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

Water-Quality, Bed-Sediment, and Biological Data (October 1996 through September 1997) and Statistical Summaries of Data for Streams in the Upper Clark Fork Basin, Montana

By Kent A. Dodge, Michelle I. Hornberger, and
Ellen V. Axtmann

Open-File Report 98-407

In cooperation with the
U.S. ENVIRONMENTAL PROTECTION AGENCY

U.S. Department of the Interior

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Helena, Montana
August 1998

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CONVERSION FACTORS AND ABBREVIATED WATER-QUALITY UNITS

Multiply	By	To obtain
cubic foot per second (ft^3/s)	0.028317	cubic meter per second
foot (ft)	0.3048	meter (m)
gallon (gal)	3.785	liter (L)
gallon (gal)	3,785	milliliter (ml)
inch (in.)	25.4	millimeter (mm)
inch (in.)	25,400	micrometer (μm)
mile (mi)	1.609	kilometer
ounce (oz)	28.35	gram (g)
part per million	1	microgram per gram (μg/g)
square mile (mi^2)	2.59	square kilometer
ton per day (ton/d)	907.2	kilogram per day

Temperature can be converted from degrees Celsius (°C) to degrees Fahrenheit (°F) by the equation:

$$°F = 9/5\ (°C) + 32$$

Abbreviated water-quality units used in this report:

μg/g	micrograms per gram
μg/L	micrograms per liter
μg/mL	micrograms per milliliter
μS/cm	microsiemens per centimeter at 25 degrees Celsius
mg/L	milligrams per liter

Water-year definition:

A water year is the 12-month period from October 1 through September 30. It is designated by the calendar year in which it ends.

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Abstract

Water, bed sediment, and biota were sampled in streams from Butte to below Missoula as part of a program to characterize aquatic resources in the upper Clark Fork basin of western Montana. Sampling stations were located on the Clark Fork and major tributaries. Water-quality data were obtained periodically at 15 stations during October 1996 through September 1997 (water year 1997). Data for 15 bed-sediment and 15 biological stations were obtained in August 1997. The primary constituents analyzed were trace elements associated with tailings from historical mining and smelting activities.

Water-quality data include concentrations of selected major ions, trace elements, and suspended sediment in stream samples collected periodically during water year 1997. Daily values of streamflow, suspended-sediment concentration, and suspended-sediment discharge are given for three stations. Bed-sediment data include trace-element concentrations in the fine-grained and bulk fractions. Biological data include trace-element concentrations in whole-body tissue of aquatic benthic insects. Quality-assurance data are reported for analytical results of water, bed sediment, and biota. Statistical summaries of water-quality, bed-sediment, and biological data are provided for the period of record at each station since 1985.

INTRODUCTION

The Clark Fork originates near Warm Springs in western Montana at the confluence of Silver Bow and Warm Springs Creeks (fig. 1). Along the 148-mi reach of stream from Silver Bow Creek in Butte to the Clark Fork at Milltown Reservoir, six major tributaries enter: Blacktail Creek, Warm Springs Creek, Little Blackfoot River, Flint Creek, Rock Creek, and Blackfoot River. Principal surface-water uses in the 6,000-mi^2 Clark Fork basin above Missoula include irrigation, stock watering, light industry, hydroelectric power generation, and habitat for trout fisheries. Current land uses primarily are cattle production, logging, mining, and recreation. Large-scale mining and smelting had been prevalent land uses in the upper basin for more than one hundred years, but are now largely discontinued.

Deposits of copper, gold, silver, and lead ores were extensively mined, milled, and smelted in the drainages of Silver Bow and Warm Springs Creeks from about 1870 to 1980. Moderate- and small-scale mining also occurred in the basins of most of the major tributaries to the upper Clark Fork. Tailings derived from mineral processing commonly contain large quantities of trace elements such as arsenic, cadmium, copper, lead, and zinc. Tailings have been eroded, mixed with stream sediment, and transported downstream since the late 1800's and redeposited in stream channels, on flood plains, and in the Warm Springs Ponds and Milltown Reservoir. The widely dispersed tailings continue to be eroded, transported, and redeposited along the stream channel and flood plain, especially during high flows. The occurrence of trace elements in elevated concentrations can pose a risk to aquatic biota and human health because they may accumulate to potentially toxic levels.

Concern about the potential toxicity of tailings to aquatic biota and human health has resulted in a comprehensive effort by State, Federal, and private entities to characterize the aquatic resources in the upper Clark Fork basin to guide and monitor remedial cleanup activities. A long-term data base was considered nec-

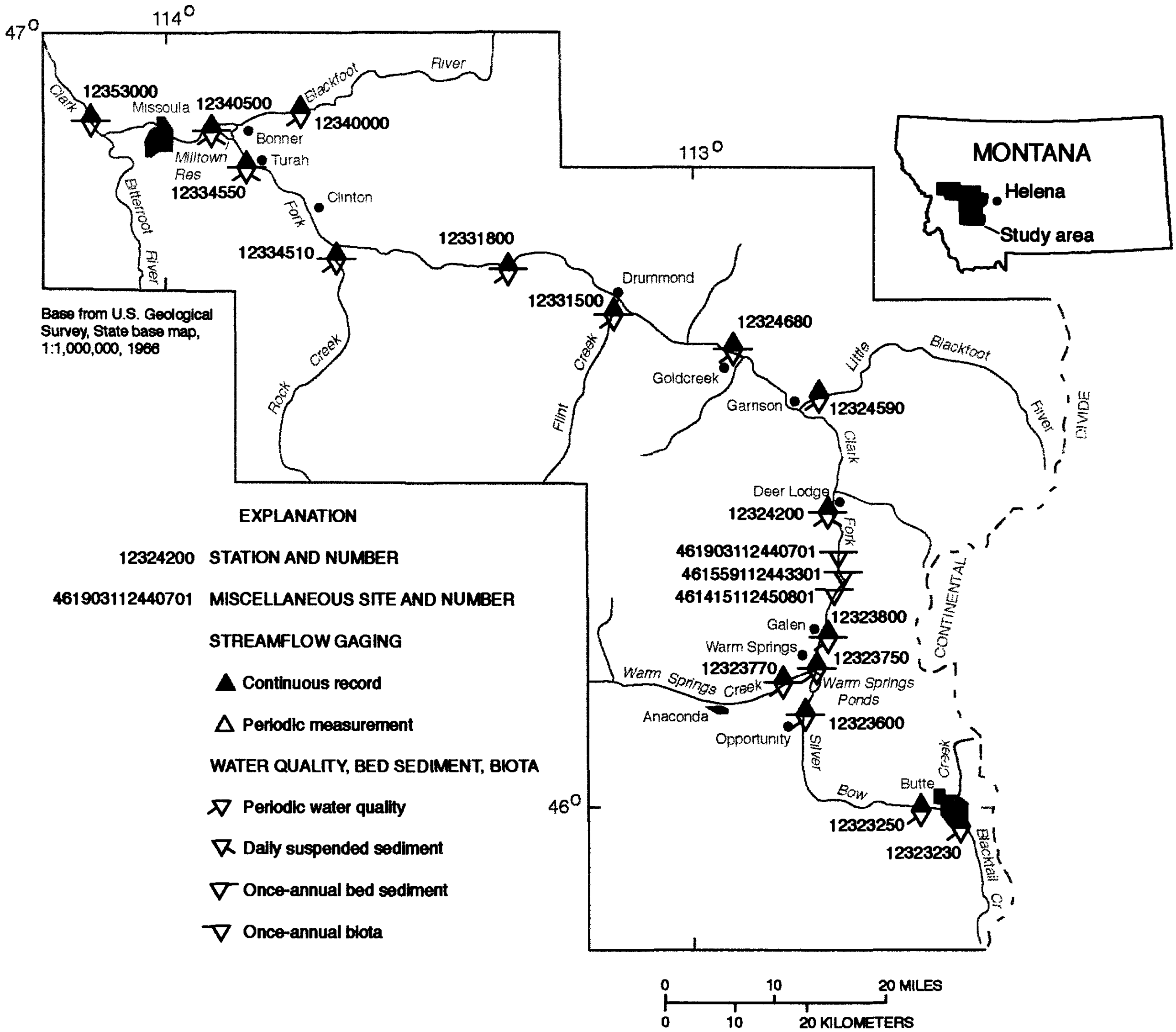

Figure 1. Location of study area.

essary to detect trends over time in order to evaluate the effectiveness of remediation. Water-quality data have been collected by the U.S. Geological Survey (USGS) at selected sites in the upper Clark Fork basin since 1985 (Lambing, 1987, 1988, 1989, 1990, and 1991; Lambing and others, 1994, 1995; and Dodge and others, 1996, 1997). Trace-element data for bed sediment and biota (aquatic benthic insects) have been collected intermittently since 1986 at selected sites as part of studies on bed-sediment contamination and bioaccumulation of metals conducted by the USGS National Research Program (Axtmann and Luoma, 1991; Axtmann and others, 1997; Cain and others, 1992, 1995; Hornberger and others, 1997). In March 1993, an expanded sampling program for water, bed sediment, and biota was implemented in cooperation with the U.S. Environmental Protection Agency to provide systematic, long-term monitoring. In 1996, water-quality and daily sediment sampling in the expanded program was scaled back to a less extensive network and reduced sampling frequency. In 1997, the water-quality network was partially restored to the pre-1996 status (water-quality sampling at the Clark Fork below Missoula was not reactivated) and sampling frequency was increased to better quantify the annual variability in selected constituents.

The purpose of this report is to present water-quality data for 15 stations and trace-element data for 15 bed-sediment and 15 biological stations in the upper Clark Fork basin collected from October 1996 through September 1997 (water year 1997). Quality-assurance data are presented for water quality, bed sediment, and biota. Statistical summaries also are provided for water-quality, bed-sediment, and biological data collected since 1985.

SAMPLING LOCATIONS AND TYPES OF DATA

Sampling stations in the upper Clark Fork basin are located on both the Clark Fork mainstem and major tributaries from Butte to below Missoula (fig. 1). Mainstem sampling sites were selected to divide the upper Clark Fork into reaches of relatively uniform length, with each reach encompassing either a major tributary or depositional environment (Warm Springs Ponds and Milltown Reservoir). Tributaries were sampled to describe water-quality characteristics for major hydrologic sources in the upper basin and to provide reference comparisons to the mainstem for bed sediment and biota. Water-quality data were obtained periodically at 15 stations; daily suspended-sediment data were obtained at 3 of these stations. Data for 15 bed-sediment and 15 biological stations were obtained once-annually (table 1).

A list of properties and constituents analyzed in samples of water, bed sediment, and biota is given in table 2. Results of analyses for water, bed sediment, biota, and associated quality assurance for water year 1997 are listed in tables 4 through 20 at the back of the report. Statistical summaries of water-quality, bed-sed-

Table 1. Type and period of data collection at sampling stations in the upper Clark Fork basin, Montana

[Abbreviation: P, present (1997). Symbol: --, no data]

Station number (fig. 1)	Station name	Continuous-record streamflow	Periodic water quality[1]	Daily suspended sediment	Fine-grained bed sediment[2]	Bulk bed sediment[2]	Biota[2]
12323230	Blacktail Creek at Harrison Avenue, at Butte	--	03/93-08/95, 12/96-P	--	--	--	--
12323250	Silver Bow Creek below Blacktail Creek, at Butte	10/83-P	03/93-08/95, 12/96-P	--	--	--	--
12323600	Silver Bow Creek at Opportunity	07/88-P	03/93-08/95, 12/96-P	03/93-09/95	07/92-P	08/93-08/95, 08/97	07/92, 08/94,08/95, 08/97
12323750	Silver Bow Creek at Warm Springs	03/72-09/79, 04/93-P	03/93-P	04/93-09/95	07/92-P	08/93, 08/95-P	07/92-P
12323770	Warm Springs Creek at Warm Springs	10/83-P	03/93-P	--	08/95, 08/97	08/95, 08/97	08/95, 08/97
12323800	Clark Fork near Galen	07/88-P	07/88-P	--	08/87, 08/91-P	08/93-P	08/87, 08/91-P
461415112450801	Clark Fork below Lost Creek, near Galen	--	--	--	08/96-P	08/96-P	08/96-P
461559112443301	Clark Fork near Racetrack	--	--	--	08/96-P	08/96-P	08/96-P
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	--	--	--	08/96-P	08/96-P	08/96-P
12324200	Clark Fork at Deer Lodge	10/78-P	03/85-P	03/85-08/86, 04/87-P	08/86, 08/87, 08/90-P	08/93-P	08/86,08/87,08/90-P
12324590	Little Blackfoot River near Garrison	10/72-P	03/85-P	--	08/86, 08/87, 08/94	08/94	08/87, 08/94
12324680	Clark Fork at Goldcreek	10/77-P	03/93-P	--	07/92-P	08/93-P	07/92-P
12331500	Flint Creek near Drummond	08/90-P	03/85-P	--	08/86, 08/89, 07/92-P	08/93-P	08/86, 07/92-P
12331800	Clark Fork near Drummond	04/93-P	03/93-P	--	08/86, 08/87, 08/91-P	08/93-P	08/86, 08/91-P
12334510	Rock Creek near Clinton	10/72-P	03/85-P	--	08/86, 08/87, 08/89, 08/91-P	08/93-P	08/87, 08/91-P
12334550	Clark Fork at Turah Bridge, near Bonner	03/85-P	03/85-P	03/85-P	08/86, 08/91-P	08/93-P	08/86, 08/91-P
12340000	Blackfoot River near Bonner	10/39-P	03/85-P	07/86-03/87, 06/88-09/95	08/86, 08/87, 08/91, 08/93-96	08/93-08/94	08/86,08/87,08/91, 08/93, 08/96
12340500	Clark Fork above Missoula	03/29-P	07/86-P	07/86-03/87, 06/88-01/96 03/96-P	08/97	08/97	08/97
12353000	Clark Fork below Missoula[3]	10/29-P	03/85-08/95	--	08/86, 08/90-P	08/93-P	08/86, 08/90-P

[1]Onsite measurements of physical properties and laboratory analyses of selected major ions, trace elements, and suspended sediment.
[2]Laboratory analyses of trace elements.
[3]Bed sediment and biota sampled about 30 miles downstream from water-quality station to conform to previous sampling location.

iment, and biological data collected since 1985 are given in tables 21-24 at the back of the report.

Quality assurance of data was maintained through the use of documented procedures designed to provide environmentally representative data. Acceptable performance of the procedures was verified with quality-control samples that were collected systematically to provide a measure of the accuracy, precision, and bias of the environmental data and to identify problems associated with sampling, processing, or analysis.

WATER-QUALITY DATA

Water-quality data consist of measurements of physical properties and concentrations of chemical and physical constituents analyzed in stream samples. Samples were collected 5 to 8 times per year on a schedule designed to describe seasonal and hydrologic variability. In addition, 21 supplemental samples were collected by a contract observer at Clark Fork at Turah Bridge, near Bonner and Clark Fork above Missoula to better define chemical changes and transport during extended high flows, and during the lowering of Milltown Reservoir water levels for dam maintenance.

Methods

Cross-sectional water samples were collected from multiple verticals across the stream using depth- and width-integration methods described by USGS (1977), Knapton (1985), and Edwards and Glysson (1988). These methods provide a vertically and laterally discharge-weighted sample that is representative of the entire flow through the cross section of a stream. Sampling equipment consisted of standard USGS depth-integrating suspended-sediment samplers (DH-48, DH-81, and D-74TM) which are either constructed of plastic or coated with a non-metallic epoxy paint, and equipped with nylon nozzles.

