 | 14.0 | 13.00 | 27.00 |
| 7                                                                    | 16.00 | 12.00   | 17.00  | 13.00  | 14.00  | 25.00 | 8.00    | 25.00 | 17.00 | 17.0 | 15.00 | 27.00 |
| 8                                                                    | 17.00 | 18.00   | 17.00  | 11.00  | 10.00  | 26.00 | 13.00   | 24.00 | 16.00 | 18.0 | 16.00 | 9.00  |
| 9                                                                    | 17.00 | 16.00   | 17.00  | 12.00  | 11.00  | 40.00 | 13.00   | 12.00 | 14.00 | 16.0 | 13.00 | 18.00 |
| 10                                                                   | 15.00 | 13.00   | 18.00  | 4.00   | 10.00  | 25.00 | 12.00   | 20.00 | 16.00 | 14.0 | 10.00 | 19.00 |
| 11                                                                   | 16.00 | 18.00   | 18.00  | 12.00  | 10.00  | 46.00 | 16.00   | 27.00 | 17.00 | 13.0 | 17.00 | 16.00 |
| 12                                                                   | 16.00 | 16.00   | 122.00 | 26.00  | 12.00  | 51.00 | 12.00   | 23.00 | 19.00 | 22.0 | 17.00 | 9.00  |
| 13                                                                   | 13.00 | 16.00   | 43.00  | 14.00  | 23.00  | 47.00 | 13.00   | 30.00 | 38.00 | 34.0 | 12.00 | 11.00 |
| 14                                                                   | 12.00 | 17.00   | 27.00  | 3.00   | 15.00  | 42.00 | 12.00   | 17.00 | 39.00 | 30.0 | 12.00 | 41.00 |
| 15                                                                   | 12.00 | 24.00   | 13.00  | 13.00  | 8.00   | 40.00 | 22.00   | 27.00 | 34.00 | 22.0 | 15.00 | 30.00 |
| 16                                                                   | 11.00 | 13.00   | 11.00  | 9.00   | 17.00  | 27.00 | 19.00   | 22.00 | 24.00 | 19.0 | 15.00 | 24.00 |
| 17                                                                   | 13.00 | 20.00   | 11.00  | 5.00   | 12.00  | 22.00 | 15.00   | 33.00 | 50.00 | 14.0 | 11.00 | 24.00 |
| 18                                                                   | 9.00  | 220.00  | 13.00  | 2.00   | 18.00  | 31.00 | 15.00   | 20.00 | 39.00 | 17.0 | 11.00 | 16.00 |
| 19                                                                   | 11.00 | 73.00   | 14.00  | 3.00   | 17.00  | 18.00 | 24.00   | 12.00 | 16.00 | 19.0 | 12.00 | 12.00 |
| 20                                                                   | 11.00 | 36.00   | 14.00  | 12.00  | 43.00  | 26.00 | 1060.00 | 13.00 | 32.00 | 22.0 | 9.00  | 13.00 |
| 21                                                                   | 9.00  | 21.00   | 14.00  | 11.00  | 70.00  | 35.00 | 783.00  | 13.00 | 15.00 | 15.0 | 8.00  | 12.00 |
| 22                                                                   | 7.00  | 32.00   | 14.00  | 38.00  | 70.00  | 21.00 | 129.00  | 30.00 | 15.00 | 18.0 | 9.00  | 10.00 |
| 23                                                                   | 11.00 | 21.00   | 14.00  | 200.00 | 97.00  | 33.00 | 76.00   | 31.00 | 27.00 | 18.0 | 12.00 | 11.00 |
| 24                                                                   | 15.00 | 22.00   | 13.00  | 19.00  | 79.00  | 19.00 | 65.00   | 31.00 | 48.00 | 16.0 | 12.00 | 14.00 |
| 25                                                                   | 17.00 | 25.00   | 13.00  | 9.00   | 57.00  | 24.00 | 36.00   | 33.00 | 21.00 | 12.0 | 13.00 | 13.00 |
| 26                                                                   | 22.00 | 18.00   | 12.00  | 9.00   | 50.00  | 27.00 | 20.00   | 15.00 | 24.00 | 15.0 | 33.00 | 14.00 |
| 27                                                                   | 8.00  | 18.00   | 12.00  | 13.00  | 55.00  | 26.00 | 27.00   | 13.00 | 17.00 | 19.0 | 22.00 | 14.00 |
| 28                                                                   | 11.00 | 20.00   | 12.00  | 14.00  | 35.00  | 11.00 | 22.00   | 19.00 | 15.00 | 25.0 | 18.00 | 12.00 |
| 29                                                                   | 20.00 | 18.00   | 11.00  | 19.00  | 19.00  | 15.00 | 27.00   | 22.00 | 34.00 | 18.0 | 32.00 | 10.00 |
| 30                                                                   | 27.00 | 55.00   | 11.00  | 11.00  | 11.00  | 12.00 | 27.00   | 24.00 | 26.00 | 17.0 | 19.00 | 11.00 |
| 31                                                                   | 8.00  |         | 11.00  | 14.00  |        | 15.00 |         | 23.00 |       | 14.0 | 12.00 |       |
| Suspended-sediment load, in tons per day                             |       |         |        |        |        |       |         |       |       |      |       |       |
| 1                                                                    | 0.72  | 798.00  | 2.10   | 0.62   | 0.53   | 1.20  | 0.81    | 2.80  | 1.20  | 1.70 | 1.20  | 0.67  |
| 2                                                                    | 0.83  | 40.00   | 1.70   | 0.66   | 0.37   | 1.60  | 0.43    | 2.70  | 1.20  | 1.60 | 1.20  | 0.42  |
| 3                                                                    | 0.71  | 4.30    | 1.60   | 0.68   | 37.00  | 1.30  | 0.33    | 2.10  | 1.20  | 1.10 | 1.30  | 0.89  |
