U.S. Department of the Interior
U.S. Geological Survey

WATER-QUALITY DATA COLLECTED DURING FLOODS IN THE COEUR D'ALENE RIVER, NORTHERN IDAHO, FEBRUARY 1996

BACKGROUND

Following an extended period of heavy snowfall and unusually cold temperatures, a powerful Pacific Ocean storm swept into the inland Northwest in early February 1996. Strong, warm winds, several inches of rain, and ice jams in river channels caused severe floods throughout the Coeur d'Alene River system (fig. 1). Coeur d'Alene Lake rose more than 8 feet above normal summertime level. The floods, the largest since 1974, forced evacuation of many low-lying areas and caused extensive damage to public and private property. Flood peaks in several areas in northern Idaho were the second largest ever recorded and exceeded flows that have a 1-percent chance of occurring in any given year.

The floods also transported large quantities of trace-metal-enriched sediments through the lower Coeur d'Alene River system and into Coeur d'Alene Lake. For almost a century, the mining district comprising the South Fork Coeur d'Alene River Valley was one of the world's largest producers of silver, lead, and zinc. Mining and related activities introduced large quantities of metal-enriched sediments into the channels, banks, and flood plains of the South Fork and lower main-stem Coeur d'Alene Rivers and into the Coeur d'Alene Lake bed (Horowitz and others, 1993, 1995; Woods and Beckwith, 1996).

The U.S. Geological Survey (USGS) operates 11 streamflow-gaging stations in the Coeur d'Alene River system and a stage-recording station on Coeur d'Alene Lake. Most

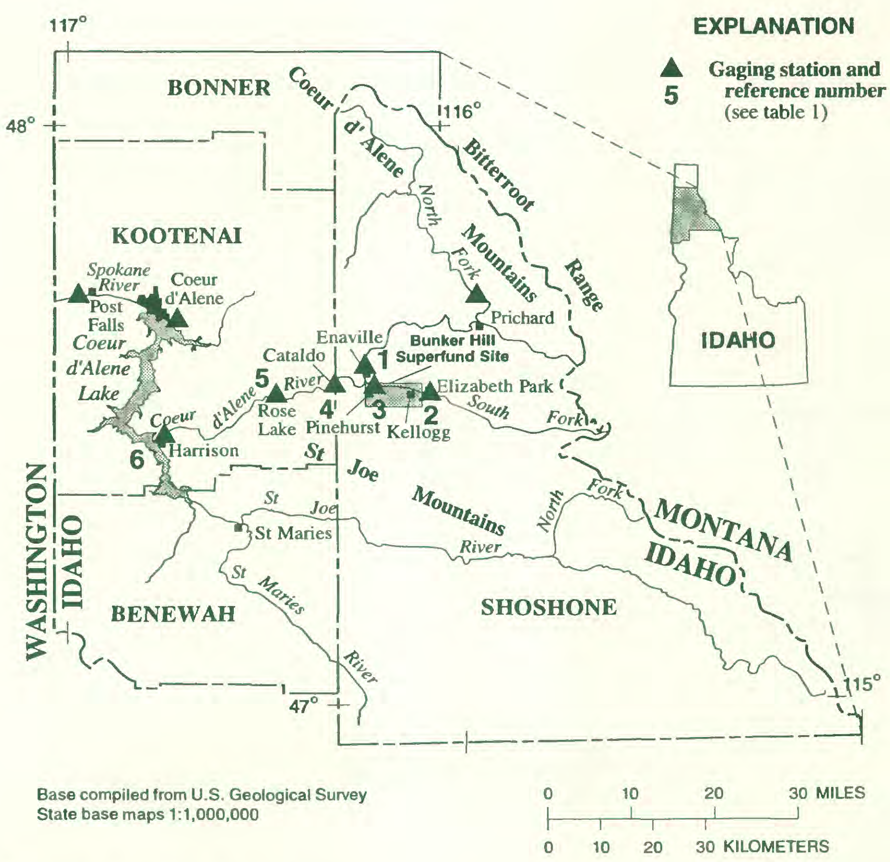

Figure 1. Location of study area.