Onsite measurements of water temperature, specific conductance, and pH were made during collection of periodic water-quality samples. Onsite sample processing, including filtration and preservation, was performed according to procedures described by Horowitz and others (1994), Ward and Harr (1990), USGS (1977), and Knapton (1985). Instantaneous streamflow at the time of water sampling was determined at all stations, either by direct measurement or from stage-discharge rating tables (Rantz and others, 1982).

Water samples were analyzed for the constituents listed in table 2 by the USGS National Water Quality Laboratory (NWQL) in Arvada, Colo. The trace elements arsenic, cadmium, copper, iron, lead, manganese, and zinc were analyzed for both dissolved and total-recoverable concentrations. Analytical methods are described by Fishman and Friedman (1989) and Fishman (1993).

Table 2. Properties and constituents analyzed in samples of water, bed sediment, and biota from the upper Clark Fork basin, Montana

Water		Bed sediment	Biota
Property	**Constituent**	**Constituent**	**Constituent**
Streamflow	Hardness	Cadmium	Cadmium
Specific conductance	Calcium	Chromium	Chromium
pH	Magnesium	Copper	Copper
Temperature	Arsenic	Iron	Iron
	Cadmium	Lead	Lead
	Copper	Manganese	Manganese
	Iron	Nickel	Nickel
	Lead	Silver	Zinc
	Manganese	Zinc	
	Zinc		
	Suspended sediment		

Cross-sectional water samples also were collected for analysis of suspended sediment whenever periodic water-quality samples were collected. These samples were analyzed for suspended-sediment concentration and the percentage of suspended sediment finer than 0.062-mm diameter (silt size and smaller) by the USGS sediment laboratory in Helena, Mont., according to methods described by Guy (1969) and Lambing and Dodge (1993).

At the three daily suspended-sediment stations (table 1), suspended-sediment samples were collected 2 to 8 times per week. These samples were collected by local contracted observers using the depth-integration method at a single vertical near mid-stream. The samples were analyzed for suspended-sediment concentration and were used to determine daily mean suspended-sediment concentrations according to methods described by Porterfield (1972).

Results

Water-quality data for samples collected periodically during October 1996 through September 1997 (water year 1997) are presented in table 4. The types of data include instantaneous streamflow, onsite measurements of water-quality properties, and analytical results for chemical constituents and suspended sediment.

Daily streamflow and suspended-sediment data for water year 1997 at the three daily suspended-sediment stations are given in tables 5 through 7. Monthly descriptive statistics for each parameter are provided along with totals for the annual discharge of water and suspended sediment.

Quality Assurance

Quality-assurance procedures used for the collection and field processing of water-quality samples are described by Horowitz and others (1994), Ward and Harr (1990), Edwards and Glysson (1988), Knapton and Nimick (1991), and Knapton (1985). Standard procedures used by the NWQL for internal sample handling and quality assurance are described by Friedman and Erdmann (1982), Jones (1987), and Pritt and Raese (1992). Quality-assurance procedures used by the Montana District sediment laboratory are described by Lambing and Dodge (1993).

The quality of analytical results reported for water-quality samples was evaluated by quality-control samples that were submitted from the field and analyzed concurrently in the laboratory with routine samples. These quality-control samples consisted of replicates, spikes, and blanks which provide quantitative information on the precision and bias of the overall field and laboratory process. Each type of quality-control sample was submitted at a proportion equivalent to about 5 percent of the total number of water-quality samples. Therefore, the total number of quality-control samples represented about 15 percent of the total number of water-quality samples.

In addition to quality-control samples submitted from the field, internal quality-assurance practices at the NWQL are performed systematically to provide quality control of analytical procedures (Pritt and Raese, 1992). These internal practices include analyses of quality-control samples such as calibration standards, standard reference water samples, replicate samples, deionized-water blanks, or spiked samples at a proportion equivalent to at least 10 percent of the sample load. The NWQL participates in a blind-sample program where standard reference water samples prepared by the USGS Branch of Quality Systems are routinely inserted into the sample line for each analytical method at a frequency proportional to the sample load. The laboratory also participates in external evaluation studies twice-yearly with the U.S. Environmental Protection Agency, the Canadian Center for Inland Water, and the Branch of Quality Systems to assess analytical performance.

Replicate data can be obtained in different ways to provide an assessment of precision (reproducibility) of analytical results. Replicate samples are two or more samples considered to be essentially identical in composition. Replicate samples can be obtained in the field by either repeating the collection process to obtain two or more samples or by splitting a single sample into two or more subsamples which are then analyzed separately (field replicate). Likewise, a single sample can be analyzed two or more times in the laboratory to obtain a measure of analytical variability (laboratory replicate).

Precision of analytical results for field replicates is affected by numerous sources of variability within the field and laboratory environments, including sample collection, sample processing, and sample analysis. To provide data on precision for samples exposed to all sources of variability, chemical-replicate samples were obtained in the field by splitting a composite stream sample. Suspended-sediment replicate samples were obtained in the field by concurrently collecting two independent cross-sectional samples. Analyses of these field replicates indicate the reproducibility of environmental data that are affected by the combined variability potentially introduced by field and laboratory processes.

Analytical precision was evaluated with laboratory replicates which excluded field sources of variability. Replicate analyses were made of an individual sample selected randomly in the laboratory from the group of samples comprising each analytical run. A separate analysis of the sample was made at the beginning and end of each analytical run to provide information on laboratory analytical precision independent of possible effects on precision caused by field collection and processing of samples.

Spiked samples are used to evaluate the ability of an analytical method to accurately measure a known amount of analyte added to a sample. Because some constituents in stream water can potentially interfere with the analysis of a targeted analyte, it is important to determine whether such effects are causing inaccurate analyses. Deionized-water blanks and aliquots of stream samples were spiked in the laboratory with known amounts of the same trace elements analyzed in water samples. Analyses of spiked blanks indicate if the spiking procedure and analytical method are within control for a water matrix that is presumably free of chemical interference. Analyses of spiked aliquots of stream samples indicate if the chemical matrix of the stream water interferes with the analytical measurement and whether these interferences could contribute significant bias to reported trace-element concentrations for stream samples.

Blank samples of deionized water were routinely analyzed to identify the presence and magnitude of contamination that potentially could bias analytical results. The particular type of blank sample routinely tested was a "field" blank. Field blanks are aliquots of deionized water that are certified as trace-element free and are processed through the sampling equipment used to collect stream samples. These blanks are then subjected to the same processing (sample splitting, filtration, preservation, transportation, and laboratory handling) as stream samples. Blank samples are analyzed for the same constituents as those of stream samples to identify whether any detectable concentrations exist.

All water samples were handled in accordance with chain-of-custody procedures that provide documentation of sample identity, shipment, receipt, and laboratory handling. All samples submitted from a sampling episode were stored and analyzed as a discrete sample group, independent of other samples submitted to the NWQL. Therefore, statistical descriptions of quality-control data generated for this program are directly applicable to the analytical results for stream samples reported herein.

Data-quality objectives (table 3) were established for water-quality data as part of the study plan for the expanded long-term monitoring program that was initiated in 1993. The objectives identify analytical requirements of detectability and serve as a guide for identifying questionable data by establishing limits for precision and bias of laboratory results. Comparisons of quality-control data to data-quality objectives are used to evaluate whether sampling and analytical procedures are producing environmentally representative data in a consistent manner. Data that did not meet the objectives were evaluated for acceptability, and corrective action was taken, when appropriate.

The precision of analytical results for a constituent can be determined by estimating a standard deviation of the differences between replicate measurements for several sets of samples. These replicate measurements may consist either of individual analyses of a pair of samples considered to be essentially identical (field replicates) or multiple analyses of an individual sample (laboratory replicates). The differences in concentration between replicate analyses can be used to estimate a standard deviation according to the following equation (Taylor, 1987):

$$S = \sqrt{\frac{\Sigma d^2}{2k}} \tag{1}$$

where

S = standard deviation of the difference in concentration between replicate analyses,

d = difference in concentration between each pair of replicate analyses, and

k = number of pairs of replicate analyses.

Precision also can be expressed as a relative standard deviation (RSD), in percent, which is computed from the standard deviation and the mean concentration for all the replicate analyses. Expressing precision relative to a mean concentration standardizes comparison of precision among individual constituents. The RSD, in percent, is calculated according to the following equation (Taylor, 1987):

Table 3. Data-quality objectives for analyses of water-quality samples collected in the upper Clark Fork basin, Montana

[Abbreviations: µg/L, micrograms per liter; mg/L, milligrams per liter; mm, millimeter. Symbol: --, not determined]

Constituent	Data-quality objectives		
	Detectability	Precision	Bias
	Minimum reporting level, in units	Maximum relative standard deviation of laboratory replicate analyses, in percent	Maximum deviation of spike recovery, in percent
Calcium, dissolved	0.02 mg/L	20	--
Magnesium, dissolved	.01 mg/L	20	--
Arsenic, total recoverable	1 µg/L	20	25
Arsenic, dissolved	1 µg/L	20	25
Cadmium, total recoverable	1 µg/L	20	25
Cadmium, dissolved	.1 µg/L	20	25
Copper, total recoverable	1 µg/L	20	25
Copper, dissolved	1 µg/L	20	25
Iron, total recoverable	10 µg/L	20	25
Iron, dissolved	3 µg/L	20	25
Lead, total recoverable	1 µg/L	20	25
Lead, dissolved	.5 µg/L	20	25
Manganese, total recoverable	10 µg/L	20	25
Manganese, dissolved	1 µg/L	20	25
Zinc, total recoverable	10 µg/L	20	25
Zinc, dissolved	3 µg/L	20	25
Sediment, suspended	1 mg/L	--	--
Sediment, suspended (percent finer than 0.062 mm)	1 percent	--	--

$$RSD = \frac{S}{\bar{x}} \times 100 \qquad (2)$$

where

RSD = relative standard deviation,
S = standard deviation, and
$\bar{x}$ = mean of all replicate concentrations.

Paired analyses of field replicates are presented in table 8. The precision estimated for each constituent based on these paired results, which include both field and laboratory sources of variability, is reported in table 9. Statistics for precision of field-replicate analyses were based on the values reported in table 8, which are rounded to standard USGS reporting levels for the particular constituent and its analytical method (Timme, 1994).

Data-quality objectives for precision are not directly applicable to field replicates because of the inability to determine whether the variability results from field sample collection and processing, or laboratory handling and analysis. However, a statistical calculation of precision for the field replicates is provided in table 9 to illustrate overall reproducibility of environmental data that incorporates both field and laboratory sources of variability. Relative standard deviations estimated from differences in analytical results between field replicates were within 20 percent for all constituents.

Analytical precision for chemical constituents based on replicate laboratory analyses of individual samples, which includes only laboratory sources of variability, is reported in table 10. Statistics for analytical precision of laboratory-replicate analyses are based on unrounded values stored in laboratory data files. Concentrations less than the minimum reporting level (censored values) were included in the calculations by arbitrarily substituting a value of one-half the reporting level.

The data-quality objective for analytical precision of laboratory-replicate analyses is a maximum relative standard deviation of 20 percent. Precision estimates for laboratory-replicate analyses were within the 20-percent relative standard deviation limits for all constituents (table 10). The precision data, therefore, indicate acceptable reproducibility of replicate analyses.

Analyses of an unspiked sample and a spiked aliquot of the same sample provide a measure of the recovery efficiency for the analytical method within the chemical matrix of the sample. Spike recovery, in percent, was calculated using equation 3 (see below).

The data-quality objective for acceptable spike recovery of trace elements in water samples was a maximum deviation of 25 percent from a theoretical 100-percent recovery of added constituent. At the laboratory, a spiked deionized-water blank and a spiked aliquot of a stream sample were prepared and analyzed along with the original unspiked sample. The differences between the spiked and unspiked sample concentrations were determined and used to compute recovery according to equation 3. If the spike recovery for a trace element was outside a range of 75 to 125 percent, the instrument was recalibrated and the entire sample set and spiked samples were reanalyzed for that particular trace element until recoveries were improved to the extent possible. Results of recovery efficiency for individual trace elements in spiked deionized-water blanks and spiked stream samples are presented in tables 11 and 12, respectively.

The mean spike recovery for deionized-water samples spiked with trace elements ranged from 85.7 to 106.4 percent. The mean spike recovery for spiked stream samples ranged from 84.3 to 107.1 percent. The 95-percent confidence intervals (Taylor, 1987) for the mean of spike recovery for each constituent analyzed in stream samples (table 12) did not exceed a 25-percent deviation from an expected 100-percent recovery, with the exception of dissolved arsenic and total-recoverable copper and zinc. The exceedances outside of the acceptable 25-percent recovery limits were minor, ranging from 25.6 to 29 percent. The principal factor contributing to exceedance of the 25 percent deviation is the small number of spiked sample sets (3) used to complete the statistics. Because all mean spike recoveries were within the 25 percent limit, spike recoveries for each trace element were considered to be within the limits of data-quality objectives and indicate acceptable analytical performance for stream samples.

High or low bias is indicated if the confidence interval does not include 100 percent recovery. All laboratory-spiked stream samples (table 12) had confidence intervals for percent recovery that included 100 percent, except for total-recoverable cadmium. Total-recoverable cadmium recoveries were low, with a 95-percent confidence interval ranging from 75.0 to 93.6 percent. Because of the small number of spiked sample sets (3), and mean spike recoveries that met data-quality objectives, no adjustments were made to analytical results for stream samples on the basis of spike recoveries.

Analytical results for field blanks are presented in table 13. A field blank with constituent concentrations equal to or less than the minimum reporting level for the analytical method indicates that the entire process

$$\text{Spike recovery, in percent} = \frac{\text{spiked sample concentration} - \text{unspiked sample concentration}}{\text{spike concentration}} \times 100 \qquad (3)$$

of sample collection, field processing, and laboratory analysis is presumably free of significant contamination. If detectable concentrations in field blanks were equal to or greater than twice the minimum reporting level (typical measurement precision at the detection level), the concentrations were noted during data review. Analytical results from the field blank for the next sample set is evaluated for a consistent trend that may indicate systematic contamination. Sporadic, infrequent exceedances of twice the minimum reporting level probably represent random contamination or instrument calibration error that is not persistent in the process and which is not likely to cause significant positive bias in a long-term record of analytical results. However, if concentrations for a particular constituent exceed twice the minimum reporting level in field blanks from two consecutive field trips, blank samples are collected from individual components of the processing sequence and are submitted for analysis in order to identify the source of contamination.

Constituent concentrations in field blanks were almost always less than the minimum reporting level. There was only one occurrence of a value equaling twice the minimum reporting level (calcium), and there were no occurrences of detectable concentrations for any trace element in two consecutive blank samples. Therefore, the analytical results for field blanks indicate no systematic contamination that would bias the reported water-quality data for stream samples.

BED-SEDIMENT DATA

Bed-sediment data consist of analyses of trace-element concentrations in the fine-grained and bulk fractions. Bed-sediment samples are collected once-annually during low, stable flow conditions to facilitate data comparisons among years.

Methods

Bed-sediment samples were collected in August 1997 using protocols described by E.V. Axtmann (U.S. Geological Survey, written commun., 1994). Samples were collected from the surfaces of streambed deposits in low-velocity areas near the edge of the stream using an acid-washed polypropylene scoop. Whenever possible, samples were collected from both sides of the stream. Three composite samples of fine-grained bed sediment and one composite sample of bulk bed sediment were collected at each site.

Individual samples of fine-grained bed sediment were collected by scooping material from the surfaces of three to five randomly selected deposits along pool or low-velocity areas. The three to five individual samples were combined to form a single composite sample. This collection process was repeated three times to obtain three composite samples. Each composite sample was wet-sieved onsite through a 0.064-mm nylon-mesh sieve using ambient stream water. The fraction of bed sediment in each composite sample that was finer than 0.064 mm was transferred to an acid-washed 500-mL polyethylene bottle and transported to the laboratory on ice.