| 4                                                                    | 0.68  | 2.40    | 1.40   | 0.69   | 14.00  | 1.50  | 0.33    | 0.98  | 1.30  | 1.00 | 0.70  | 1.20  |
| 5                                                                    | 0.62  | 1.30    | 1.20   | 0.67   | 3.50   | 1.40  | 0.38    | 1.50  | 1.30  | 1.30 | 0.86  | 0.80  |
| 6                                                                    | 0.52  | 1.30    | 1.10   | 0.68   | 1.80   | 1.70  | 0.48    | 1.70  | 1.30  | 1.00 | 0.89  | 2.20  |
| 7                                                                    | 0.64  | 0.69    | 1.00   | 0.70   | 0.87   | 1.70  | 0.43    | 2.40  | 1.10  | 1.40 | 1.10  | 1.40  |
| 8                                                                    | 0.90  | 1.10    | 1.00   | 0.61   | 0.61   | 1.70  | 0.74    | 2.30  | 1.10  | 1.30 | 1.20  | 0.40  |
| 9                                                                    | 0.88  | 0.99    | 1.10   | 0.82   | 0.64   | 3.70  | 0.80    | 1.00  | 0.97  | 1.20 | 0.85  | 1.30  |
| 10                                                                   | 0.74  | 0.77    | 1.00   | 0.23   | 0.57   | 2.20  | 0.73    | 1.70  | 1.10  | 1.00 | 0.68  | 1.00  |
| 11                                                                   | 0.72  | 1.00    | 1.10   | 0.63   | 0.52   | 3.80  | 0.99    | 2.30  | 1.10  | 1.00 | 1.10  | 0.75  |
| 12                                                                   | 0.72  | 0.89    | 15.00  | 1.70   | 0.61   | 3.90  | 0.72    | 2.00  | 1.10  | 2.00 | 1.20  | 0.42  |
| 13                                                                   | 0.61  | 0.92    | 4.90   | 1.20   | 1.20   | 3.50  | 0.75    | 2.50  | 2.20  | 4.20 | 0.84  | 0.43  |
| 14                                                                   | 0.55  | 0.94    | 2.40   | 0.20   | 0.81   | 3.00  | 0.67    | 1.40  | 2.20  | 3.20 | 0.80  | 5.50  |
| 15                                                                   | 0.57  | 1.30    | 1.10   | 0.74   | 0.45   | 2.80  | 1.40    | 2.20  | 1.80  | 1.90 | 0.95  | 2.20  |
| 16                                                                   | 0.50  | 0.71    | 0.90   | 0.46   | 0.86   | 1.90  | 1.50    | 1.60  | 1.50  | 1.60 | 0.93  | 1.40  |
| 17                                                                   | 0.54  | 1.20    | 0.86   | 0.27   | 0.72   | 1.40  | 1.20    | 3.20  | 4.50  | 1.10 | 0.65  | 1.40  |
| 18                                                                   | 0.38  | 34.00   | 0.93   | 0.09   | 1.70   | 2.00  | 1.10    | 1.50  | 2.90  | 1.40 | 0.61  | 0.87  |
| 19                                                                   | 0.47  | 7.30    | 0.94   | 0.17   | 1.00   | 1.10  | 1.90    | 0.81  | 1.10  | 1.60 | 0.68  | 0.65  |
| 20                                                                   | 0.49  | 3.10    | 0.95   | 0.58   | 3.70   | 1.60  | 916.00  | 0.88  | 2.30  | 1.80 | 0.50  | 0.70  |
| 21                                                                   | 0.40  | 1.80    | 0.89   | 0.59   | 7.50   | 2.40  | 261.00  | 0.93  | 1.00  | 1.20 | 0.42  | 0.59  |
| 22                                                                   | 0.30  | 2.70    | 0.89   | 5.60   | 12.00  | 1.30  | 23.00   | 2.30  | 1.10  | 1.60 | 0.48  | 0.47  |
| 23                                                                   | 0.39  | 1.80    | 0.87   | 48.00  | 13.00  | 2.10  | 11.00   | 2.30  | 1.90  | 1.60 | 0.59  | 0.48  |
| 24                                                                   | 0.60  | 1.70    | 0.85   | 1.40   | 8.70   | 1.10  | 8.80    | 2.20  | 3.40  | 1.30 | 0.57  | 0.63  |
| 25                                                                   | 0.88  | 1.80    | 0.79   | 0.55   | 7.10   | 1.40  | 4.50    | 2.30  | 1.40  | 0.95 | 0.65  | 0.59  |
| 26                                                                   | 1.00  | 1.30    | 0.74   | 0.50   | 4.20   | 1.60  | 2.30    | 1.10  | 1.30  | 1.20 | 2.10  | 0.61  |
| 27                                                                   | 0.37  | 1.30    | 0.68   | 0.75   | 5.90   | 1.50  | 2.90    | 0.82  | 1.00  | 1.50 | 1.20  | 0.66  |
| 28                                                                   | 0.43  | 1.40    | 0.67   | 0.74   | 3.60   | 0.68  | 2.30    | 1.20  | 0.89  | 1.90 | 0.90  | 0.57  |
| 29                                                                   | 1.10  | 1.20    | 0.65   | 1.00   | 1.60   | 0.99  | 2.70    | 1.30  | 2.10  | 1.30 | 1.50  | 0.48  |
| 30                                                                   | 1.50  | 7.40    | 0.65   | 0.58   |        | 0.71  | 2.60    | 1.40  | 1.60  | 1.30 | 0.89  | 0.51  |
| 31                                                                   | 0.42  |         | 0.67   | 0.67   |        | 0.89  |         | 1.20  |       | 1.00 | 0.55  |       |

**Table 5.** Daily mean suspended sediment concentration and daily suspended-sediment load at site SN1 on Sny Magill Creek; Water Year 1992.