Table 1. Concentrations of trace metals and suspended sediment in unfiltered samples, Coeur d'Alene River Basin, February 8–10, 1996

[Map reference No., locations on figure 1; μg/L, micrograms per liter; mg/L, milligrams per liter; <, less than]

Map reference No.	Gaging-station No. and name	Sampling date and time (24-hour)	Cadmium (μg/L)	Copper (μg/L)	Lead (μg/L)	Zinc (μg/L)	Suspended sediment (mg/L)
1	12413000........................ North Fork Coeur d'Alene River at Enaville	Feb. 8 1300	<1	2	10	30	68
2	12413210........................ South Fork Coeur d'Alene River at Elizabeth Park near Kellogg	Feb. 8 1130	5	20	410	820	180
		Feb. 9 1210	13	91	3,500	2,000	1,900
3	12413470........................ South Fork Coeur d'Alene River near Pinehurst	Feb. 8 1330	7	21	420	780	410
4	12413500........................ Coeur d'Alene River at Cataldo	Feb. 8 0910	2	4	66	190	76
		Feb. 9 1600	9	43	840	690	890
		Feb. 10 1000	3	13	340	330	290
5	12413810........................ Coeur d'Alene River at Rose Lake	Feb. 8 1430	3	7	500	390	96
		Feb. 9 0915	11	57	4,500	1,700	980
		Feb. 10 1040	6	24	3,700	850	440
6	12413860........................ Coeur d'Alene River at Harrison	[1]Feb. 8 1400	6	22	3,100	890	[2]260
		Feb. 10 0730	11	50	6,500	1,600	620

[1]Sample collected by Idaho Department of Health and Welfare, Division of Environmental Quality; analyzed by U.S. Geological Survey.

[2]Sample collected by Idaho Department of Health and Welfare, Division of Environmental Quality; analyzed by Bureau of Laboratories.

of these stations are funded by partnerships between the USGS and other Federal, State, tribal, and local agencies. Data from these stations are crucial for water supply planning; flood forecasting and response; dam and reservoir system operation; and engineering and maintenance of bridges, roads, and other structures. Some stations provide vital real-time data through satellite or ground communication links.

Floods often transport large quantities of sediment and chemical constituents over relatively short periods. Collection of water-quality data during floods can be difficult and sometimes dangerous but greatly enhances understanding of the environmental effects of floods on water quality. In the Coeur d'Alene River Basin, these data could be of considerable value in designing environmental management and remediation actions (such as those for the Bunker Hill smelter complex in Kellogg) and evaluating the environmental and cost effectiveness of these actions.

WATER-QUALITY DATA

Water samples were collected at six gaging stations in the Coeur d'Alene River Basin to characterize sediment and selected trace-metal concentrations and transport during the floods (fig. 1). Samples were collected at the Cataldo and Rose Lake gaging stations prior to the flood peak, at the peak, and following the peak (fig. 2). Samples were collected at the Harrison gaging station twice, prior to and after the flood peak. Access problems precluded sampling the other gaging stations more than once during the floods. Because of the large amount of floating debris and the extreme forces exerted on sampling equipment, water and suspended sediment samples

Table 2. Concentrations of trace metals in unfiltered and filtered samples, Coeur d'Alene River, February 10, 1996

[Map reference No., locations shown on figure 1; Unfilt, unfiltered recoverable; Filt, filtered; values in micrograms per liter; <, less than]

Map reference No.	Gaging-station No. and name	Cadmium		Copper		Lead		Zinc	
		Unfilt	Filt	Unfilt	Filt	Unfilt	Filt	Unfilt	Filt
4	12413500 Coeur d'Alene River at Cataldo	3	<1	13	<10	340	10	330	77
5	12413810 Coeur d'Alene River at Rose Lake	6	<1	24	<10	3,700	20	850	69
6	12413860 Coeur d'Alene River at Harrison	11	1	50	<10	6,500	100	1,600	200

Table 3. Specific conductance, total hardness, and nutrient concentrations, Coeur d'Alene River Basin, February 10, 1996

[Map reference No., locations on figure 1; µS/cm, microsiemens per centimeter at 25 degrees Celsius; $CaCO_3$, calcium carbonate; values in milligrams per liter unless otherwise indicated; <, less than]

Map reference No.	Gaging-station No. and name	Specific conductance (µS/cm)	Hardness, total as $CaCO_3$	Nitrite, dissolved as N	Nitrite plus nitrate, dissolved as N	Nitrogen, ammonia, dissolved as N	Nitrogen, ammonia plus organic, total as N	Nitrogen, ammonia plus organic, dissolved as N	Phosphorus, total as P	Phosphorus, dissolved as P	Phosphorus, dissolved orthophosphorus as P
4	12413500 Coeur d'Alene River at Cataldo	34	12	<0.01	0.05	<0.015	<0.2	<0.2	0.04	<0.01	<0.01
5	12413810 Coeur d'Alene River at Rose Lake	35	11	<.01	.05	<.015	<.2	<.2	.05	.01	<.01
6	12413860 Coeur d'Alene River at Harrison	42	13	<.01	.06	.070	.3	.2	.11	.03	.01

were collected only from mid-channel and near the river surface.