Individual samples of bulk bed sediment also were collected by scooping material from the surfaces of three to five randomly selected deposits. Because the streambed at most sampling locations is predominantly gravel and cobble, deposits were selected where cobbles and gravel could be excluded from the samples. Bulk bed-sediment samples are not sieved and generally are composed of particles smaller than about 10 mm in diameter. The individual unsieved samples were composited into an acid-washed polyethylene bottle and transported to the laboratory on ice.

Bed-sediment samples were prepared for analysis at the USGS National Research Program laboratory in Boulder, Colo. Fine-grained and bulk bed-sediment samples were oven-dried at 60 °C and ground using an acid-washed ceramic mortar and pestle. Duplicate aliquots of approximately 0.6 g of sediment from each of the three composite fine-grained bed sediment samples were digested using a hot, concentrated nitric acid reflux according to methods described by Luoma and Bryan (1981). Triplicate aliquots were digested from the single composite sample of bulk bed sediment. After a digestion period of up to several weeks, the aliquots were evaporated to dryness on a hot plate. The dry residue was redissolved with 20 mL of 0.6 N (normal) hydrochloric acid. The reconstituted aliquots then were filtered through a 0.45-µm filter using a syringe and in-line disposable filter cartridge. The filtrate was subsequently diluted to either a 1:5 or 1:10 ratio with 0.6 N hydrochloric acid. These final solutions were assigned a sequential number and submitted blind (without station identification) to the Geology Department at the University of Montana, Missoula, Mont., to be analyzed for cadmium, chromium, iron, lead, manganese, nickel, and zinc using Inductively Coupled Argon Plasma Emission Spectroscopy (ICAPES). Copper and silver were analyzed by flame atomic absorption (AA) at the USGS National Research Program laboratory in Boulder, Colo.

Results

Concentrations of trace elements measured in samples of fine-grained and bulk bed sediment collected during August 1997 are summarized in tables 14 and 15, respectively. Liquid-phase concentrations, in μg/mL, that were analyzed in the reconstituted aliquots of digested bed sediment were converted to solid-phase concentrations, in μg/g, using the following equation:

$$\mu g/g = \frac{\mu g/mL \times \text{volume of digested sample, in mL}}{\text{dry weight of sample, in g} \times \text{dilution ratio}} \quad (4)$$

The reported solid-phase concentrations in table 14 and 15 are the means of all analyses of replicate aliquots from each composite sample collected at the site. Because the conversion from liquid-phase to solid-phase concentration is dependent on both the dilution ratio and the dry weight of the sample, minimum reporting levels for some trace elements may differ among stations and among years.

Quality Assurance

The protocols for field collection and processing of bed-sediment samples are designed to prevent contamination from metal sources. Non-metallic sampling and processing equipment was acid-washed and rinsed with deionized water prior to the first sample collection. Nylon-mesh sieves were washed in a laboratory-grade detergent and rinsed with deionized water. All equipment was given a final rinse onsite with stream water. Sampling equipment that was reused at each site was rinsed between sites with 10-percent nitric acid, deionized water, and stream water. Separate sieves were used at each site and, therefore, did not require between-site cleaning.

Quality assurance of analytical results for bed sediment included laboratory instrument calibration with standard solutions and analysis of quality-control samples designed to identify the presence and magnitude of bias (E.V. Axtmann, written commun., 1994). Quality-control samples consisted of standard reference materials and procedural blanks. Each type of sample was analyzed in a proportion equivalent to about 10 to 20 percent of the total number of bed-sediment samples.

Standard reference materials (SRM) are commercially prepared materials that have certified concentrations of trace elements. Replicate analyses of standard reference materials are used to indicate the reproducibility of analytical results and the ability of the method to accurately measure a known quantity of a constituent. Recovery efficiency of trace-element analyses of standard reference materials for bed sediment is summarized in table 16. Two standard reference materials consisting of agricultural soils representing low and high concentrations of trace elements were analyzed to test recovery efficiency for a range of concentrations generally similar to those occurring in the upper Clark Fork basin. The digestion process used to analyze bed-sediment samples is not a "total" digestion (does not liberate elements associated with crystalline lattices); therefore, 100-percent recovery may not be achieved for elements strongly bound to the sediment. The percent recovery of trace elements in standard reference materials under such conditions serve to indicate which trace elements display strong sediment-binding characteristics and whether analytical recovery is consistent between multiple sets of analyses.

Although data-quality objectives have not been established for bed sediment, percent recoveries are shown in table 16 to illustrate analytical performance. Elements with mean recoveries outside a 25-percent deviation from complete (100 percent) recovery were cadmium, chromium, and silver for the low-concentration range (SRM 2709), and chromium for the high-concentration range (SRM 2711). Chromium had the lowest recovery (60.6 and 64.0 percent) of all the elements. There were two notable high recovery anomalies in the low-range SRM--301 percent for silver and 296 percent for cadmium. The reason for both high recoveries is believed to be the result of analyzing concentrations very close to the detection limit, coupled with signal enhancement resulting from matrix interference. Because very few bed-sediment samples have cadmium and silver concentrations as low as SRM 2709, no adjustments were made to trace-element concentrations in bed-sediment samples on the basis of recovery efficiencies.

Procedural blanks for bed-sediment samples consisted of the same reagents used for sample digestion and reconstitution. Concentrated nitric acid used for sample digestion was heated and evaporated to dryness. After evaporation, 0.6 N hydrochloric acid was added quantitatively to the dry residue to obtain the same dilution ratio as that used in the analysis of bed sediment. Procedural blanks, therefore, represent the same chemical matrix as the reagents used to digest and reconstitute bed-sediment samples. Analytical results for procedural blanks can indicate the presence and magnitude of potential contamination associated with sample handling and analysis in the laboratory environment. Results of trace-element analyses of procedural blanks for bed sediment are in table 17.

Analytical results of procedural blanks are reported as a liquid-phase concentration, in μg/mL, which is equivalent to parts per million. Determination of the significance of a detectable blank concentration is based on the magnitude of the equivalent solid-phase concentration, in μg/g, relative to the ambient concentration of the trace element in bed-sediment samples. Because sample weights of individual aliquots may vary, the relative significance of blank concentrations may differ among samples. If a detectable blank concentration, after conversion to a solid-phase concentration, represents 10 percent or more of the ambient solid-phase concentration, then the blank concentration is subtracted to remove potential contamination bias. Almost all procedural blanks had concentrations less than analytical detection levels. No detectable concentrations were twice the detection level, except for iron. None of the detectable concentrations in blanks were greater than 10 percent of the ambient concentration, with the exception of the 1:10 dilution for sample G (table 17). Anomalously high concentrations of iron, lead, manganese, and zinc were measured in this one blank, but after reviewing all replicate analyses of the bed-sediment digests, no environmental samples appeared to be similarly affected. Therefore, no adjustments were made to trace-element concentrations in bed-sediment samples on the basis of procedural blanks.

BIOLOGICAL DATA

Biological data consist of analysis of trace elements in the whole-body tissue of aquatic benthic insects. Insect samples are collected once-annually at the same sites and dates as bed-sediment samples (table 1), allowing for a direct comparison of annual results.

Methods

Insect samples were collected using protocols described in Hornberger and others (1997). Immature stages of aquatic benthic insects were collected using a large nylon-mesh kick net. A single riffle at each station was sampled repeatedly until an adequate number of individuals was collected to provide sufficient mass for analysis. Targeted taxa for collection were *Hydropsyche* spp., Order Trichoptera (caddisflies); *Arctopsyche grandis*, Order Trichoptera; and *Claassenia sabulosa*, Order Plecoptera (stoneflies). Samples of each taxon were stored separately, by genus, in acid-washed plastic containers. Containers were kept on ice in the field while the insects were allowed to evacuate the gut contents in ambient stream water for a period of six to eight hours. Excess water then was drained and insects were frozen for transport to the laboratory.

Insect samples were processed and analyzed at the USGS National Research Program laboratory in Menlo Park, Calif. Insects were thawed and rinsed with ultra-pure deionized water to remove particulate matter, then sorted to their lowest possible taxonomic level. When large numbers of specimens were collected from a station, similar-sized individuals were composited into replicate subsamples. Subsamples were placed in tared scintillation vials and oven-dried at 70 °C. Subsamples were weighed to obtain a final dry weight and digested by reflux using concentrated nitric acid (Cain and others, 1992). After digestion, insect samples were evaporated to dryness on a hot plate. The dry residue was reconstituted in 0.6 N hydrochloric acid, filtered through a 0.45-μm filter, and analyzed undiluted by ICAPES for cadmium, chromium, copper, iron, lead, manganese, nickel, and zinc.

Results

Concentrations of trace elements in whole-body tissue of aquatic insects collected during August 1997 are summarized in table 18. The variability in the number of composite samples among species and among sites reflects differences in insect abundance, with the number of composite samples increasing with the relative abundance of insects. Liquid-phase concentrations analyzed in the reconstituted samples were converted to solid-phase concentrations using equation 4. As in bed sediment, minimum reporting levels may differ among sites as a result of variable sample weights. In general, the smaller the biological sample weight (a function of insect abundance), the higher the minimum reporting level. Therefore, higher minimum reporting levels do not necessarily imply a higher trace-element concentration in tissue.

Two genera of *Hydropsyche* were collected for this study: *Hydropsyche occidentalis* and *Hydropsyche morosa* group. Two species of *Hydropsyche* were identified within the *morosa* group (*H. cockerelli* and *H. tana*). Results of analyses are listed for the individual species within the *morosa* group where positive identification was possible. In some instances, a sample was not positively identifiable as *H. cockerelli* although it could be identified as belonging to the *morosa* group. These samples are most likely *H. cockerelli* based on a distinct head pattern. However, the small size of the insect made it difficult to definitively determine the species. When positive identification of species was not possible, *Hydropsyche* spp. was used.

Quality Assurance

The protocols for field collection and processing of biota samples are designed to prevent contamination from metal sources. Non-metallic nets, sampling, and processing equipment were employed in all sample collection. Equipment was acid-washed and rinsed in ultra-pure deionized water prior to the first sample collection. Nets and equipment were thoroughly rinsed in ambient stream water at each new mainstem station. New nets and depuration chambers were used for the tributary stations. Biota samples were collected along an increasing concentration gradient to minimize effects from station-to-station carryover contamination.

Quality assurance of analytical results for biota samples included laboratory instrument calibration with standard solutions and analyses of quality-control samples designed to identify the presence and magnitude of bias. Quality-control samples consisted of standard reference material and procedural blanks. Each type of sample was analyzed in a proportion equivalent to about 10 to 20 percent of the total number of biota samples.

Recovery efficiency for trace-element analyses of standard reference material for biota is summarized in table 19. The reference material tested was lobster hepatopancreas. Data-quality objectives have not been established for analytical recovery in biota, but percent recoveries are shown to illustrate analytical performance. Mean recoveries were within 25 percent of complete (100 percent) recovery for all trace metals. A slight low bias is indicated for all constituents (confidence interval does not include 100 percent), except for chromium, which showed a high bias; however, no adjustments were made to trace-element concentrations for insect samples on the basis of recovery efficiency because mean recoveries were within 25 percent for all constituents.

Results of trace-element analyses of procedural blanks for biota are in table 20. Procedural blanks for biota consisted of the same reagents used to digest and reconstitute tissue of aquatic insects. The blanks were analyzed undiluted at a proportion of one blank per site. Analytical results for blanks indicated no significant contamination bias. With the exception of iron and zinc, most concentrations in the blanks were below detection levels. The detectable concentrations are within the range of instrument variability and are insignificant in relation to the measured concentrations in the insect samples; thus, no adjustments were made to trace-element concentrations in biota.

STATISTICAL SUMMARIES OF DATA

Statistical summaries of water-quality, bed-sediment, and biological data are provided in tables 21-24 for the period of record at each station since 1985. The summaries include the period of record, number of samples, maximum, minimum, mean, and median of concentrations.

Statistical summaries of water-quality data (table 21) are based on results of cross-sectional samples collected periodically by the USGS during the station's period of record. They do not include supplemental single-vertical samples collected by a contract observer at Clark Fork at Turah Bridge and Clark Fork above Missoula during 1997. Statistical summaries of bed-sediment (table 22 and 23) and biological data (table 24) are based on results of samples collected once-annually during the indicated years. Because not all stations were sampled for bed sediment and biota every year, these data do not represent a consecutive annual record.

Sample sizes and statistics for bed-sediment data are based on the annual mean concentrations determined from the combined results of composite samples for a given year. Therefore, sample sizes for bed sediment represent the number of years sampled. Sample sizes and statistics for biological data are based on individual analyses for each composite sample collected in individual years rather than the combined annual mean concentration. Biota sample sizes therefore reflect differences in species abundances at each site and among all years. The statistics for biota describe the full range of trace-element concentrations measured among all available composite samples. The abundance of aquatic insects at a particular site in a given year limits the biomass of the sample which, in turn, may result in different taxa analyzed among years or in variable analytical detection limits. Where minimum reporting levels vary among years, statistical summaries are provided only as a general indication of the range of detection.

The presence or absence of insect species at a given site can vary among years and may result in different taxa being analyzed in the long-term period of record. Because *Hydropsyche* insects were not sorted to the species level during 1986-89, statistics for stations sampled during those years are based on the results of all *Hydropsyche* species combined. At some sites, statistics for the *Hydropsyche morosa* group are based on the combined results for two or more species because these samples could not be identified clearly to the species, but had *morosa* characteristics.