| Day                                                                  | Oct   | Nov    | Dec   | Jan   | Feb    | Mar   | Apr     | May   | Jun   | Jul   | Aug   | Sep    |
|----------------------------------------------------------------------|-------|--------|-------|-------|--------|-------|---------|-------|-------|-------|-------|--------|
| Mean daily suspended-sediment concentration, in milligrams per liter |       |        |       |       |        |       |         |       |       |       |       |        |
| 1                                                                    | 28.00 | 236.00 | 21.00 | 16.00 | 3.00   | 31.00 | 38.00   | 31.00 | 32.00 | 14.00 | 39.00 | 18.00  |
| 2                                                                    | 26.00 | 88.00  | 12.00 | 11.00 | 10.00  | 37.00 | 28.00   | 29.00 | 18.00 | 35.00 | 44.00 | 20.00  |
| 3                                                                    | 20.00 | 35.00  | 9.00  | 12.00 | 115.00 | 31.00 | 16.00   | 29.00 | 32.00 | 36.00 | 31.00 | 16.00  |
| 4                                                                    | 29.00 | 30.00  | 22.00 | 16.00 | 41.00  | 35.00 | 20.00   | 30.00 | 40.00 | 43.00 | 22.00 | 15.00  |
| 5                                                                    | 47.00 | 28.00  | 30.00 | 15.00 | 13.00  | 42.00 | 11.00   | 31.00 | 36.00 | 32.00 | 33.00 | 15.00  |
| 6                                                                    | 45.00 | 27.00  | 21.00 | 11.00 | 12.00  | 58.00 | 16.00   | 46.00 | 39.00 | 44.00 | 21.00 | 27.00  |
| 7                                                                    | 42.00 | 22.00  | 14.00 | 10.00 | 10.00  | 67.00 | 29.00   | 44.00 | 42.00 | 86.00 | 23.00 | 29.00  |
| 8                                                                    | 28.00 | 31.00  | 11.00 | 10.00 | 6.00   | 67.00 | 22.00   | 40.00 | 34.00 | 45.00 | 40.00 | 29.00  |
| 9                                                                    | 29.00 | 24.00  | 14.00 | 11.00 | 4.00   | 68.00 | 17.00   | 40.00 | 20.00 | 24.00 | 24.00 | 31.00  |
| 10                                                                   | 36.00 | 14.00  | 14.00 | 6.00  | 4.00   | 61.00 | 21.00   | 37.00 | 19.00 | 32.00 | 21.00 | 13.00  |
| 11                                                                   | 35.00 | 16.00  | 15.00 | 6.00  | 3.00   | 56.00 | 19.00   | 27.00 | 29.00 | 77.00 | 21.00 | 12.00  |
| 12                                                                   | 35.00 | 27.00  | 31.00 | 11.00 | 2.00   | 55.00 | 33.00   | 28.00 | 28.00 | 99.00 | 23.00 | 23.00  |
| 13                                                                   | 37.00 | 32.00  | 24.00 | 12.00 | 5.00   | 65.00 | 17.00   | 45.00 | 16.00 | 42.00 | 23.00 | 28.00  |
| 14                                                                   | 23.00 | 48.00  | 9.00  | 3.00  | 6.00   | 64.00 | 17.00   | 41.00 | 8.00  | 39.00 | 15.00 | 320.00 |
| 15                                                                   | 16.00 | 26.00  | 5.00  | 1.00  | 4.00   | 53.00 | 20.00   | 30.00 | 39.00 | 15.00 | 18.00 | 212.00 |
| 16                                                                   | 27.00 | 17.00  | 11.00 | 5.00  | 40.00  | 44.00 | 26.00   | 41.00 | 32.00 | 19.00 | 24.00 | 26.00  |
| 17                                                                   | 46.00 | 16.00  | 19.00 | 3.00  | 58.00  | 34.00 | 17.00   | 80.00 | 47.00 | 20.00 | 25.00 | 22.00  |
| 18                                                                   | 61.00 | 115.00 | 18.00 | 15.00 | 67.00  | 20.00 | 11.00   | 46.00 | 73.00 | 22.00 | 19.00 | 21.00  |
| 19                                                                   | 67.00 | 58.00  | 18.00 | 7.00  | 39.00  | 29.00 | 29.00   | 40.00 | 55.00 | 32.00 | 31.00 | 8.00   |
| 20                                                                   | 34.00 | 49.00  | 14.00 | 1.00  | 41.00  | 38.00 | 2390.00 | 38.00 | 86.00 | 32.00 | 26.00 | 10.00  |
| 21                                                                   | 21.00 | 40.00  | 6.00  | 5.00  | 44.00  | 21.00 | 325.00  | 43.00 | 64.00 | 25.00 | 15.00 | 11.00  |
| 22                                                                   | 22.00 | 34.00  | 6.00  | 45.00 | 41.00  | 11.00 | 61.00   | 54.00 | 22.00 | 35.00 | 19.00 | 10.00  |
| 23                                                                   | 69.00 | 40.00  | 9.00  | 61.00 | 35.00  | 22.00 | 85.00   | 49.00 | 13.00 | 32.00 | 26.00 | 15.00  |
| 24                                                                   | 84.00 | 38.00  | 14.00 | 16.00 | 43.00  | 22.00 | 63.00   | 49.00 | 23.00 | 31.00 | 27.00 | 19.00  |
| 25                                                                   | 71.00 | 39.00  | 16.00 | 9.00  | 51.00  | 24.00 | 43.00   | 77.00 | 16.00 | 42.00 | 14.00 | 18.00  |
| 26                                                                   | 77.00 | 40.00  | 13.00 | 9.00  | 41.00  | 18.00 | 32.00   | 68.00 | 18.00 | 35.00 | 10.00 | 21.00  |
| 27                                                                   | 80.00 | 40.00  | 12.00 | 3.00  | 38.00  | 16.00 | 37.00   | 30.00 | 45.00 | 23.00 | 10.00 | 11.00  |
| 28                                                                   | 85.00 | 40.00  | 10.00 | 5.00  | 37.00  | 23.00 | 35.00   | 53.00 | 39.00 | 27.00 | 17.00 | 10.00  |
| 29                                                                   | 99.00 | 40.00  | 10.00 | 7.00  | 28.00  | 15.00 | 22.00   | 66.00 | 35.00 | 38.00 | 20.00 | 12.00  |
| 30                                                                   | 85.00 | 45.00  | 17.00 | 5.00  |        | 24.00 | 36.00   | 80.00 | 25.00 | 43.00 | 16.00 | 10.00  |
| 31                                                                   | 77.00 |        | 20.00 | 9.00  |        | 31.00 |         | 76.00 |       | 47.00 | 16.00 |        |
| Suspended-sediment load, in tons per day                             |       |        |       |       |        |       |         |       |       |       |       |        |