Concentrations of selected trace metals and suspended sediment in unfiltered water samples are shown in table 1. Concentrations of trace metals in the North Fork Coeur d'Alene River on February 8 were considerably smaller than those in the South Fork and main-stem Coeur d'Alene Rivers, which have received metal-enriched sediments from historical mining activities upstream. Trace-metal and suspended sediment concentrations were larger in samples collected near the flood peak (68,300 cubic feet per second at the Cataldo gaging station at approximately 1745 hours on February 9, 1996) than in samples collected at non-peak times. Trace-metal and suspended sediment concentrations generally were larger at the downstream gaging stations—concentrations at Rose Lake were larger than at Cataldo, and concentrations near the river mouth at Harrison were the largest.

A comparison of trace-metal concentrations in unfiltered and filtered samples collected on February 10 at the Cataldo, Rose Lake, and Harrison gaging stations is shown in table 2. These results indicate that trace metals were associated primarily with and transported by suspended sediment rather than "dissolved" in the water.

Specific conductance, total hardness, and nitrogen and phosphorus data from samples collected on the main-stem Coeur d'Alene River on February 10 are shown in table 3. Nitrogen (especially ammonia nitrogen) and phosphorus concentrations generally were larger at the downstream gaging stations. Nitrogen

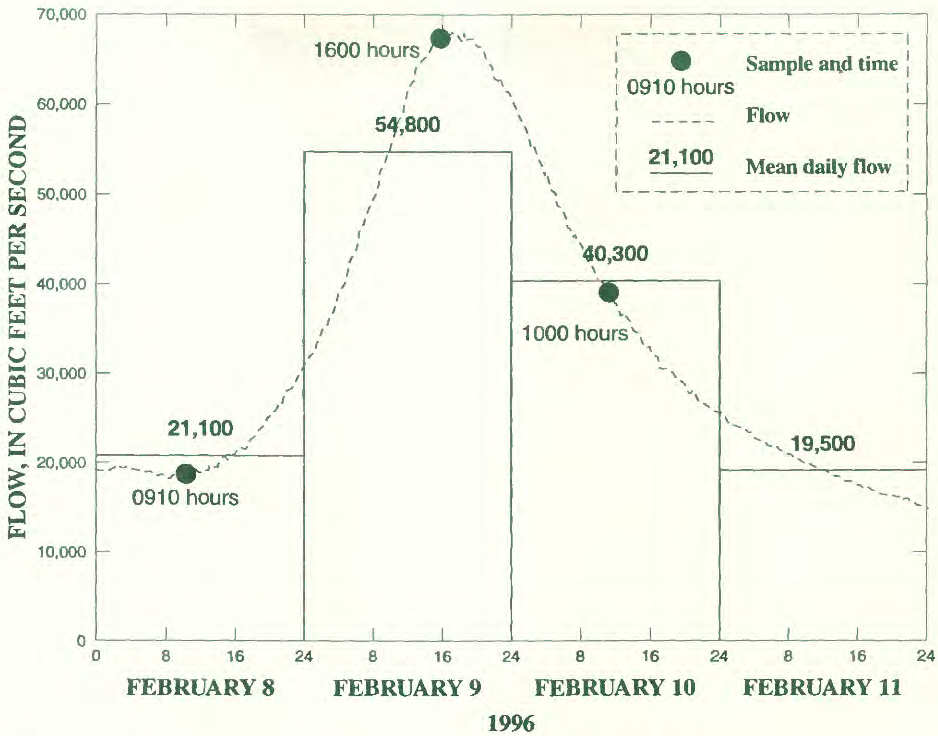

Figure 2. Flood hydrograph, sampling times, and mean daily flow at Coeur d'Alene River at Cataldo, Idaho. (Gaging station number 12413500)

appeared to be primarily in a dissolved phase, whereas phosphorus generally was associated with a solid phase.

The flood hydrograph for the Cataldo gaging station during February 8–11 is shown in figure 2. The hydrograph shows relations between mean daily flow and the rate of flow at the time of sample collection and at the flood peak.

Severe flood conditions prevented sampling throughout the water column, especially near the riverbed and banks, where considerable sediment and associated constituent transport can be expected. Therefore, actual trace-metal and suspended sediment concentrations and estimates of constituent transport through the Coeur d'Alene River system and into Coeur d'Alene Lake during the February 1996 flood might be considerably larger than indicated by results in this Fact Sheet.

—Michael A. Beckwith

REFERENCES CITED

Horowitz, Art, Elrick, Kent, and Cook, Robert, 1993, Effect of mining and related activities on the sediment trace element geochemistry of Lake Coeur d'Alene, Idaho, USA, Part I, Surface sediments: Hydrological Processes, v. 7, p. 403–423.

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