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DATA

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997

[Abbreviations: ft^3/s, cubic feet per second; °C, degrees Celsius; e, estimated; µg/L, micrograms per liter; µS/cm, microsiemens per centimeter at 25 °C; mg/L, milligrams per liter; mm, millimeter; ton/d, tons per day. Symbols: <, less than minimum reporting level; --, no data]

12323230--BLACKTAIL CREEK AT HARRISON AVENUE, AT BUTTE, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (µg/L)
Dec 1996									
09...	1200	6.0	412	7.4	4.0	140	36	11	3
Mar 1997									
03...	0845	5.3	309	7.7	3.0	120	35	8.5	2
20...	1450	156	116	7.7	2.0	38	11	2.7	18
Apr									
21...	1115	24	206	7.6	4.0	80	23	5.5	7
May									
05...	1110	31	214	7.8	6.5	85	25	5.8	7
Jun									
04...	0915	23	207	7.8	11.5	80	23	5.3	11
25...	1015	29	208	7.8	9.0	85	24	5.9	8
Aug									
04...	1000	14	280	7.8	14.0	110	32	7.6	9

Date	Arsenic, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Copper, total recoverable (µg/L)	Copper, dissolved (µg/L)	Iron, total recoverable (µg/L)	Iron, dissolved (µg/L)	Lead, total recoverable (µg/L)
Dec 1996								
09...	2	<1	<0.1	4	2	470	41	2
Mar 1997								
03...	1	<1	<.1	3	<10	390	66	<1
20...	10	<1	<.1	25	9	4,200	220	14
Apr								
21...	4	<1	<.1	7	4	1,100	430	2
May								
05...	4	<1	<.1	9	5	930	360	1
Jun								
04...	7	<1	<.1	9	6	900	330	1
25...	7	<1	<.1	6	4	760	440	<1
Aug								
04...	6	<1	.1	4	3	570	230	<1

Date	Lead, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Dec 1996								
09...	<0.5	60	57	10	4	11	0.18	96
Mar 1997								
03...	<.5	60	44	<10	5	5	.07	93
20...	.6	240	100	40	5	139	59	68
Apr								
21...	<.5	50	28	<10	<3	11	.71	86
May								
05...	<.5	40	26	<10	<3	17	1.4	76
Jun								
04...	<.5	60	38	<10	4	12	.75	71
25...	<.5	40	31	<10	<3	6	.47	82
Aug								
04...	<.5	30	22	<10	<3	3	.11	86

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12323250--SILVER BOW CREEK BELOW BLACKTAIL CREEK, AT BUTTE, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
Dec 1996									
09...	1345	23	597	7.4	6.5	180	49	13	13
Mar 1997									
03...	1035	22	522	7.5	5.0	160	45	12	14
20...	1320	134	226	7.2	3.0	66	19	4.5	45
Apr									
21...	1245	42	425	7.3	6.5	140	39	9.2	11
May									
05...	1245	40	418	7.2	9.5	140	40	10	10
Jun									
04...	1100	41	416	7.4	13.0	140	41	9.9	12
25...	1140	46	409	7.5	11.5	140	40	9.7	11
Aug									
04...	1140	31	520	7.6	15.0	180	50	13	11

Date	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)
Dec 1996								
09...	6	4	3	220	120	700	110	4
Mar 1997								
03...	4	3	3	300	160	740	100	13
20...	9	4	1	370	120	5,900	210	130
Apr								
21...	5	6	5	300	250	900	200	6
May								
05...	5	3	3	190	130	820	180	4
Jun								
04...	5	5	5	430	300	860	180	10
25...	5	5	4	200	110	690	97	5
Aug								
04...	5	6	5	180	98	530	26	8

Date	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Dec 1996								
09...	<0.5	680	720	1,300	1,200	9	0.56	83
Mar 1997								
03...	<.5	760	730	1,200	1,000	11	.65	86
20...	1.9	840	410	980	490	194	70	76
Apr								
21...	.8	880	880	1,600	1,500	12	1.4	88
May								
05...	<.5	600	620	980	940	11	1.2	91
Jun								
04...	1.6	990	960	1,500	1,500	11	1.2	90
25...	<.5	770	750	1,300	1,200	15	1.9	50
Aug								
04...	.6	990	1,000	1,800	1,800	6	.50	91

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12323600--SILVER BOW CREEK AT OPPORTUNITY, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
Dec 1996									
09...	1515	47	501	8.2	1.5	160	45	11	16
Mar 1997									
04...	1000	44	493	8.1	0.0	170	50	11	19
20...	0620	361	202	7.6	0.0	60	18	3.4	230
Apr									
21...	1405	103	308	7.7	8.0	110	33	7.2	27
May									
06...	0915	126	269	7.6	6.0	100	30	6.3	27
Jun									
04...	1305	296	218	8.1	11.0	86	26	5.0	22
25...	1310	148	300	8.2	11.5	110	34	7.0	18
Aug									
04...	1330	59	448	8.8	17.0	170	49	11	17

Date	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)
Dec 1996								
09...	6	3	2	160	39	910	13	21
Mar 1997								
04...	8	3	2	200	46	1,100	10	23
20...	14	12	2	1,900	160	24,000	310	650
Apr								
21...	9	3	2	220	68	1,700	54	42
May								
06...	9	2	1	180	59	1,800	110	45
Jun								
04...	11	2	1	160	51	2,600	120	32
25...	9	2	1	130	53	1,000	67	17
Aug								
04...	8	3	2	190	54	630	16	14

Date	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Dec 1996								
09...	<0.5	620	590	760	520	20	2.5	79
Mar 1997								
04...	<.5	730	690	910	660	27	3.2	84
20...	5.1	2,000	690	2,300	580	801	781	65
Apr								
21...	.7	570	480	720	430	66	18	63
May								
06...	1.0	420	320	500	310	61	21	61
Jun								
04...	1.5	340	240	390	180	109	87	37
25...	.5	470	400	500	330	38	15	48
Aug								
04...	<.5	880	840	790	210	10	1.6	86

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
Dec 1996									
09...	1615	81	545	8.3	2.0	240	68	16	18
Mar 1997									
04...	1115	69	568	8.6	2.0	240	70	16	18
Apr									
21...	1555	210	386	8.6	8.5	150	45	9.4	37
May									
06...	1100	307	353	8.7	8.0	140	41	8.8	41
17...	0815	634	300	8.9	12.0	120	35	6.8	53
Jun									
01...	0830	662	265	8.9	13.0	110	34	5.9	49
23...	1220	527	290	9.3	12.5	130	39	6.6	34
Aug									
08...	1645	135	384	9.0	21.0	160	46	11	41

Date	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)
Dec 1996								
09...	14	<1	<0.1	12	6	280	6	2
Mar 1997								
04...	14	<1	.2	24	11	300	7	2
Apr								
21...	28	<1	<.1	24	11	570	24	4
May								
06...	30	<1	.1	25	13	480	24	4
17...	38	<1	<.1	19	14	840	50	5
Jun								
01...	38	<1	<.1	29	17	380	34	3
23...	29	<1	.1	33	17	310	27	4
Aug								
08...	39	<1	<.1	12	8	150	15	1

Date	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Dec 1996								
09...	<0.5	120	100	40	23	6	1.3	87
Mar 1997								
04...	<.5	280	240	110	33	5	.93	87
Apr								
21...	<.5	120	23	50	6	19	11	88
May								
06...	<.5	110	12	40	<3	22	18	80
17...	<.5	100	39	30	<3	37	63	80
Jun								
01...	<.5	80	41	30	7	17	30	78
23...	<.5	100	41	50	4	11	16	43
Aug								
08...	<.5	70	37	10	<3	7	2.6	44

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12323770--WARM SPRINGS CREEK AT WARM SPRINGS, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
Dec 1996									
09...	1645	e54	347	8.3	3.0	170	51	10	5
Apr 1997									
21...	1515	64	356	8.3	7.5	170	51	11	6
May									
17...	0945	280	173	8.2	7.0	80	25	4.2	17
Jun									
01...	0945	420	139	7.9	7.0	72	22	3.9	27
23...	1300	275	191	8.3	9.0	91	28	5.1	8
Aug									
08...	1730	128	257	8.5	16.0	120	37	6.8	7

Date	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)
Dec 1996								
09...	5	<1	<0.1	11	3	170	6	<1
Apr 1997								
21...	5	<1	<.1	10	2	160	3	<1
May								
17...	4	<1	<.1	82	7	1,700	26	9
Jun								
01...	11	<1	<.1	97	14	1,300	29	9
23...	6	<1	<.1	25	4	360	10	2
Aug								
08...	6	<1	<.1	11	4	130	11	1

Date	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Dec 1996								
09...	<0.5	240	210	<10	<3	9	e1.3	75
Apr 1997								
21...	<.5	270	220	<10	<3	9	1.6	83
May								
17...	<.5	300	66	40	8	100	76	75
Jun								
01...	<.5	170	43	30	<3	77	87	77
23...	<.5	110	62	10	5	22	16	65
Aug								
08...	<.5	90	77	<10	4	10	3.5	55

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12323800--CLARK FORK NEAR GALEN, MONT.

Date	Time	Streamflow, instantaneous (ft³/s)	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (µg/L)
Dec 1996									
10...	0810	136	486	8.0	1.5	210	59	14	12
Mar 1997									
04...	1210	109	511	8.4	1.5	230	66	15	11
Apr									
21...	1705	251	383	8.6	8.0	160	47	10	31
May									
06...	1140	342	357	8.5	9.0	150	43	9.2	37
17...	1040	907	266	8.7	10.5	110	33	6.2	47
Jun									
01...	1035	1,050	237	8.7	12.0	100	31	5.5	41
23...	1050	809	265	9.0	11.0	120	36	6.3	28
Aug									
08...	1845	248	329	8.8	19.0	140	43	8.7	25

Date	Arsenic, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Copper, total recoverable (µg/L)	Copper, dissolved (µg/L)	Iron, total recoverable (µg/L)	Iron, dissolved (µg/L)	Lead, total recoverable (µg/L)
Dec 1996								
10...	10	<1	<0.1	12	5	240	5	1
Mar 1997								
04...	8	<1	.1	21	8	270	<3	2
Apr								
21...	25	<1	<.1	26	9	560	14	4
May								
06...	27	<1	<.1	38	12	710	15	6
17...	27	<1	<.1	92	15	1,500	39	10
Jun								
01...	26	<1	.1	64	21	770	30	6
23...	21	<1	<.1	38	13	400	22	4
Aug								
08...	24	<1	<.1	11	7	150	12	1

Date	Lead, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Dec 1996								
10...	<0.5	170	130	30	13	6	2.2	78
Mar 1997								
04...	<.5	310	270	80	31	7	2.1	88
Apr								
21...	<.5	160	58	50	9	23	16	80
May								
06...	<.5	210	31	50	5	26	24	72
17...	<.5	270	41	80	3	74	181	65
Jun								
01...	<.5	120	39	50	12	43	122	62
23...	<.5	110	50	40	8	30	66	41
Aug								
08...	<.5	80	44	<10	<3	6	4.0	78

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12324200--CLARK FORK AT DEER LODGE, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
Dec 1996									
10...	0925	302	503	8.1	1.5	210	62	14	15
Mar 1997									
04...	1345	233	511	8.3	3.0	230	67	15	12
Apr									
21...	1810	437	425	8.3	9.0	180	53	12	30
May									
06...	1335	532	403	8.2	10.0	170	50	11	32
17...	1230	1,080	285	8.2	13.0	120	35	6.7	70
Jun									
01...	1215	1,260	286	8.1	12.5	120	36	6.8	44
23...	1430	1,170	296	8.5	12.5	130	40	7.5	37
Aug									
09...	0640	313	395	8.3	14.0	180	53	11	27

Date	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)
Dec 1996								
10...	11	<1	<0.1	36	5	660	10	4
Mar 1997								
04...	8	<1	<.1	23	5	360	<3	3
Apr								
21...	16	<1	<.1	75	11	1,100	11	9
May								
06...	20	<1	<.1	60	12	930	11	7
17...	22	1	.1	300	30	4,300	37	40
Jun								
01...	22	<1	.2	130	32	1,600	30	15
23...	21	<1	.1	92	18	1,100	21	11
Aug								
09...	24	<1	<.1	47	10	470	11	5

Date	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Dec 1996								
10...	<0.5	120	40	50	11	33	27	70
Mar 1997								
04...	<.5	100	63	40	19	16	10	71
Apr								
21...	<.5	160	24	70	6	68	80	59
May								
06...	<.5	170	15	60	6	52	75	54
17...	<.5	430	34	230	13	295	860	46
Jun								
01...	<.5	190	34	110	23	113	384	50
23...	<.5	160	55	80	8	65	205	56
Aug								
09...	<.5	90	30	40	10	20	17	77

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12324590--LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
Dec 1996									
10...	1125	64	279	8.4	2.0	120	36	8.4	4
Apr 1997									
23...	0905	416	211	8.2	3.5	94	27	6.4	6
May									
13...	1100	854	157	8.0	9.0	69	20	4.6	11
Jun									
01...	1405	1,040	179	8.1	13.0	80	23	5.4	9
23...	1640	361	220	8.2	12.5	100	29	6.9	7
Aug									
09...	0850	126	278	8.2	11.5	130	38	8.5	7

Date	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)
Dec 1996								
10...	4	<1	<0.1	2	<1	90	5	<1
Apr 1997								
23...	4	<1	<.1	3	2	710	91	2
May								
13...	5	<1	<.1	7	3	3,000	110	7
Jun								
01...	6	<1	<.1	5	3	1,200	67	3
23...	5	<1	<.1	2	<1	180	26	<1
Aug								
09...	6	<1	<.1	<1	1	180	16	<1

Date	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Dec 1996								
10...	<0.5	20	6	<10	<3	3	0.52	88
Apr 1997								
23...	<.5	50	6	<10	<3	34	38	68
May								
13...	<.5	150	11	30	3	190	438	53
Jun								
01...	<.5	60	13	<10	<3	85	239	53
23...	<.5	30	15	<10	<3	7	6.8	76
Aug								
09...	<.5	30	12	<10	<3	6	2.0	86

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12324680--CLARK FORK AT GOLDCREEK, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (µg/L)
Dec 1996									
10...	1235	441	461	8.5	2.0	210	59	14	14
Mar 1997									
04...	1535	356	462	8.7	3.0	210	61	14	9
Apr									
23...	1015	894	349	8.3	6.0	150	44	9.8	17
May									
06...	1515	1,150	312	8.2	9.5	130	39	8.4	20
17...	1410	2,820	207	8.1	11.5	86	26	5.1	43
Jun									
01...	1530	3,120	233	8.1	13.5	99	30	6.0	32
23...	0915	1,950	294	8.3	11.0	130	39	7.7	30
Aug									
09...	1015	612	378	8.4	13.5	170	51	11	20

Date	Arsenic, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Copper, total recoverable (µg/L)	Copper, dissolved (µg/L)	Iron, total recoverable (µg/L)	Iron, dissolved (µg/L)	Lead, total recoverable (µg/L)
Dec 1996								
10...	7	<1	<0.1	35	5	590	6	4
Mar 1997								
04...	8	<1	<.1	16	4	240	<3	2
Apr								
23...	11	<1	<.1	44	7	1,000	28	6
May								
06...	12	<1	<.1	48	9	1,200	36	8
17...	15	<1	<.1	200	17	5,000	66	36
Jun								
01...	15	<1	<.1	110	18	3,100	47	16
23...	20	<1	.2	78	14	1,000	23	8
Aug								
09...	17	<1	<.1	29	9	420	13	3

Date	Lead, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Dec 1996								
10...	<0.5	110	25	50	<3	28	33	81
Mar 1997								
04...	<.5	60	32	30	12	10	9.6	84
Apr								
23...	<.5	120	11	50	<3	57	138	66
May								
06...	<.5	150	10	50	4	68	211	62
17...	<.5	390	19	190	19	367	2,790	48
Jun								
01...	<.5	230	23	110	8	219	1,840	51
23...	<.5	130	40	70	12	54	284	63
Aug								
09...	<.5	70	20	30	9	20	33	81

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12331500--FLINT CREEK NEAR DRUMMOND, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
Dec 1996									
10...	1405	140	314	8.5	1.0	150	39	12	10
Mar 1997									
05...	0820	136	311	8.4	.5	150	40	13	9
Apr									
23...	1140	362	209	8.2	5.5	92	24	7.5	17
May									
06...	1700	366	215	8.2	8.5	98	26	7.7	24
17...	1540	700	134	8.2	12.0	59	16	4.4	28
Jun									
01...	1645	722	166	8.1	12.0	74	20	5.6	29
23...	0740	484	230	8.3	9.5	110	31	8.4	23
Aug									
09...	1145	99	363	8.6	13.5	170	46	14	14

Date	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)
Dec 1996								
10...	6	<1	<0.1	3	<1	310	19	4
Mar 1997								
05...	5	<1	<.1	2	<1	220	<3	3
Apr								
23...	6	<1	<.1	9	4	1,500	140	12
May								
06...	6	<1	<.1	7	2	1,400	130	16
17...	8	<1	<.1	11	4	1,600	110	21
Jun								
01...	13	<1	<.1	11	3	1,400	59	24
23...	14	<1	<.1	4	<1	530	31	9
Aug								
09...	13	<1	<.1	3	1	310	12	3

Date	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Dec 1996								
10...	<0.5	80	23	10	<3	15	5.7	86
Mar 1997								
05...	<.5	60	20	10	8	12	4.4	82
Apr								
23...	<.5	210	14	40	<3	103	101	82
May								
06...	<.5	260	20	50	<3	97	96	68
17...	.7	320	29	60	4	113	214	62
Jun								
01...	.7	340	42	50	5	121	236	59
23...	<.5	180	46	30	<3	35	46	69
Aug								
09...	<.5	90	41	10	<3	17	4.5	87