| 1                                                                    | 0.64  | 58.00  | 1.40  | 0.58  | 0.11   | 1.70  | 1.90    | 2.20  | 1.20  | 0.50  | 1.50  | 0.42   |
| 2                                                                    | 0.66  | 10.00  | 0.70  | 0.42  | 0.33   | 2.20  | 1.30    | 2.00  | 0.71  | 1.40  | 1.70  | 0.55   |
| 3                                                                    | 0.53  | 2.80   | 0.47  | 0.44  | 20.00  | 1.80  | 0.70    | 2.00  | 1.20  | 1.40  | 1.10  | 0.50   |
| 4                                                                    | 1.10  | 1.90   | 0.96  | 0.59  | 2.60   | 1.90  | 0.82    | 2.00  | 1.40  | 1.60  | 0.83  | 0.50   |
| 5                                                                    | 2.00  | 1.60   | 1.40  | 0.55  | 0.56   | 2.40  | 0.45    | 2.00  | 1.20  | 1.10  | 1.20  | 0.48   |
| 6                                                                    | 1.50  | 1.30   | 0.96  | 0.42  | 0.47   | 3.30  | 0.61    | 2.80  | 1.10  | 1.50  | 0.75  | 1.70   |
| 7                                                                    | 1.30  | 0.91   | 0.62  | 0.38  | 0.38   | 3.90  | 1.10    | 2.50  | 1.30  | 4.80  | 1.20  | 1.20   |
| 8                                                                    | 0.80  | 1.20   | 0.47  | 0.43  | 0.22   | 3.80  | 0.88    | 2.30  | 1.20  | 1.90  | 1.90  | 1.10   |
| 9                                                                    | 0.78  | 1.00   | 0.64  | 0.48  | 0.15   | 4.90  | 0.74    | 2.20  | 0.72  | 0.89  | 0.93  | 1.50   |
| 10                                                                   | 0.96  | 0.57   | 0.61  | 0.23  | 0.11   | 4.30  | 1.10    | 1.90  | 0.68  | 1.30  | 0.76  | 0.55   |
| 11                                                                   | 0.94  | 0.67   | 0.69  | 0.21  | 0.09   | 3.50  | 0.97    | 1.40  | 1.10  | 2.90  | 0.68  | 0.41   |
| 12                                                                   | 1.00  | 1.10   | 2.90  | 0.47  | 0.08   | 3.10  | 1.50    | 1.50  | 1.10  | 5.10  | 0.83  | 0.78   |
| 13                                                                   | 1.10  | 1.20   | 2.10  | 0.57  | 0.16   | 3.50  | 0.71    | 2.10  | 0.58  | 2.80  | 0.80  | 0.90   |
| 14                                                                   | 0.64  | 1.80   | 0.61  | 0.11  | 0.22   | 3.30  | 0.70    | 2.00  | 0.30  | 2.60  | 0.50  | 52.00  |
| 15                                                                   | 0.45  | 1.00   | 0.30  | 0.04  | 0.15   | 2.60  | 0.94    | 1.40  | 1.50  | 0.74  | 0.59  | 18.00  |
| 16                                                                   | 0.78  | 0.66   | 0.62  | 0.16  | 1.50   | 2.10  | 1.60    | 1.70  | 1.30  | 0.90  | 0.76  | 1.60   |
| 17                                                                   | 1.30  | 0.69   | 1.00  | 0.09  | 2.20   | 1.60  | 0.94    | 5.40  | 2.10  | 0.86  | 0.75  | 1.30   |
| 18                                                                   | 1.70  | 11.00  | 0.77  | 0.42  | 3.60   | 0.88  | 0.61    | 2.20  | 2.60  | 0.97  | 0.58  | 1.40   |
| 19                                                                   | 1.90  | 4.00   | 0.77  | 0.16  | 1.60   | 1.30  | 1.90    | 1.80  | 1.80  | 1.30  | 0.95  | 0.44   |
| 20                                                                   | 0.93  | 2.90   | 0.66  | 0.04  | 3.40   | 1.60  | 1190.00 | 1.60  | 4.00  | 1.40  | 0.75  | 0.50   |
| 21                                                                   | 0.58  | 2.00   | 0.28  | 0.15  | 2.90   | 0.84  | 71.00   | 2.00  | 2.40  | 0.99  | 0.42  | 0.54   |
| 22                                                                   | 0.62  | 1.50   | 0.25  | 2.60  | 2.60   | 0.44  | 7.90    | 2.50  | 0.84  | 1.70  | 0.53  | 0.47   |
| 23                                                                   | 1.80  | 1.90   | 0.38  | 5.30  | 2.20   | 0.86  | 9.80    | 2.30  | 0.54  | 1.60  | 0.71  | 0.63   |
| 24                                                                   | 2.40  | 1.60   | 0.61  | 0.53  | 3.00   | 0.82  | 6.70    | 2.10  | 0.95  | 1.50  | 0.67  | 0.75   |
| 25                                                                   | 2.90  | 1.40   | 0.65  | 0.32  | 3.20   | 0.92  | 4.40    | 3.30  | 0.66  | 1.90  | 0.39  | 0.71   |
| 26                                                                   | 3.30  | 1.50   | 0.53  | 0.30  | 2.00   | 0.66  | 3.00    | 3.00  | 0.68  | 1.60  | 0.35  | 0.85   |
| 27                                                                   | 3.30  | 1.60   | 0.41  | 0.11  | 2.30   | 0.52  | 3.20    | 1.30  | 1.70  | 0.93  | 0.27  | 0.49   |
| 28                                                                   | 3.30  | 1.50   | 0.34  | 0.16  | 2.20   | 0.90  | 2.90    | 2.20  | 1.40  | 1.00  | 0.46  | 0.37   |
| 29                                                                   | 4.40  | 1.60   | 0.36  | 0.22  | 1.50   | 0.72  | 1.70    | 2.50  | 1.20  | 1.50  | 0.50  | 0.46   |
| 30                                                                   | 4.00  | 4.20   | 0.57  | 0.17  |        | 1.10  | 2.60    | 3.30  | 0.86  | 1.80  | 0.39  | 0.37   |
| 31                                                                   | 3.30  |        | 0.74  | 0.29  |        | 1.50  |         | 2.90  |       | 2.10  | 0.38  |        |



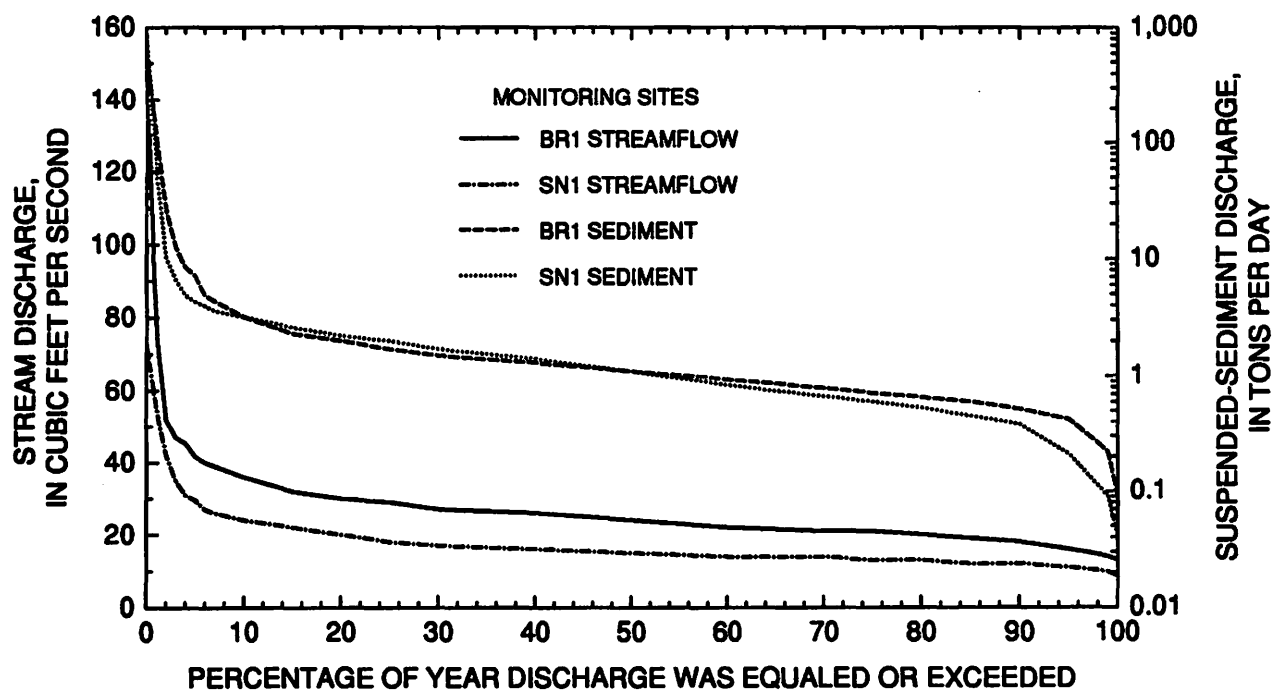
**Figure 2.** Suspended-sediment and stream discharge at the monitoring sites in Bloody Run and Sny Magill watersheds for Water Year 1992.



**Figure 3.** Summary of the monthly mean daily suspended-sediment concentrations at the monitoring sites in Bloody Run and Sny Magill watersheds for Water Year 1992.

**Table 6.** Particle size distribution of suspended sediment at the monitoring sites on Bloody Run and Sny Magill creeks.

| Date     | Time<br>(24-hour) | Instantaneous<br>discharge<br>(cubic feet/sec) | Sediment<br>Concentration<br>(mg/L) | Silt-clay<br>(percent<br><0.62 mm) | Sand<br>(percent<br>>0.62mm) |