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12331800--CLARK FORK NEAR DRUMMOND, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
Dec 1996									
10...	1520	663	465	8.3	3.0	210	59	14	13
Mar 1997									
05...	0955	584	473	8.3	2.5	210	61	15	11
Apr									
23...	1300	1,410	340	8.2	7.5	150	43	11	18
May									
07...	0820	1,620	323	8.1	8.0	140	40	9.3	25
17...	1715	3,480	226	8.1	14.0	94	28	5.9	49
Jun									
01...	1810	3,860	252	8.1	15.0	110	32	6.8	38
22...	1315	2,890	309	8.2	13.5	140	41	8.8	30
Aug									
11...	1510	716	431	8.4	18.0	200	57	14	16

Date	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)
Dec 1996								
10...	7	<1	<0.1	33	4	660	5	5
Mar 1997								
05...	9	<1	<.1	21	4	450	<3	3
Apr								
23...	9	<1	<.1	50	7	1,500	68	9
May								
07...	10	<1	<.1	67	8	1,900	57	13
17...	15	1	<.1	220	17	5,300	60	36
Jun								
01...	19	<1	<.1	150	18	3,500	42	25
22...	20	<1	.1	77	12	1,400	21	10
Aug								
11...	15	<1	<.1	16	6	230	3	2

Date	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Dec 1996								
10...	<0.5	120	18	50	5	36	64	81
Mar 1997								
05...	<.5	70	25	40	11	22	35	79
Apr								
23...	<.5	160	11	70	<3	96	365	65
May								
07...	<.5	230	11	100	6	111	485	65
17...	<.5	500	27	290	12	356	3,340	64
Jun								
01...	<.5	340	31	180	11	238	2,480	63
22...	<.5	170	48	90	4	91	710	60
Aug								
11...	<.5	50	16	20	<3	13	25	82

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12334510--ROCK CREEK NEAR CLINTON, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (µg/L)
Dec 1996									
11...	1545	284	133	8.1	1.5	59	15	5.2	3
Apr 1997									
22...	1445	1,140	93	7.9	6.5	40	10	3.5	<1
May									
19...	1030	4,940	55	7.7	5.5	22	5.9	1.9	2
Jun									
02...	0730	5,060	59	7.7	8.5	25	6.6	2.1	2
22...	1130	2,260	82	7.9	9.5	38	9.9	3.1	<1
Aug									
11...	1340	435	128	8.3	15.5	59	16	4.9	<1

Date	Arsenic, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Copper, total recoverable (µg/L)	Copper, dissolved (µg/L)	Iron, total recoverable (µg/L)	Iron, dissolved (µg/L)	Lead, total recoverable (µg/L)
Dec 1996								
11...	<1	<1	<0.1	<1	<1	40	10	<1
Apr 1997								
22...	<1	<1	<.1	2	<1	390	160	<1
May								
19...	1	<1	<.1	3	1	1,200	98	1
Jun								
02...	1	<1	<.1	3	1	1,200	83	1
22...	<1	<1	<.1	2	<1	220	44	<1
Aug								
11...	<1	<1	<.1	<1	<1	60	16	<1

Date	Lead, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Dec 1996								
11...	<0.5	<10	<1	30	<3	2	1.5	73
Apr 1997								
22...	<.5	<10	2	<10	<3	14	43	69
May								
19...	<.5	40	4	<10	<3	117	1,560	66
Jun								
02...	<.5	40	4	<10	<3	223	3,050	39
22...	<.5	10	4	<10	<3	17	104	61
Aug								
11...	<.5	<10	3	<10	<3	2	2.3	67

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (µg/L)
Dec 1996									
11...	1345	987	374	8.5	2.0	170	47	12	7
Mar 1997									
05...	1140	845	392	8.4	3.0	180	50	13	7
Apr									
22...	1130	3,150	234	8.1	7.0	98	27	7.3	11
May									
07...	1100	3,840	213	7.9	8.5	92	26	6.7	12
[1]13...	1600	6,660	156	8.0	13.0	68	19	4.8	19
[1]14...	1030	6,420	163	7.9	13.0	72	20	5.1	18
[1]15...	1045	7,500	149	7.8	11.0	65	19	4.5	20
[1]16...	1300	8,480	143	7.9	15.0	62	18	4.2	22
[1]18...	0800	8,940	136	7.9	9.0	58	17	3.9	23
[1]19...	0925	8,910	143	8.0	9.0	60	17	4.1	21
19...	1320	8,880	140	8.0	9.0	58	17	3.9	20
[1]20...	1415	8,180	152	7.9	13.0	65	19	4.4	17
[1]21...	1215	7,760	153	7.9	12.0	65	19	4.4	14
[1]22...	1030	7,700	151	7.9	12.0	64	18	4.4	13
[1]23...	0945	7,530	150	8.1	11.0	64	18	4.3	12
Jun									
[1]01...	1730	9,410	156	8.1	15.0	66	19	4.4	18
[1]02...	0945	9,650	160	8.1	13.0	67	19	4.5	20
02...	0950	9,560	160	8.1	11.0	67	19	4.6	22
[1]03...	1440	9,030	168	8.0	14.0	72	21	4.8	18
[1]04...	0940	8,620	175	8.1	12.0	72	21	4.8	16
22...	1540	5,670	225	8.2	13.5	100	29	6.8	18
Jul									
[1]01...	1515	4,140	244	8.3	13.0	100	30	7.0	13
[1]03...	1105	4,120	258	8.2	13.0	110	32	7.5	15
[1]07...	0615	2,880	265	8.2	15.0	110	33	7.7	13
[1]11...	1025	2,430	272	8.3	13.0	120	34	8.0	11
[1]15...	0940	1,870	283	8.2	16.0	120	35	8.3	10
[1]17...	0830	1,790	282	8.2	17.0	120	36	8.6	10
[1]19...	1030	1,970	275	8.3	16.0	120	35	8.3	11
Aug									
11...	1210	1,160	329	8.4	16.0	150	42	11	10

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT. (Continued)

Date	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)
Dec 1996								
11...	5	<1	<0.1	14	4	270	5	2
Mar 1997								
05...	6	<1	<.1	10	3	190	<3	1
Apr								
22...	5	<1	<.1	36	6	1,600	94	7
May								
07...	6	<1	<.1	37	5	1,400	74	7
[1]13...	7	<1	<.1	93	13	3,100	91	16
[1]14...	7	<1	<.1	73	10	2,900	79	14
[1]15...	7	<1	<.1	92	12	3,700	75	18
[1]16...	8	<1	<.1	99	20	4,000	95	20
[1]18...	8	<1	<.1	110	13	4,300	120	21
[1]19...	8	<1	<.1	92	13	3,500	110	16
19...	8	<1	<.1	85	12	3,000	76	14
[1]20...	8	<1	<.1	66	11	2,200	82	11
[1]21...	7	<1	<.1	49	10	1,700	67	9
[1]22...	8	<1	<.1	42	10	1,600	50	8
[1]23...	6	<1	.1	48	10	1,400	49	7
Jun								
[1]01...	7	<1	<.1	87	11	2,900	50	15
[1]02...	9	<1	<.1	100	13	3,400	71	17
02...	8	<1	<.1	86	12	2,900	69	15
[1]03...	9	<1	<.1	70	13	1,900	40	10
[1]04...	8	<1	<.1	57	12	1,500	37	9
22...	13	<1	.1	43	9	960	25	6
Jul								
[1]01...	8	<1	.1	26	9	750	12	4
[1]03...	11	<1	<.1	25	10	680	14	4
[1]07...	10	<1	<.1	18	7	420	11	3
[1]11...	10	<1	<.1	13	6	290	9	2
[1]15...	9	<1	<.1	13	10	240	7	2
[1]17...	9	<1	<.1	13	6	200	4	2
[1]19...	9	<1	<.1	16	6	310	8	2
Aug								
11...	10	<1	<.1	9	4	160	5	1

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT. (Continued)

Date	Lead, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Dec 1996								
11...	<0.5	60	4	20	<3	16	43	87
Mar 1997								
05...	<.5	30	10	20	12	8	18	87
Apr								
22...	<.5	140	7	60	<3	86	731	67
May								
07...	<.5	130	11	60	5	99	1,030	52
[1]13...	<.5	280	3	150	5	442	7,950	--
[1]14...	<.5	270	3	130	7	332	5,750	--
[1]15...	<.5	340	2	180	8	348	7,050	--
[1]16...	<.5	410	3	200	10	411	9,410	--
[1]18...	<.5	390	4	210	6	315	7,600	--
[1]19...	<.5	370	5	180	4	244	5,870	--
19...	<.5	260	16	150	9	207	4,960	66
[1]20...	<.5	200	7	110	9	169	3,730	--
[1]21...	<.5	160	13	90	10	126	2,640	--
[1]22...	<.5	150	3	80	7	128	2,660	--
[1]23...	<.5	130	1	70	6	108	2,200	--
Jun								
[1]01...	<.5	270	7	150	6	328	8,330	--
[1]02...	.8	330	9	180	4	326	8,490	--
02...	<.5	270	19	150	6	244	6,300	60
[1]03...	<.5	190	3	110	6	202	4,920	--
[1]04...	<.5	160	3	90	9	151	3,510	--
22...	<.5	120	37	60	7	64	980	67
Jul								
[1]01...	<.5	90	<1	40	<3	44	492	--
[1]03...	<.5	80	1	40	<3	38	423	--
[1]07...	<.5	60	6	30	<3	26	202	--
[1]11...	<.5	50	<1	20	5	18	118	--
[1]15...	<.5	40	<1	20	5	14	71	--
[1]17...	<.5	40	<1	20	3	10	48	--
[1]19...	<.5	50	<1	20	12	18	96	--
Aug								
11...	<.5	30	9	10	7	8	25	83

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12340000--BLACKFOOT RIVER NEAR BONNER, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
Dec 1996									
11...	1120	701	258	8.5	1.0	130	33	12	<1
May 1997									
19...	1945	13,400	150	8.3	9.0	72	19	5.9	3
Jun									
02...	1155	11,800	147	8.3	10.0	72	19	5.8	2
22...	0935	5,130	179	8.4	11.5	91	24	7.7	<1
Aug									
11...	0920	1,160	258	8.4	14.5	130	33	12	1

Date	Arsenic, dissolved (μg/L)	Cadmium, total recoverable (μg/L)	Cadmium, dissolved (μg/L)	Copper, total recoverable (μg/L)	Copper, dissolved (μg/L)	Iron, total recoverable (μg/L)	Iron, dissolved (μg/L)	Lead, total recoverable (μg/L)
Dec 1996								
11...	<1	<1	<0.1	1	<1	50	3	<1
May 1997								
19...	1	<1	<.1	8	2	1,900	43	3
Jun								
02...	1	<1	<.1	34	2	1,300	47	2
22...	1	<1	<.1	3	<1	330	13	<1
Aug								
11...	1	<1	<.1	<1	<1	60	4	<1

Date	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Dec 1996								
11...	<0.5	<10	<1	<10	<3	2	3.8	83
May 1997								
19...	<.5	110	6	<10	<3	212	7,670	68
Jun								
02...	<.5	80	4	<10	<3	157	4,990	67
22...	<.5	30	4	<10	<3	23	319	84
Aug								
11...	<.5	<10	1	<10	<3	3	9.4	93

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12340500--CLARK FORK ABOVE MISSOULA, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance, onsite (μS/cm)	pH, onsite (standard units)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (μg/L)
Dec 1996									
11...	0930	1,700	323	8.3	1.0	150	41	12	4
Mar 1997									
05...	1415	1,450	330	8.4	2.5	150	42	12	4
Apr									
22...	0900	8,680	196	8.0	6.0	89	24	7.2	5
May									
07...	1445	10,800	181	8.0	8.0	84	22	6.7	5
[1]13...	1700	17,000	150	8.0	12.0	71	19	5.5	10
[1]14...	1145	17,500	154	8.0	12.0	73	20	5.6	8
[1]15...	1150	20,900	147	7.8	11.0	69	19	5.2	10
[1]16...	1415	23,600	147	8.0	13.0	69	19	5.1	14
[1]18...	0930	26,700	141	8.2	9.0	67	19	5.0	14
[1]19...	1045	24,200	147	8.1	9.0	69	19	5.2	12
20...	0715	21,600	154	8.1	9.5	69	19	5.3	10
[1]20...	1505	20,600	157	8.0	13.0	72	20	5.5	9
[1]21...	1300	18,900	157	7.9	11.0	73	20	5.6	8
[1]22...	1125	17,700	155	7.9	12.0	71	19	5.5	7
[1]23...	1055	17,300	154	8.2	12.0	72	20	5.5	6
Jun									
[1]01...	1820	20,400	150	8.1	13.0	69	19	5.2	8
[1]02...	1030	21,100	152	8.2	13.0	70	19	5.2	10
02...	1345	21,100	153	8.2	11.5	70	19	5.3	11
[1]03...	1545	19,000	157	8.1	15.0	73	20	5.4	9
[1]04...	1030	18,200	161	8.2	12.0	75	21	5.6	7
22...	1740	10,100	204	8.3	14.0	96	26	7.3	9
Jul									
[1]01...	1615	7,940	219	8.3	13.0	99	27	7.4	7
[1]03...	1210	7,730	232	8.2	13.0	100	29	7.8	9
[1]07...	0710	6,210	235	8.2	15.0	110	29	8.0	7
[1]11...	1145	5,340	243	8.3	15.0	110	30	8.3	7
[1]15...	1040	4,330	253	8.2	18.0	120	32	8.8	8
[1]17...	1030	3,980	254	8.3	17.0	120	32	9.1	7
[1]19...	1130	4,220	253	8.3	17.0	120	32	8.8	6
Aug									
11...	1040	2,470	293	8.5	16.0	140	38	11	7

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12340500--CLARK FORK ABOVE MISSOULA, MONT. (Continued)

Date	Arsenic, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Copper, total recoverable (µg/L)	Copper, dissolved (µg/L)	Iron, total recoverable (µg/L)	Iron, dissolved (µg/L)	Lead, total recoverable (µg/L)
Dec 1996								
11...	3	<1	<0.1	6	2	130	<3	<1
Mar 1997								
05...	4	<1	<.1	7	2.	170	<3	1
Apr								
22...	3	<1	<.1	14	3	990	110	3
May								
07...	3	<1	<.1	20	4	800	59	3
[1]13...	4	<1	<.1	47	5	2,900	61	10
[1]14...	4	<1	<.1	37	5	2,100	64	7
[1]15...	4	<1	<.1	42	5	3,500	73	10
[1]16...	4	<1	<.1	62	7	4,700	76	13
[1]18...	4	<1	<.1	63	6	5,000	71	14
[1]19...	4	<1	<.1	53	6	3,700	77	11
20...	4	<1	<.1	50	6	3,000	65	9
[1]20...	4	<1	<.1	36	6	2,200	44	7
[1]21...	4	<1	<.1	30	5	1,600	54	5
[1]22...	4	<1	<.1	24	6	1,400	41	4
[1]23...	3	<1	<.1	23	6	1,300	39	4
Jun								
[1]01...	3	<1	<.1	39	8	2,000	45	7
[1]02...	4	<1	<.1	45	7	2,200	53	9
02...	4	<1	<.1	49	7	2,200	44	9
[1]03...	5	<1	<.1	38	7	1,500	32	6
[1]04...	4	<1	.1	27	7	1,200	30	5
22...	7	<1	<.1	22	4	560	17	3
Jul								
[1]01...	6	<1	<.1	22	7	400	10	3
[1]03...	6	<1	<.1	20	7	450	11	2
[1]07...	6	<1	<.1	15	4	300	5	2
[1]11...	6	<1	<.1	19	4	430	4	2
[1]15...	5	<1	<.1	23	4	500	<3	3
[1]17...	6	<1	<.1	23	4	400	<3	3
[1]19...	5	<1	<.1	9	4	160	<3	1
Aug								
11...	6	<1	<.1	6	3	100	7	<1

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 1996 through September 1997 (Continued)

12340500--CLARK FORK ABOVE MISSOULA, MONT. (Continued)

Date	Lead, dissolved (μg/L)	Manganese, total recoverable (μg/L)	Manganese, dissolved (μg/L)	Zinc, total recoverable (μg/L)	Zinc, dissolved (μg/L)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)	Sediment, suspended (percent finer than 0.062 mm)
Dec 1996								
11...	<0.5	30	12	10	<3	6	28	87
Mar 1997								
05...	<.5	30	19	20	3	8	31	95
Apr								
22...	<.5	80	11	30	<3	61	1,430	85
May								
07...	<.5	70	16	20	<3	54	1,570	80
[1]13...	<.5	220	5	100	3	182	8,350	--
[1]14...	<.5	170	3	60	<3	272	12,900	--
[1]15...	<.5	250	2	100	<3	360	20,300	--
[1]16...	<.5	300	3	120	<3	436	27,800	--
[1]18...	<.5	320	3	130	<3	518	37,300	--
[1]19...	<.5	260	8	120	4	338	22,100	--
20...	<.5	180	15	90	4	260	15,200	52
[1]20...	<.5	160	6	70	5	212	11,800	--
[1]21...	<.5	130	11	60	<3	146	7,450	--
[1]22...	<.5	110	3	50	8	124	5,930	--
[1]23...	<.5	90	1	40	7	106	4,950	--
Jun								
[1]01...	<.5	140	5	60	4	173	9,530	--
[1]02...	<.5	170	9	80	8	182	10,400	--
02...	<.5	190	17	80	5	187	10,700	66
[1]03...	<.5	120	4	60	<3	129	6,620	--
[1]04...	<.5	100	3	50	8	97	4,770	--
22...	<.5	70	24	30	<3	37	1,010	78
Jul								
[1]01...	<.5	50	<1	20	<3	22	472	--
[1]03...	<.5	50	<1	30	<3	26	543	--
[1]07...	<.5	40	5	20	4	18	302	--
[1]11...	<.5	50	1	30	<3	29	418	--
[1]15...	<.5	60	<1	40	3	42	491	--
[1]17...	<.5	40	<1	30	5	34	365	--
[1]19...	<.5	30	<1	10	<3	14	160	--
Aug								
11...	<.5	30	20	<10	7	4	27	93

[1]Supplemental sampling to better define chemical changes during extended high-water runoff, and the lowering of Milltown Reservoir levels for dam structure maintenance.

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 1996 through September 1997

[Abbreviations: ft^3/s, cubic feet per second; e, estimated; mg/L, milligrams per liter; ton/d, tons per day. Symbol: ---, no data]

Day	Mean streamflow (ft^3/s)	Suspended sediment		Mean streamflow (ft^3/s)	Suspended sediment		Mean streamflow (ft^3/s)	Suspended sediment	
		Mean concentration (mg/L)	Discharge (ton/d)		Mean concentration (mg/L)	Discharge (ton/d)		Mean concentration (mg/L)	Discharge (ton/d)
	1996								
	October			**November**			**December**		
1	189	15	7.7	264	25	18	289	21	16
2	183	19	9.4	272	24	18	270	20	15
3	181	22	11	274	21	16	253	19	13
4	176	23	11	280	20	15	246	18	12
5	175	21	9.9	283	19	15	254	19	13
6	172	18	8.4	281	19	14	257	20	14
7	176	15	7.1	283	19	15	254	24	16
8	179	12	5.8	288	19	15	276	28	21
9	183	21	10	293	21	17	328	34	30
10	188	32	16	291	22	17	311	38	32
11	197	29	15	282	21	16	310	55	46
12	206	25	14	278	18	14	295	45	36
13	207	22	12	278	16	12	279	35	26
14	206	18	10	285	15	12	284	27	21
15	206	14	7.8	279	15	11	264	23	16
16	209	11	6.2	256	14	9.7	276	22	16
17	210	11	6.2	243	14	9.2	230	22	14
18	215	12	7.0	264	14	10	214	24	14
19	225	12	7.3	278	15	11	236	30	19
20	240	13	8.4	339	28	26	241	25	16
21	240	13	8.4	299	31	25	e230	18	11
22	241	14	9.1	307	31	26	e220	12	7.1
23	254	18	12	300	29	23	e200	10	5.4
24	264	24	17	280	22	17	e190	10	5.1
25	258	23	16	295	19	15	e180	10	4.9
26	254	21	14	287	19	15	e170	10	4.6
27	252	19	13	275	19	14	e170	12	5.5
28	258	18	13	293	20	16	e200	14	7.6
29	266	19	14	298	21	17	254	16	11
30	274	19	14	275	21	16	512	479	662
31	262	21	15	---	---	---	653	760	1340
TOTAL	6,746	---	335.7	8,500	---	474.9	8,346	---	2,470.2
MEAN	218	19	11	283	20	16	269	61	80
MAX	274	32	17	339	31	26	653	760	1,340
MIN	172	11	5.8	243	14	9.2	170	10	4.6

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 1996 through September 1997 (Continued)

Day	Mean streamflow (ft^3/s)	Suspended sediment		Mean streamflow (ft^3/s)	Suspended sediment		Mean streamflow (ft^3/s)	Suspended sediment	
		Mean concentration (mg/L)	Discharge (ton/d)		Mean concentration (mg/L)	Discharge (ton/d)		Mean concentration (mg/L)	Discharge (ton/d)
				1997					
	January			February			March		
1	1,040	785	2,200	393	33	35	240	15	9.7
2	766	235	486	361	31	30	235	17	11
3	565	110	168	312	28	24	235	21	13
4	484	70	91	271	26	19	237	18	12
5	432	45	52	e230	23	14	232	20	13
6	359	35	34	e220	20	12	236	19	12
7	363	30	29	e210	18	10	244	24	16
8	350	28	26	235	17	11	246	33	22
9	336	26	24	235	17	11	229	17	11
10	323	25	22	232	23	14	245	20	13
11	e250	23	16	245	30	20	258	49	34
12	e190	20	10	260	31	22	278	39	29
13	e170	18	8.3	264	31	22	279	27	20
14	c160	16	6.9	269	31	23	269	18	13
15	e170	17	7.8	280	31	23	274	39	29
16	e190	25	13	325	31	27	321	107	93
17	e220	32	19	321	31	27	372	303	304
18	285	35	27	295	31	25	364	111	109
19	328	33	29	290	30	23	414	163	182
20	316	28	24	279	29	22	431	174	202
21	308	22	18	274	26	19	445	136	163
22	322	18	16	274	23	17	503	180	244
23	288	19	15	267	22	16	492	111	147
24	271	20	15	259	21	15	453	84	103
25	e250	21	14	262	20	14	373	59	59
26	e240	22	14	265	19	14	352	52	49
27	e230	22	14	249	17	11	349	43	41
28	249	22	15	235	15	9.5	341	40	37
29	243	21	14	---	---	---	319	33	28
30	299	29	23	---	---	---	321	30	26
31	424	39	45	---	---	---	324	32	28
TOTAL	10,421	---	3,496.0	7,612	---	529.5	9,911	---	2,072.7
MEAN	336	61	113	272	25	19	320	66	67
MAX	1,040	785	2,200	393	33	35	503	303	304
MIN	160	16	6.9	210	15	9.5	229	15	9.7

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 1996 through September 1997 (Continued)

Day	Mean streamflow (ft³/s)	Suspended sediment		Mean streamflow (ft³/s)	Suspended sediment		Mean streamflow (ft³/s)	Suspended sediment	
		Mean concentration (mg/L)	Discharge (ton/d)		Mean concentration (mg/L)	Discharge (ton/d)		Mean concentration (mg/L)	Discharge (ton/d)
	1997								
	April			May			June		
1	324	28	24	563	88	134	1,260	108	367
2	328	29	26	576	86	134	1,370	116	429
3	330	29	26	545	68	100	1,360	93	341
4	322	23	20	510	59	81	1,360	82	301
5	297	29	23	509	54	74	1,430	86	332
6	304	32	26	534	91	131	1,660	97	435
7	323	27	24	615	100	166	1,770	101	483
8	312	25	21	600	95	154	1,880	93	472
9	308	23	19	614	73	121	1,900	82	421
10	294	25	20	623	77	130	1,830	73	361
11	286	28	22	684	126	233	1,860	67	336
12	298	31	25	736	169	336	1,950	77	405
13	299	31	25	775	172	360	1,900	79	405
14	294	20	16	836	172	388	1,980	86	460
15	293	26	21	888	239	573	1,860	59	296
16	305	24	20	957	251	649	1,740	57	268
17	311	35	29	1,070	286	826	1,680	60	272
18	334	34	31	1,130	219	668	1,670	59	266
19	364	46	45	1,140	166	511	1,640	55	244
20	414	75	84	1,040	135	379	1,530	53	219
21	436	73	86	989	113	302	1,390	53	199
22	434	66	77	965	98	255	1,250	58	196
23	434	60	70	956	96	248	1,150	64	199
24	500	115	155	1,040	108	303	1,070	60	173
25	490	79	105	1,270	152	521	1,000	59	159
26	481	67	87	1,270	121	415	919	57	141
27	480	60	78	1,170	81	256	818	55	121
28	506	61	83	1,050	75	213	774	49	102
29	524	94	133	1,040	74	208	737	41	82
30	544	77	113	1,120	86	260	765	41	85
31	---	---	---	1,190	96	308	---	---	---
TOTAL	11,169	---	1,534	27,005	---	9,437	43,503	---	8,570
MEAN	372	46	51	871	123	304	1,450	71	286
MAX	544	115	155	1,270	286	826	1,980	116	483
MIN	286	20	16	509	54	74	737	41	82

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 1996 through September 1997 (Continued)

Day	July: Mean streamflow (ft³/s)	July: Suspended sediment, Mean concentration (mg/L)	July: Suspended sediment, Discharge (ton/d)	August: Mean streamflow (ft³/s)	August: Suspended sediment, Mean concentration (mg/L)	August: Suspended sediment, Discharge (ton/d)	September: Mean streamflow (ft³/s)	September: Suspended sediment, Mean concentration (mg/L)	September: Suspended sediment, Discharge (ton/d)
1997									
1	994	83	223	381	20	21	292	8	6.3
2	963	47	122	408	22	24	285	8	6.2
3	900	35	85	382	23	24	283	9	6.9
4	841	32	73	330	23	20	305	9	7.4
5	772	29	60	370	23	23	294	9	7.1
6	759	28	57	418	26	29	297	9	7.2
7	722	27	53	382	24	25	292	8	6.3
8	632	26	44	354	17	16	291	8	6.3
9	586	26	41	317	20	17	287	7	5.4
10	566	25	38	308	17	14	277	7	5.2
11	559	24	36	300	14	11	283	7	5.3
12	521	22	31	292	11	8.7	305	7	5.8
13	486	21	28	284	10	7.7	313	7	5.9
14	443	20	24	288	10	7.8	317	8	6.8
15	384	19	20	264	10	7.1	316	8	6.8
16	334	19	17	320	15	13	330	9	8.0
17	335	19	17	348	17	16	329	8	7.1
18	354	19	18	367	17	17	323	8	7.0
19	394	23	24	399	18	19	317	8	6.8
20	715	173	334	357	14	13	324	7	6.1
21	582	36	57	360	12	12	337	8	7.3
22	515	23	32	350	11	10	338	8	7.3
23	468	20	25	333	11	9.9	334	9	8.1
24	432	19	22	323	10	8.7	310	10	8.4
25	399	19	20	322	10	8.7	294	10	7.9
26	375	19	19	325	10	8.8	288	10	7.8
27	354	19	18	337	17	15	295	10	8.0
28	338	19	17	329	10	8.9	300	10	8.1
29	335	20	18	315	9	7.7	297	10	8.0
30	337	18	16	298	8	6.4	291	10	7.9
31	342	16	15	295	7	5.6	--	--	--
TOTAL	16,737	--	1,604	10,456	--	435.0	9,144	--	208.7
MEAN	540	30	52	337	15	14	305	8	7.0
MAX	994	173	334	418	26	29	338	10	8.4
MIN	334	16	15	264	7	5.6	277	7	5.2

TOTAL FOR WATER YEAR 1997:

STREAMFLOW--169,550 ft³/s
SEDIMENT DISCHARGE--31,167.7 tons

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 1996 through September 1997

[Abbreviations: ft^3/s, cubic feet per second; e, estimated; mg/L, milligrams per liter; ton/d, tons per day. Symbol: ---, no data]

Day	Mean streamflow (ft^3/s)	Suspended sediment		Mean streamflow (ft^3/s)	Suspended sediment		Mean streamflow (ft^3/s)	Suspended sediment	
		Mean concentration (mg/L)	Discharge (ton/d)		Mean concentration (mg/L)	Discharge (ton/d)		Mean concentration (mg/L)	Discharge (ton/d)
					1996				
	October			**November**			**December**		
1	905	11	27	884	8	19	867	7	16
2	879	10	24	897	7	17	891	7	17
3	871	9	21	909	7	17	846	7	16
4	873	8	19	915	7	17	807	8	17
5	864	8	19	920	6	15	814	9	20
6	849	8	18	916	6	15	836	9	20
7	855	7	16	913	6	15	830	8	18
8	856	7	16	918	6	15	860	6	14
9	849	7	16	916	6	15	944	5	13
10	853	7	16	914	6	15	999	16	43
11	872	7	16	909	7	17	987	17	45
12	873	7	16	907	7	17	960	12	31
13	872	9	21	904	6	15	897	9	22
14	883	9	21	911	6	15	852	8	18
15	909	9	22	914	6	15	858	8	19
16	920	8	20	862	6	14	861	8	19
17	921	8	20	798	6	13	781	8	17
18	921	8	20	844	5	11	e650	8	14
19	940	7	18	929	6	15	e680	12	22
20	937	7	18	937	6	15	e720	11	21
21	925	7	17	985	7	19	e750	7	14
22	914	8	20	917	6	15	e660	4	7.1
23	932	9	23	937	14	35	e540	4	5.8
24	940	9	23	860	13	30	e580	4	6.3
25	933	10	25	900	14	34	e590	4	6.4
26	931	10	25	923	14	35	e450	4	4.9
27	924	10	25	888	10	24	e400	4	4.3
28	915	9	22	901	10	24	e640	4	6.9
29	930	9	23	926	12	30	e800	5	11
30	935	9	23	894	11	27	e1,000	34	92
31	913	8	20	---	---	---	e1,500	81	328
TOTAL	27,894	---	630	27,148	---	580	24,850	---	908.7
MEAN	900	8	20	905	8	19	802	11	29
MAX	940	11	27	985	14	35	1,500	81	328
MIN	849	7	16	798	5	11	400	4	4.3

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 1996 through September 1997 (Continued)