|----------|-------------------|------------------------------------------------|-------------------------------------|------------------------------------|------------------------------|
| Site BR1 |                   |                                                |                                     |                                    |                              |
| 11/8/91  | 1530              | 27                                             | 22                                  | 55                                 | 45                           |
| 12/5/91  | 1630              | 26                                             | 39                                  | 14                                 | 86                           |
| 1/10/92  | 1015              | 21                                             | 18                                  | 25                                 | 75                           |
| 2/13/92  | 1630              | 21                                             | 14                                  | 31                                 | 69                           |
| 3/4/92   | 1630              | 25                                             | 13                                  | 76                                 | 24                           |
| 4/9/92   | 1630              | 21                                             | 29                                  | 42                                 | 58                           |
| 4/10/92  | 1230              | 23                                             | 28                                  | 14                                 | 86                           |
| 4/24/92  | 1515              | 47                                             | 46                                  | 69                                 | 31                           |
| 4/24/92  | 1800              | 49                                             | 48                                  | 66                                 | 34                           |
| 5/7/92   | 1900              | 31                                             | 19                                  | 61                                 | 39                           |
| 5/8/92   | 1210              | 35                                             | 39                                  | 59                                 | 41                           |
| 6/4/92   | 1030              | 23                                             | 26                                  | 48                                 | 52                           |
| 7/8/92   | 1045              | 27                                             | 59                                  | 53                                 | 47                           |
| 7/8/92   | 1900              | 26                                             | 47                                  | 34                                 | 66                           |
| 8/5/92   | 1930              | 23                                             | 10                                  | 39                                 | 61                           |
| 9/2/92   | 1715              | 18                                             | 10                                  | 69                                 | 31                           |
| 9/14/92  | 1445              | 73                                             | 104                                 | 95                                 | 5                            |
| -----    |                   |                                                |                                     |                                    |                              |
| Site SN1 |                   |                                                |                                     |                                    |                              |
| 11/7/91  | 930               | 14                                             | 22                                  | 58                                 | 42                           |
| 12/6/91  | 930               | 16                                             | 30                                  | 33                                 | 67                           |
| 1/9/92   | 1100              | 16                                             | 18                                  | 34                                 | 66                           |
| 2/14/92  | 1000              | 13                                             | 9                                   | 54                                 | 46                           |
| 3/5/92   | 1000              | 21                                             | 13                                  | 66                                 | 34                           |
| 6/5/92   | 1000              | 14                                             | 40                                  | 49                                 | 51                           |
| 8/6/92   | 1200              | 14                                             | 44                                  | 67                                 | 33                           |
| 9/3/92   | 1515              | 11                                             | 48                                  | 88                                 | 12                           |
| 9/14/92  | 1135              | 103                                            | 163                                 | 98                                 | 2                            |
| 9/14/92  | 1735              | 55                                             | 488                                 | 99                                 | 1                            |



**Figure 4.** Percentage of year stream and suspended-sediment discharge was equaled or exceeded in Sny Magill and Bloody Run creeks for Water Year 1992.

**Table 7. Daily mean discharge at the monitoring sites in the Bloody Run and Sny Magill watersheds; Water Year 1992. (Discharge in cubic feet per second).**

(Discharge in cubic feet per second)

| Day      | Oct  | Nov   | Dec  | Jan  | Feb  | Mar  | Apr   | May  | Jun  | Jul  | Aug  | Sep  |
|----------|------|-------|------|------|------|------|-------|------|------|------|------|------|
| Site BRI |      |       |      |      |      |      |       |      |      |      |      |      |
| 1        | 14.0 | 205.0 | 36.0 | 20.0 | 19.0 | 27.0 | 23.0  | 34.0 | 20.0 | 23.0 | 26.0 | 17.0 |
| 2        | 14.0 | 64.0  | 31.0 | 21.0 | 18.0 | 29.0 | 23.0  | 34.0 | 19.0 | 28.0 | 26.0 | 16.0 |
| 3        | 13.0 | 41.0  | 29.0 | 21.0 | 58.0 | 27.0 | 23.0  | 35.0 | 18.0 | 27.0 | 26.0 | 16.0 |
| 4        | 15.0 | 32.0  | 25.0 | 21.0 | 43.0 | 25.0 | 23.0  | 36.0 | 20.0 | 26.0 | 26.0 | 15.0 |
| 5        | 15.0 | 29.0  | 26.0 | 21.0 | 31.0 | 26.0 | 22.0  | 36.0 | 22.0 | 27.0 | 25.0 | 14.0 |
| 6        | 14.0 | 26.0  | 24.0 | 20.0 | 26.0 | 25.0 | 20.0  | 35.0 | 24.0 | 26.0 | 26.0 | 27.0 |
| 7        | 15.0 | 22.0  | 22.0 | 20.0 | 23.0 | 25.0 | 20.0  | 35.0 | 25.0 | 30.0 | 29.0 | 18.0 |
| 8        | 19.0 | 23.0  | 22.0 | 21.0 | 21.0 | 24.0 | 21.0  | 35.0 | 25.0 | 27.0 | 28.0 | 16.0 |
| 9        | 19.0 | 23.0  | 24.0 | 25.0 | 21.0 | 34.0 | 22.0  | 34.0 | 26.0 | 28.0 | 25.0 | 26.0 |
| 10       | 18.0 | 23.0  | 22.0 | 21.0 | 20.0 | 33.0 | 23.0  | 32.0 | 26.0 | 28.0 | 24.0 | 20.0 |
| 11       | 16.0 | 22.0  | 22.0 | 19.0 | 19.0 | 31.0 | 22.0  | 32.0 | 24.0 | 29.0 | 24.0 | 17.0 |
| 12       | 17.0 | 21.0  | 41.0 | 24.0 | 20.0 | 28.0 | 22.0  | 32.0 | 23.0 | 34.0 | 25.0 | 16.0 |
| 13       | 18.0 | 21.0  | 42.0 | 29.0 | 20.0 | 27.0 | 22.0  | 31.0 | 21.0 | 45.0 | 26.0 | 15.0 |
| 14       | 17.0 | 21.0  | 33.0 | 22.0 | 21.0 | 27.0 | 21.0  | 31.0 | 21.0 | 39.0 | 24.0 | 36.0 |
| 15       | 17.0 | 21.0  | 30.0 | 20.0 | 21.0 | 26.0 | 23.0  | 31.0 | 20.0 | 31.0 | 24.0 | 27.0 |
| 16       | 17.0 | 20.0  | 30.0 | 20.0 | 19.0 | 26.0 | 30.0  | 27.0 | 23.0 | 30.0 | 23.0 | 21.0 |
| 17       | 15.0 | 22.0  | 28.0 | 20.0 | 22.0 | 24.0 | 28.0  | 35.0 | 32.0 | 30.0 | 22.0 | 21.0 |
| 18       | 16.0 | 53.0  | 26.0 | 18.0 | 33.0 | 24.0 | 27.0  | 28.0 | 27.0 | 30.0 | 21.0 | 20.0 |
| 19       | 17.0 | 37.0  | 24.0 | 19.0 | 23.0 | 23.0 | 30.0  | 26.0 | 26.0 | 30.0 | 21.0 | 20.0 |
| 20       | 16.0 | 32.0  | 25.0 | 18.0 | 25.0 | 23.0 | 152.0 | 25.0 | 27.0 | 31.0 | 21.0 | 20.0 |
| 21       | 16.0 | 32.0  | 24.0 | 19.0 | 38.0 | 25.0 | 105.0 | 26.0 | 26.0 | 29.0 | 20.0 | 19.0 |
| 22       | 15.0 | 31.0  | 24.0 | 22.0 | 43.0 | 24.0 | 65.0  | 27.0 | 28.0 | 33.0 | 20.0 | 18.0 |
| 23       | 14.0 | 32.0  | 23.0 | 61.0 | 49.0 | 23.0 | 53.0  | 27.0 | 26.0 | 33.0 | 19.0 | 17.0 |
| 24       | 14.0 | 29.0  | 23.0 | 27.0 | 39.0 | 22.0 | 50.0  | 26.0 | 26.0 | 30.0 | 18.0 | 16.0 |
| 25       | 19.0 | 27.0  | 22.0 | 23.0 | 41.0 | 22.0 | 47.0  | 26.0 | 25.0 | 30.0 | 18.0 | 16.0 |
| 26       | 17.0 | 26.0  | 22.0 | 21.0 | 30.0 | 22.0 | 44.0  | 26.0 | 21.0 | 31.0 | 24.0 | 17.0 |
| 27       | 17.0 | 27.0  | 21.0 | 21.0 | 39.0 | 21.0 | 40.0  | 24.0 | 22.0 | 29.0 | 21.0 | 18.0 |
| 28       | 15.0 | 25.0  | 21.0 | 20.0 | 37.0 | 22.0 | 39.0  | 22.0 | 23.0 | 27.0 | 19.0 | 17.0 |
| 29       | 19.0 | 25.0  | 21.0 | 20.0 | 30.0 | 24.0 | 37.0  | 22.0 | 24.0 | 27.0 | 18.0 | 17.0 |
| 30       | 20.0 | 47.0  | 21.0 | 19.0 |      | 23.0 | 37.0  | 21.0 | 23.0 | 29.0 | 17.0 | 17.0 |