Day	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
					1997				
	January			February			March		
1	2,080	114	640	1,300	53	186	858	13	30
2	3,230	490	4,270	1,340	46	166	876	13	31
3	2,360	277	1,770	1,250	35	118	862	12	28
4	1,860	100	502	1,050	25	71	845	9	21
5	1,600	62	268	e850	24	55	840	9	20
6	1,330	52	187	e800	24	52	835	9	20
7	1,240	44	147	e750	23	47	846	9	21
8	1,260	39	133	e700	22	42	876	10	24
9	1,210	37	121	e750	22	45	878	11	26
10	1,210	36	118	e800	22	48	902	13	32
11	1,130	34	104	e850	22	50	972	20	52
12	e800	32	69	e900	22	53	1,020	28	77
13	e600	32	52	918	18	45	999	29	78
14	e520	34	48	910	12	29	913	18	44
15	e540	36	52	936	18	45	889	11	26
16	e580	37	58	985	28	74	952	16	41
17	e700	38	72	1,010	33	90	1,310	105	371
18	e800	39	84	1,030	37	103	1,590	169	726
19	e1,000	40	108	1,020	38	105	2,060	380	2,110
20	e1,050	41	116	998	38	102	2,740	468	3,460
21	e1,040	42	118	959	36	93	2,860	320	2,470
22	e1,040	40	112	951	32	82	2,720	107	786
23	e1,000	33	89	937	29	73	2,620	121	856
24	e950	22	56	918	28	69	2,470	80	534
25	e950	16	41	888	27	65	2,350	69	438
26	e850	17	39	909	25	61	2,510	86	583
27	e800	19	41	915	22	54	3,070	180	1,490
28	e800	21	45	885	18	43	2,790	80	603
29	e900	23	56	---	---	---	2,460	44	292
30	e1,000	25	68	---	---	---	2,280	41	252
31	e1,200	35	113	---	---	---	2,250	39	237
TOTAL	35,630	---	9,697	26,509	---	2,066	50,443	---	15,779
MEAN	1,149	62	313	947	28	74	1,627	81	509
MAX	3,230	490	4,270	1,340	53	186	3,070	468	3,460
MIN	520	16	39	700	12	29	835	9	20

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 1996 through September 1997 (Continued)

Day	Mean streamflow (ft^3/s)	Suspended sediment		Mean streamflow (ft^3/s)	Suspended sediment		Mean streamflow (ft^3/s)	Suspended sediment	
		Mean concentration (mg/L)	Discharge (ton/d)		Mean concentration (mg/L)	Discharge (ton/d)		Mean concentration (mg/L)	Discharge (ton/d)
	1997								
	April			May			June		
1	2,130	32	184	3,300	51	454	8,930	239	5,760
2	2,000	29	157	3,140	45	382	9,530	248	6,380
3	1,950	28	147	3,050	39	321	9,060	171	4,180
4	1,910	26	134	3,050	37	305	8,710	130	3,060
5	1,810	22	108	3,210	41	355	8,870	147	3,520
6	1,700	18	83	3,450	56	522	9,060	147	3,600
7	1,690	20	91	3,790	97	993	8,590	114	2,640
8	1,680	20	91	3,790	103	1,050	8,540	132	3,040
9	1,620	17	74	3,760	84	853	8,800	143	3,400
10	1,560	15	63	4,100	132	1,460	8,060	110	2,390
11	1,430	15	58	4,880	222	2,930	8,050	106	2,300
12	1,400	15	57	5,370	257	3,730	8,280	144	3,220
13	1,420	13	50	5,800	316	4,950	8,220	120	2,660
14	1,450	14	55	6,640	318	5,700	8,450	133	3,030
15	1,510	15	61	7,500	326	6,600	8,430	134	3,050
16	1,580	14	60	8,340	370	8,330	8,150	149	3,280
17	1,760	22	105	8,680	335	7,850	7,720	124	2,580
18	2,050	41	227	8,920	307	7,390	7,760	93	1,950
19	2,270	55	337	8,910	220	5,290	7,460	111	2,240
20	2,760	106	790	8,180	154	3,400	6,640	96	1,720
21	3,190	130	1,120	7,760	122	2,560	6,210	73	1,220
22	3,130	90	761	7,700	116	2,410	5,700	61	939
23	3,010	72	585	7,610	99	2,030	5,270	48	683
24	3,110	66	554	7,960	117	2,510	4,940	45	600
25	3,110	70	588	8,840	192	4,580	4,580	42	519
26	3,050	60	494	8,910	182	4,380	4,210	39	443
27	3,150	65	553	8,300	116	2,600	3,820	37	382
28	3,420	94	868	7,700	97	2,020	3,450	34	317
29	3,470	81	759	7,580	97	1,990	3,330	34	306
30	3,360	62	562	8,070	121	2,640	3,870	43	449
31	---	---	---	8,420	189	4,300	---	---	---
TOTAL	67,680	---	9,776	196,710	---	94,885	212,690	---	69,858
MEAN	2,256	44	326	6,345	160	3,060	7,090	108	2,330
MAX	3,470	130	1,120	8,920	370	8,330	9,530	248	6,380
MIN	1,400	13	50	3,050	37	305	3,330	34	306

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 1996 through September 1997 (Continued)

Day	Mean stream-flow (ft^3/s)	Suspended sediment		Mean stream-flow (ft^3/s)	Suspended sediment		Mean stream-flow (ft^3/s)	Suspended sediment	
		Mean concen-tration (mg/L)	Dis-charge (ton/d)		Mean concen-tration (mg/L)	Dis-charge (ton/d)		Mean concen-tration (mg/L)	Dis-charge (ton/d)
					1997				
	July			August			September		
1	4,050	43	470	1,390	12	45	946	7	18
2	4,470	66	797	1,400	11	42	939	8	20
3	4,080	40	441	1,400	11	42	955	7	18
4	3,670	32	317	1,340	10	36	988	7	19
5	3,250	34	298	1,270	10	34	988	7	19
6	3,010	27	219	1,290	10	35	984	7	19
7	2,870	25	194	1,320	9	32	965	6	16
8	2,660	21	151	1,360	9	33	950	6	15
9	2,500	20	135	1,270	8	27	943	6	15
10	2,480	20	134	1,190	8	26	938	6	15
11	2,430	18	118	1,160	8	25	e930	4	10
12	2,320	18	113	1,110	8	24	e970	6	16
13	2,180	15	88	1,070	8	23	1,010	7	19
14	2,080	14	79	1,050	7	20	1,030	8	22
15	1,970	13	69	1,050	6	17	1,060	10	29
16	1,870	10	50	1,030	3	8.3	1,110	11	33
17	1,790	10	48	1,130	4	12	1,120	12	36
18	1,870	17	86	1,150	6	19	1,120	11	33
19	2,010	24	130	1,140	4	12	1,100	10	30
20	2,290	53	328	1,140	3	9.2	1,090	9	26
21	2,400	59	382	1,110	3	9.0	1,090	8	24
22	2,160	32	187	1,110	3	9.0	1,090	8	24
23	1,990	20	107	1,070	3	8.7	1,090	8	24
24	1,860	17	85	1,070	4	12	1,090	8	24
25	1,780	15	72	1,060	4	11	1,090	8	24
26	1,680	15	68	1,050	4	11	1,070	8	23
27	1,620	14	61	1,020	4	11	1,110	8	24
28	1,570	14	59	1,020	4	11	1,130	8	24
29	1,530	13	54	1,020	4	11	1,120	7	21
30	1,500	13	53	989	6	16	1,110	7	21
31	1,430	12	46	962	7	18	---	---	---
TOTAL	73,370	---	5,439	35,741	---	649.2	31,126	---	661
MEAN	2,367	24	175	1,153	6	21	1,038	8	22
MAX	4,470	66	797	1,400	12	45	1,130	12	36
MIN	1,430	10	46	962	3	8.3	930	4	10

TOTAL FOR WATER YEAR 1997:

STREAMFLOW--809,791 ft^3/sec
SEDIMENT DISCHARGE--210,929 tons

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 1996 through September 1997

[Abbreviations: ft^3/s, cubic feet per second; e, estimated; mg/L, milligrams per liter; ton/d, tons per day. Symbol: ---, no data]

Day	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
				1996					
	October			**November**			**December**		
1	1,570	5	21	1,320	6	21	1,540	4	17
2	1,560	6	25	1,450	6	23	1,560	4	17
3	1,530	6	25	1,560	6	25	1,500	4	16
4	1,540	6	25	1,560	6	25	1,400	4	15
5	1,530	5	21	1,560	6	25	1,380	5	19
6	1,490	5	20	1,580	8	34	1,470	6	24
7	1,490	5	20	1,540	9	37	1,460	6	24
8	1,480	5	20	1,560	8	34	1,480	7	28
9	1,470	5	20	1,550	7	29	1,650	12	53
10	1,470	5	20	1,570	5	21	1,710	10	46
11	1,480	6	24	1,560	5	21	1,720	6	28
12	1,500	5	20	1,540	5	21	1,660	6	27
13	1,500	4	16	1,560	5	21	1,520	6	25
14	1,530	4	17	1,560	5	21	1,490	5	20
15	1,550	4	17	1,560	5	21	1,490	5	20
16	1,590	4	17	1,490	5	20	e1,450	5	20
17	1,570	4	17	1,370	5	18	e1,300	6	21
18	1,590	4	17	1,420	4	15	e1,100	9	27
19	1,630	4	18	1,290	3	10	e1,150	10	31
20	1,650	4	18	1,520	3	12	e1,400	10	38
21	1,660	5	22	1,500	3	12	e1,400	9	34
22	1,650	6	27	1,550	3	13	e1,200	8	26
23	1,710	6	28	1,570	4	17	e1,050	8	23
24	1,660	6	27	1,440	4	16	e1,150	8	25
25	1,680	7	32	1,520	4	16	e1,150	8	25
26	1,660	8	36	1,610	4	17	e900	8	19
27	1,660	8	36	1,550	4	17	e900	8	19
28	1,580	8	34	1,580	5	21	e1,200	8	26
29	1,660	8	36	1,620	5	22	e1,500	8	32
30	1,620	18	79	1,570	5	21	e1,900	8	41
31	1,440	10	39	---	---	---	2,470	18	120
TOTAL	48,700	---	794	45,630	---	626	44,250	---	906
MEAN	1,571	6	26	1,521	5	21	1,427	7	29
MAX	1,710	18	79	1,620	9	37	2,470	18	120
MIN	1,440	4	16	1,290	3	10	900	4	15

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 1996 through September 1997 (Continued)

Day	Mean stream-flow (ft^3/s)	Suspended sediment		Mean stream-flow (ft^3/s)	Suspended sediment		Mean stream-flow (ft^3/s)	Suspended sediment	
		Mean concen-tration (mg/L)	Dis-charge (ton/d)		Mean concen-tration (mg/L)	Dis-charge (ton/d)		Mean concen-tration (mg/L)	Dis-charge (ton/d)
				1997					
	January			February			March		
1	3,250	37	325	2,130	17	98	1,530	11	45
2	4,660	182	2,290	2,120	16	92	1,550	8	33
3	3,520	100	950	1,970	15	80	1,540	10	42
4	2,860	48	371	1,800	12	58	1,490	8	32
5	2,360	44	280	e1,600	10	43	1,470	8	32
6	2,210	36	215	e1,450	10	39	1,460	10	39
7	2,090	22	124	e1,300	9	32	1,470	12	48
8	2,110	14	80	e1,200	8	26	1,520	8	33
9	2,040	11	61	e1,300	8	28	1,540	9	37
10	2,070	10	56	e1,400	8	30	1,600	9	39
11	e1,800	9	44	1,530	8	33	1,730	12	56
12	e1,300	9	32	1,570	9	38	1,760	15	71
13	e1,000	10	27	1,630	9	40	1,840	17	84
14	e1,000	11	30	1,640	10	44	1,610	11	48
15	e1,150	14	43	1,610	10	43	1,500	7	28
16	e1,400	19	72	1,690	10	46	1,630	9	40
17	e1,800	26	126	1,750	10	47	1,990	13	70
18	2,190	22	130	1,800	10	49	2,290	33	204
19	2,050	16	89	1,860	14	70	2,790	56	422
20	2,050	12	66	1,750	26	123	3,950	127	1,350
21	2,100	9	51	1,690	27	123	4,310	84	978
22	2,050	8	44	1,670	26	117	4,310	61	710
23	1,970	7	37	1,670	22	99	4,380	50	591
24	e1,850	6	30	1,670	18	81	4,230	39	445
25	e1,700	6	28	1,590	15	64	4,190	41	464
26	e1,500	5	20	1,600	15	65	4,470	45	543
27	e1,300	6	21	1,600	15	65	5,680	60	920
28	e1,400	9	34	1,570	12	51	5,620	58	880
29	e1,600	14	60	---	---	---	4,910	38	504
30	1,760	16	76	---	---	---	4,580	28	346
31	1,990	17	91	---	---	---	4,470	26	314
TOTAL	62,130	---	5,903	46,160	---	1,724	87,410	---	9,448
MEAN	2,004	24	190	1,649	14	62	2,820	30	305
MAX	4,660	182	2,290	2,130	27	123	5,680	127	1,350
MIN	1,000	5	20	1,200	8	26	1,460	7	28

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 1996 through September 1997 (Continued)

Day	Mean streamflow (ft³/s)	Suspended sediment Mean concentration (mg/L)	Suspended sediment Discharge (ton/d)	Mean streamflow (ft³/s)	Suspended sediment Mean concentration (mg/L)	Suspended sediment Discharge (ton/d)	Mean streamflow (ft³/s)	Suspended sediment Mean concentration (mg/L)	Suspended sediment Discharge (ton/d)
				1997					
	April			May			June		
1	4,290	22	255	9,420	39	992	19,600	154	8,150
2	3,960	20	214	8,920	33	795	21,000	183	10,400
3	3,970	20	214	8,590	31	719	19,400	135	7,070
4	3,940	21	223	8,720	30	706	18,300	105	5,190
5	3,660	16	158	9,230	33	822	19,800	128	6,840
6	3,460	13	121	9,880	42	1,120	20,600	168	9,340
7	3,370	14	127	10,700	52	1,500	19,100	119	6,140
8	3,360	15	136	10,800	54	1,570	18,000	107	5,200
9	3,220	16	139	10,800	57	1,660	18,000	106	5,150
10	3,190	14	121	11,700	71	2,240	16,700	95	4,280
11	2,910	13	102	13,500	121	4,410	16,700	82	3,700
12	2,850	12	92	14,900	158	6,360	17,500	95	4,490
13	2,890	12	94	16,300	184	8,100	17,100	85	3,920
14	3,080	12	100	18,400	316	15,700	16,600	75	3,360
15	3,240	14	122	20,900	431	24,300	16,300	76	3,340
16	3,490	17	160	23,000	510	31,700	15,700	68	2,880
17	4,070	22	242	25,200	557	37,900	14,800	62	2,480
18	5,120	36	498	26,400	592	42,200	14,300	56	2,160
19	5,610	35	530	24,100	399	26,000	13,800	53	1,970
20	6,840	52	960	21,000	254	14,400	12,600	48	1,630
21	8,190	73	1,610	18,800	180	9,140	11,300	41	1,250
22	8,450	57	1,300	17,800	145	6,970	10,300	38	1,060
23	8,430	43	979	17,400	125	5,870	9,590	33	854
24	8,400	81	1,840	18,200	133	6,540	9,080	29	711
25	8,060	79	1,720	20,200	177	9,650	8680	27	633
26	8,180	42	928	19,800	172	9,200	8,110	25	547
27	8,740	40	944	18,000	118	5,730	7,630	23	474
28	9,550	48	1,240	16,800	101	4,580	7,320	20	395
29	9,800	49	1,300	16,300	83	3,650	7,160	18	348
30	9,590	44	1,140	16,700	81	3,650	7,750	24	502
31	---	---	---	17,700	100	4,780	---	---	---
TOTAL	163,910	---	17,609	500,160	---	292,954	432,820	---	104,464
MEAN	5,464	32	587	16,130	174	9,450	14,430	76	3,480
MAX	9,800	81	1,840	26,400	592	42,200	21,000	183	10,400
MIN	2,850	12	92	8,590	30	706	7,160	18	348

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 1996 through September 1997 (Continued)