| 31       | 19.0 |       | 21.0 | 18.0 |      | 23.0 |       | 20.0 |      | 27.0 | 17.0 |      |
| Site SNI |      |       |      |      |      |      |       |      |      |      |      |      |
| 1        | 8.5  | 76.0  | 24.0 | 14.0 | 12.0 | 20.0 | 18.0  | 26.0 | 14.0 | 13.0 | 14.0 | 8.5  |
| 2        | 9.4  | 42.0  | 22.0 | 14.0 | 12.0 | 22.0 | 17.0  | 26.0 | 14.0 | 15.0 | 15.0 | 10.0 |
| 3        | 9.8  | 30.0  | 19.0 | 14.0 | 42.0 | 21.0 | 16.0  | 25.0 | 14.0 | 14.0 | 13.0 | 12.0 |
| 4        | 13.0 | 24.0  | 16.0 | 14.0 | 21.0 | 20.0 | 15.0  | 24.0 | 13.0 | 14.0 | 14.0 | 12.0 |
| 5        | 16.0 | 21.0  | 17.0 | 13.0 | 16.0 | 21.0 | 14.0  | 24.0 | 12.0 | 13.0 | 13.0 | 12.0 |
| 6        | 13.0 | 19.0  | 17.0 | 14.0 | 15.0 | 21.0 | 14.0  | 22.0 | 11.0 | 13.0 | 13.0 | 22.0 |
| 7        | 11.0 | 15.0  | 17.0 | 14.0 | 14.0 | 21.0 | 15.0  | 21.0 | 12.0 | 20.0 | 16.0 | 15.0 |
| 8        | 11.0 | 15.0  | 16.0 | 15.0 | 13.0 | 21.0 | 15.0  | 21.0 | 12.0 | 15.0 | 18.0 | 14.0 |
| 9        | 10.0 | 16.0  | 17.0 | 16.0 | 12.0 | 27.0 | 16.0  | 20.0 | 13.0 | 14.0 | 14.0 | 18.0 |
| 10       | 9.9  | 15.0  | 17.0 | 14.0 | 12.0 | 26.0 | 19.0  | 19.0 | 14.0 | 15.0 | 13.0 | 15.0 |
| 11       | 9.9  | 15.0  | 17.0 | 14.0 | 12.0 | 23.0 | 18.0  | 19.0 | 14.0 | 14.0 | 12.0 | 13.0 |
| 12       | 11.0 | 15.0  | 31.0 | 16.0 | 13.0 | 21.0 | 17.0  | 20.0 | 14.0 | 19.0 | 13.0 | 13.0 |
| 13       | 11.0 | 13.0  | 31.0 | 17.0 | 13.0 | 20.0 | 16.0  | 18.0 | 14.0 | 24.0 | 13.0 | 12.0 |
| 14       | 10.0 | 14.0  | 25.0 | 13.0 | 13.0 | 19.0 | 15.0  | 18.0 | 14.0 | 24.0 | 12.0 | 47.0 |
| 15       | 10.0 | 15.0  | 22.0 | 11.0 | 14.0 | 18.0 | 17.0  | 17.0 | 14.0 | 18.0 | 12.0 | 29.0 |
| 16       | 11.0 | 14.0  | 21.0 | 11.0 | 14.0 | 17.0 | 22.0  | 16.0 | 15.0 | 17.0 | 12.0 | 23.0 |
| 17       | 10.0 | 15.0  | 20.0 | 12.0 | 14.0 | 18.0 | 21.0  | 24.0 | 17.0 | 16.0 | 11.0 | 22.0 |
| 18       | 10.0 | 33.0  | 16.0 | 9.7  | 19.0 | 16.0 | 21.0  | 18.0 | 13.0 | 17.0 | 11.0 | 25.0 |
| 19       | 10.0 | 25.0  | 15.0 | 10.0 | 15.0 | 16.0 | 24.0  | 17.0 | 13.0 | 15.0 | 11.0 | 22.0 |
| 20       | 10.0 | 22.0  | 18.0 | 11.0 | 25.0 | 15.0 | 90.0  | 16.0 | 17.0 | 16.0 | 11.0 | 19.0 |
| 21       | 10.0 | 18.0  | 16.0 | 11.0 | 24.0 | 15.0 | 69.0  | 17.0 | 14.0 | 15.0 | 10.0 | 18.0 |
| 22       | 10.0 | 16.0  | 15.0 | 16.0 | 25.0 | 15.0 | 48.0  | 17.0 | 14.0 | 18.0 | 10.0 | 17.0 |
| 23       | 9.9  | 17.0  | 16.0 | 27.0 | 23.0 | 14.0 | 43.0  | 17.0 | 16.0 | 19.0 | 9.9  | 15.0 |
| 24       | 11.0 | 15.0  | 16.0 | 13.0 | 25.0 | 14.0 | 39.0  | 16.0 | 15.0 | 18.0 | 9.2  | 15.0 |
| 25       | 15.0 | 13.0  | 15.0 | 13.0 | 23.0 | 14.0 | 38.0  | 16.0 | 15.0 | 17.0 | 10.0 | 15.0 |
| 26       | 16.0 | 13.0  | 15.0 | 13.0 | 18.0 | 14.0 | 35.0  | 16.0 | 14.0 | 17.0 | 13.0 | 15.0 |
| 27       | 15.0 | 15.0  | 13.0 | 13.0 | 22.0 | 12.0 | 31.0  | 16.0 | 14.0 | 15.0 | 11.0 | 16.0 |
| 28       | 14.0 | 14.0  | 13.0 | 12.0 | 23.0 | 14.0 | 30.0  | 15.0 | 13.0 | 14.0 | 9.9  | 14.0 |
| 29       | 16.0 | 15.0  | 13.0 | 12.0 | 20.0 | 18.0 | 29.0  | 14.0 | 13.0 | 14.0 | 9.2  | 14.0 |
| 30       | 17.0 | 33.0  | 13.0 | 12.0 |      | 18.0 | 27.0  | 15.0 | 13.0 | 15.0 | 9.2  | 14.0 |
| 31       | 16.0 |       | 13.0 | 12.0 |      | 18.0 |       | 14.0 |      | 16.0 | 8.8  |      |

**Table 8.** Stage, mean velocity, and discharge measurements at supplemental sites in Bloody Run and Sny Magill watersheds.

| Site | Date     | Stage<br>(Feet below<br>reference<br>mark) | Mean<br>velocity<br>(feet/sec) | Discharge<br>(cubic<br>feet/sec) | Site | Date     | Stage<br>(Feet below<br>reference<br>mark) | Mean<br>velocity<br>(feet/sec) | Discharge<br>(cubic<br>feet/sec) |
|------|----------|--------------------------------------------|--------------------------------|----------------------------------|------|----------|--------------------------------------------|--------------------------------|----------------------------------|
| BRSC | 10/10/91 |                                            | 0.23                           | 2.95                             | NCC  | 10/10/91 | 9.32                                       | 0.09                           | 1.28                             |
|      | 12/5/91  | 18.60                                      | 0.46                           | 6.22                             |      | 11/7/91  | 9.91                                       | 0.98                           | 2.48                             |
|      | 1/10/92  | 18.70                                      | 0.40                           | 5.14                             |      | 12/6/91  | 9.80                                       | 1.40                           | 3.36                             |
|      | 2/13/92  | 18.63                                      | 0.44                           | 5.61                             |      | 1/9/91   | 9.90                                       | 1.30                           | 2.59                             |
|      | 3/4/92   | 18.67                                      | 0.44                           | 5.98                             |      | 2/14/92  | 9.95                                       | 1.35                           | 2.79                             |
|      | 4/10/92  | 18.70                                      | 0.41                           | 5.72                             |      | 3/5/92   | 9.88                                       | 1.15                           | 2.28                             |
|      | 5/7/92   | 18.49                                      | 0.41                           | 5.83                             |      | 4/9/92   | 9.94                                       | 1.34                           | 2.65                             |
|      | 6/4/92   | 18.55                                      | 0.37                           | 5.00                             |      | 5/8/92   | 9.73                                       | 1.44                           | 3.54                             |
|      | 7/9/92   | 18.54                                      | 0.36                           | 4.72                             |      | 6/5/92   | 9.95                                       | 1.20                           | 2.58                             |
| BR2  | 8/7/92   | 18.57                                      | 0.40                           | 4.85                             | SNT  | 7/8/92   | 9.96                                       | 1.15                           | 2.32                             |
|      | 10/10/91 | 17.58                                      | 0.15                           | 3.88                             |      | 8/6/92   | 9.88                                       | 1.21                           | 1.92                             |
|      | 6/4/92   | 17.48                                      | 0.60                           | 11.00                            |      | 10/10/91 | 12.69                                      | 0.20                           | 0.45                             |
|      | 7/9/92   | 17.70                                      | 0.57                           | 9.36                             |      | 11/7/91  | 12.69                                      | 0.47                           | 0.87                             |
| SN3  | 8/7/92   | 17.57                                      | 0.34                           | 7.72                             | SN2  | 12/6/91  | 12.65                                      | 0.64                           | 1.08                             |
|      | 10/10/91 | 18.93                                      | 0.48                           | 1.40                             |      | 1/9/91   | 12.70                                      | 0.92                           | 1.46                             |
|      | 11/7/91  | 18.80                                      | 0.86                           | 2.32                             |      | 2/14/92  | 12.72                                      | 0.47                           | 0.71                             |
|      | 12/6/91  | 18.57                                      | 0.97                           | 2.70                             |      | 3/5/92   | 12.70                                      | 0.74                           | 1.28                             |
|      | 1/9/92   | 18.74                                      | 0.88                           | 2.66                             |      | 4/9/92   | 12.74                                      | 0.74                           | 1.08                             |
|      | 2/14/92  |                                            | 0.96                           | 2.10                             |      | 5/8/92   | 12.51                                      | 0.91                           | 1.49                             |
|      | 3/5/92   | 18.77                                      | 1.15                           | 3.96                             |      | 6/5/92   | 12.73                                      | 0.61                           | 0.80                             |
|      | 4/9/92   | 18.76                                      | 0.78                           | 2.81                             |      | 7/8/92   | 12.74                                      | 0.85                           | 0.82                             |
|      | 5/8/92   | 18.67                                      | 0.67                           | 3.11                             |      | 8/6/92   | 12.62                                      | 0.50                           | 0.54                             |
| SNWF | 6/5/92   | 18.73                                      | 0.77                           | 2.76                             | SN2  | 10/10/91 | 21.06                                      | 0.46                           | 7.65                             |
|      | 7/8/92   | 18.74                                      | 0.85                           | 2.79                             |      | 11/7/91  | 21.06                                      | 0.94                           | 13.40                            |
|      | 8/6/92   | 18.77                                      | 0.43                           | 2.20                             |      | 12/6/91  | 20.94                                      | 1.16                           | 12.10                            |
|      | 10/10/91 | 10.74                                      | 0.22                           | 1.96                             |      | 1/9/91   | 21.05                                      | 0.94                           | 12.70                            |
|      | 11/7/91  | 10.79                                      | 0.38                           | 2.01                             |      | 2/14/92  | 21.20                                      | 1.05                           | 10.30                            |
|      | 12/6/91  | 10.73                                      | 0.69                           | 1.98                             |      | 3/5/92   | 21.00                                      | 1.38                           | 15.80                            |
|      | 1/9/92   | 10.82                                      | 1.12                           | 2.99                             |      | 4/9/92   | 21.10                                      | 1.17                           | 12.80                            |
|      | 2/14/92  | 10.90                                      | 0.92                           | 2.23                             |      | 5/8/92   | 20.79                                      | 1.35                           | 15.80                            |
|      | 3/5/92   | 10.82                                      | 0.98                           | 3.86                             |      | 6/5/92   | 20.96                                      | 0.91                           | 11.50                            |
|      | 4/9/92   | 10.81                                      | 1.04                           | 2.55                             |      | 7/8/92   | 20.94                                      | 1.02                           | 12.30                            |
|      | 5/8/92   | 10.62                                      | 0.91                           | 2.66                             |      | 8/6/92   | 20.98                                      | 0.88                           | 9.27                             |
|      | 6/5/92   | 10.80                                      | 0.82                           | 2.31                             |      |          |                                            |                                |                                  |
|      | 7/8/92   | 10.77                                      | 0.81                           | 2.12                             |      |          |                                            |                                |                                  |
|      | 8/6/92   | 10.62                                      | 0.96                           | 2.57                             |      |          |                                            |                                |                                  |