Day	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
	1997								
	July			August			September		
1	7,840	23	487	2,940	5	40	1,920	4	21
2	8,190	32	708	2,920	5	39	1,900	5	26
3	7,740	27	564	2,880	5	39	1,930	5	26
4	7,250	22	431	2,870	5	39	1,940	5	26
5	6,730	21	382	2,660	5	36	1,950	5	26
6	6,410	19	329	2,650	5	36	1,950	5	26
7	6,150	18	299	2,690	5	36	1,920	6	31
8	5,840	19	300	2,690	6	44	1,860	6	30
9	5,510	23	342	2,620	6	42	1,830	6	30
10	5,430	25	367	2,520	5	34	1,830	5	25
11	5,300	29	415	2,460	4	27	1,820	5	25
12	5,050	34	464	2,400	5	32	1,830	5	25
13	4,800	47	609	2,470	7	47	1,870	8	40
14	4,580	50	618	2,290	7	43	1,900	8	41
15	4,370	42	496	2,230	7	42	1,950	9	47
16	4,140	37	414	2,250	7	43	2,060	9	50
17	3,800	30	308	2,370	6	38	2,090	7	40
18	3,770	12	122	2,,390	5	32	2,080	7	39
19	4,170	14	158	2,370	5	32	1,990	6	32
20	4,670	13	164	2,310	5	31	1,950	6	32
21	5,090	15	206	2,240	5	30	1,940	6	31
22	e4,500	14	170	2,230	5	30	1,920	5	26
23	e4,200	7	79	2,170	5	29	1,900	5	26
24	e3,900	6	63	2,150	5	29	1,890	5	26
25	e3,700	6	60	2,180	5	29	1,870	5	25
26	e3,500	6	57	2,140	5	29	1,880	5	25
27	e3,300	6	53	2,090	5	28	1,920	5	26
28	e3,200	6	52	2,060	5	28	1,900	5	26
29	3,170	6	51	2,030	5	27	1,900	4	21
30	3160	6	51	1,990	4	21	1,900	4	21
31	3,040	6	49	1,950	4	21	---	---	---
TOTAL	152,500	---	8,868	74,210	---	1,053	57,590	---	891
MEAN	4,919	20	286	2394	5	34	1,920	6	30
MAX	8,190	50	708	2,940	7	47	2,090	9	50
MIN	3,040	6	49	1,950	4	21	1,820	4	21

TOTAL FOR WATER YEAR 1997:

STREAMFLOW--1,715,470 ft³/sec
SEDIMENT DISCHARGE--445,240 tons

Table 8. Chemical and suspended-sediment analyses of field replicates for water samples, upper Clark Fork basin, Montana

[Abbreviations: µg/L, micrograms per liter; mg/L, milligrams per liter; mm, millimeter. Symbols: <, less than minimum reporting level; --, no data]

Station number	Station name	Date	Time	Hardness total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (µg/L)
12324200	Clark Fork at Deer Lodge	03-04-97	1345	230	67	15	12
		03-04-97	1350	230	67	15	11
		08-09-97	0640	180	53	11	27
		08-09-97	0645	180	53	11	27
12324590	Little Blackfoot River near Garrison	06-23-97	1640	100	29	6.9	7
		06-23-97	1645	100	30	7.0	6
12324680	Clark Fork at Goldcreek	04-23-97	1015	150	44	9.8	17
		04-23-97	1020	150	44	9.6	17
12334550	Clark Fork at Turah Bridge, near Bonner	05-07-97	1100	92	26	6.7	12
		05-07-97	1105	92	26	6.7	13
		05-19-97	1320	58	17	3.9	20
		05-19-97	1325	58	17	4.0	19
12340500	Clark Fork above Missoula	06-02-97	1345	70	19	5.3	11
		06-02-97	1350	170	19	5.3	11

Station number	Date	Arsenic, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Copper, total recoverable (µg/L)	Copper, dissolved (µg/L)	Iron, total recoverable (µg/L)	Iron, dissolved (µg/L)	Lead, total recoverable (µg/L)
12324200	03-04-97	8	<1	<0.1	23	5.0	360	<3	3
	03-04-97	9	<1	<.1	22	5.0	350	<3	3
	08-09-97	24	<1	<.1	47	10	470	11	5
	08-09-97	24	<1	<.1	47	9.8	470	12	5
12324590	06-23-97	5	<1	<.1	2	<1	180	26	<1
	06-23-97	6	<1	<.1	2	<1	180	27	<1
12324680	04-23-97	11	<1	<.1	44	7.2	1,000	28	6
	04-23-97	10	<1	<.1	49	7.3	1,000	28	9
12334550	05-07-97	6	<1	<.1	37	5.3	1,400	74	7
	05-07-97	5	<1	<.1	40	5.3	1,400	83	8
	05-19-97	8	<1	<.1	85	12	3,000	76	14
	05-19-97	7	<1	<.1	86	12	2,900	77	14
12340500	06-02-97	4	<1	<.1	49	6.5	2,200	44	9
	06-02-97	4	<1	<.1	49	9.7	2,100	47	8

Station number	Date	Lead, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Sediment, suspended (mg/L)	Sediment, suspended, diameter, percent finer than 0.062 mm
12324200	03-04-97	<0.5	100	63	40	19	16	71
	03-04-97	<.5	100	62	40	20	15	77
	08-09-97	<.5	93	30	40	9.9	20	77
	08-09-97	<.5	91	29	40	9.0	20	79
12324590	06-23-97	<.5	29	15	<10	<3	7	76
	06-23-97	<.5	23	16	<10	<3	7	71
12324680	04-23-97	<.5	120	11	50	<3	57	66
	04-23-97	<.5	120	11	50	3.0	59	65
12334550	05-07-97	<.5	130	11	60	4.6	99	52
	05-07-97	<.5	130	11	60	3.0	96	54
	05-19-97	<.5	260	16	150	9.3	207	66
	05-19-97	<.5	270	17	160	10	213	65
12340500	06-02-97	<.5	190	17	80	4.7	187	66
	06-02-97	<.5	180	17	90	3.2	188	65

Table 9. Precision of chemical and suspended-sediment analyses of field replicates for water samples, upper Clark Fork basin, Montana

[Abbreviations: µg/L, micrograms per liter; mg/L, milligrams per liter; mm, millimeter]

Constituent and reporting unit	Number of replicate pairs	Standard deviation, in units (+/-)	Relative standard deviation, in percent (+/-)
Calcium, dissolved, mg/L	7	0.27	0.74
Magnesium, dissolved, mg/L	7	.07	.84
Arsenic, total recoverable, µg/L	7	.53	3.5
Arsenic, dissolved, µg/L	7	.60	6.4
Cadmium, total recoverable, µg/L	7	.0	.0
Cadmium, dissolved, µg/L	7	.0	.0
Copper, total recoverable, µg/L	7	1.6	3.8
Copper, dissolved, µg/L	7	.86	12
Iron, total recoverable, µg/L	7	38	3.1
Iron, dissolved, µg/L	7	2.6	6.8
Lead, total recoverable, µg/L	7	.89	14
Lead, dissolved, µg/L	7	.0	.0
Manganese, total recoverable, µg/L	7	4.1	3.1
Manganese, dissolved, µg/L	7	.53	2.3
Zinc, total recoverable, µg/L	7	3.8	6.1
Zinc, dissolved, µg/L	7	.71	9.8
Sediment, suspended, mg/L	7	1.9	2.2
Sediment, suspended, percent finer than 0.062 mm	7	2.3	3.4

Table 10. Precision of chemical analyses of laboratory replicates for water samples, upper Clark Fork basin, Montana

[Abbreviations: µg/L, micrograms per liter; mg/L, milligrams per liter]

Constituent and reporting unit	Number of replicate pairs	Standard deviation, in units (+/-)	Relative standard deviation, in percent (+/-)	Within limits of data-quality objective
Calcium, dissolved, mg/L	11	0.33	1.0	Yes
Magnesium, dissolved, mg/L	11	.08	1.1	Yes
Arsenic, total recoverable, µg/L	11	.16	1.1	Yes
Arsenic, dissolved, µg/L	11	.51	4.9	Yes
Cadmium, total recoverable, µg/L	11	.01	1.8	Yes
Cadmium, dissolved, µg/L	11	.02	6.0	Yes
Copper, total recoverable, µg/L	11	.94	1.9	Yes
Copper, dissolved, µg/L	11	.33	1.9	Yes
Iron, total recoverable, µg/L	11	20	1.8	Yes
Iron, dissolved, µg/L	11	1.7	1.4	Yes
Lead, total recoverable, µg/L	11	.26	5.2	Yes
Lead, dissolved, µg/L	11	.0	.0	Yes
Manganese, total recoverable, µg/L	11	1.8	1.0	Yes
Manganese, dissolved, µg/L	11	2.5	2.8	Yes
Zinc, total recoverable, µg/L	11	1.3	.8	Yes
Zinc, dissolved, µg/L	11	6.1	5.6	Yes

Table 11. Recovery efficiency for trace-element analyses of laboratory-spiked deionized-water blanks

[Abbreviation: μg/L, micrograms per liter]

Constituent and reporting unit	Number of samples	95-percent confidence interval for spike recovery, in percent	Mean spike recovery, in percent	Within limits of data-quality objective
Arsenic, total recoverable, μg/L	3	104-108	106.1	Yes
Arsenic, dissolved, μg/L	3	87.8-100	93.9	Yes
Cadmium, total recoverable, μg/L	3	77.7-93.7	85.7	Yes
Cadmium, dissolved, μg/L	3	92.1-105	98.5	Yes
Copper, total recoverable, μg/L	3	82.0-131	106.4	Yes
Copper, dissolved, μg/L	3	86.2-116	101.1	Yes
Iron, total recoverable, μg/L	3	78.5-111	94.7	Yes
Iron, dissolved, μg/L	3	80.2-112	96.1	Yes
Lead, total recoverable, μg/L	3	88.9-113	101.1	Yes
Lead, dissolved, μg/L	3	93.4-109	101.0	Yes
Manganese, total recoverable, μg/L	3	82.7-97.9	90.3	Yes
Manganese, dissolved, μg/L	3	95.8-103	99.3	Yes
Zinc, total recoverable, μg/L	3	86.4-99.0	92.7	Yes
Zinc, dissolved, μg/L	3	78.1-118	97.9	Yes

Table 12. Recovery efficiency for trace-element analyses of laboratory-spiked stream samples, upper Clark Fork basin, Montana

[Abbreviation: µg/L, micrograms per liter]

Constituent and reporting unit	Number of samples	95-percent confidence interval for spike recovery, in percent	Mean spike recovery, in percent	Within limits of data-quality objective
Arsenic, total recoverable, µg/L	3	99.9-114	107.1	Yes
Arsenic, dissolved, µg/L	3	73.5-113	93.3	Yes
Cadmium, total recoverable, µg/L	3	75.0-93.6	84.3	Yes
Cadmium, dissolved, µg/L	3	83.5-113	98.1	Yes
Copper, total recoverable, µg/L	3	71.9-129	100.5	Yes
Copper, dissolved, µg/L	3	88.3-106	97.3	Yes
Iron, total recoverable, µg/L	3	81.0-118	99.3	Yes
Iron, dissolved, µg/L	3	78.2-117	97.5	Yes
Lead, total recoverable, µg/L	3	99.1-105	102.1	Yes
Lead, dissolved, µg/L	3	91.6-110	100.8	Yes
Manganese, total recoverable, µg/L	3	84.0-102	93.0	Yes
Manganese, dissolved, µg/L	3	94.5-105	99.8	Yes
Zinc, total recoverable, µg/L	3	74.4-111	92.7	Yes
Zinc, dissolved, µg/L	3	89.9-104	97.0	Yes

Table 13. Chemical analyses of field blanks for water samples

[Abbreviations: °C, degrees Celsius; µg/L, micrograms per liter; µS/cm, microsiemens per centimeter at 25 °C; mg/L, milligrams per liter. Symbol: <, less than minimum reporting level]

Date	Time	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, total recoverable (µg/L)	Arsenic, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Copper, total recoverable (µg/L)
Dec 1996										
11..	0830	3	5.7	<0.02	<0.01	<1	<1	<1	<0.1	<1
Mar 1997										
04...	1800	3	5.5	<.02	<.01	<1	<1	<1	<.1	<1
Apr										
22...	1330	3	5.4	<.02	<.01	<1	<1	<1	<.1	<1
May										
18...	0600	3	5.6	.04	.01	<1	<1	<1	<.1	<1
Jun										
01...	1900	2	5.7	<.02	<.01	<1	<1	<1	<.1	<1
23...	1600	3	5.6	<.02	<.01	<1	<1	<1	<.1	<1
Aug										
10...	1700	2	5.6	<.02	<.01	<1	<1	<1	<.1	<1

Date	Copper, dissolved (µg/L)	Iron, total recoverable (µg/L)	Iron, dissolved (µg/L)	Lead, total recoverable (µg/L)	Lead, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Zinc, dissolved (µg/L)
Dec 1996									
11..	<1	<10	<3	<1	<0.5	<10	<1	<10	<3
Mar 1997									
04...	<1	<10	<3	<1	<.5	<10	<1	<10	4
Apr									
22...	<1	<10	<3	<1	<.5	<10	<1	<10	<3
May									
18...	<1	<10	<3	<1	<.5	<10	<1	<10	<3
Jun									
01...	<1	<10	<3	<1	<.5	<10	<1	<10	<3
23...	<1	<10	<3	<1	<.5	<10	<1	<10	3
Aug									
10...	<1	<10	<3	<1	<.5	<10	<1	<10	<3

Table 14. Trace-element analyses of fine-grained bed sediment, upper Clark Fork basin, Montana, August 1997

[Fine-grained sediment is material less than 0.064 millimeter in diameter. Concentrations are the mean of all analyses for replicate aliquots from each composite sample. Abbreviation: μg/g, micrograms per gram of dry sample weight. Symbol: <, less than]

Station number (fig. 1)	Station name	Number of composite samples	Concentration, in μg/g								
			Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Silver	Zinc
12323600	Silver Bow Creek at Opportunity	3	25.5	31.0	4,810	40,600	788	1,840	16.2	16.4	7,130
12323750	Silver Bow Creek at Warm Springs	3	5.3	24.3	268	21,700	61	1,670	12.5	2.1	639
12323770	Warm Springs Creek at Warm Springs	3	2.6	30.8	848	22,400	86	2,020	17.6	3.7	372
12323800	Clark Fork near Galen	3	7.6	33.9	1,540	30,900	152	2,780	18.2	5.3	1,160
461415112450801	Clark Fork below Lost Creek, near Galen	3	8.4	34.5	2,050	31,400	190	3,540	18.7	7.0	1,460
461559112443301	Clark Fork near Racetrack	3	7.5	33.3	1,610	29,800	153	2,680	16.5	6.0	1,190
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	3	6.9	31.1	1,550	30,200	152	2,630	15.8	6.2	1,260
12324200	Clark Fork at Deer Lodge	3	6.0	35.7	1,500	31,000	159	1,630	17.6	5.9	1,140
12324680	Clark Fork at Goldcreek	3	5.5	36.8	1,080	28,600	118	1,840	17.8	4.8	1,070
12331500	Flint Creek near Drummond	3	2.4	23.9	70	23,400	178	2,360	11.7	7.5	648
12331800	Clark Fork near Drummond	3	4.3	32.6	747	24,500	105	1,560	15.7	4.7	1,000
12334510	Rock Creek near Clinton	3	<.8	21.4	14	17,200	<10	618	11.6	.4	45
12334550	Clark Fork at Turah Bridge, near Bonner	3	4.4	30.3	635	23,000	85	1,700	16.2	3.9	1,050
12340050	Clark Fork above Missoula	3	3.7	28.5	516	21,800	63	1,160	14.5	2.9	924
12353000	Clark Fork below Missoula[1]	3	1.8	20.9	192	17,500	27	1,270	11.8	1.7	437

[1]Samples collected about 30 miles downstream from water-quality station to conform to previous sampling location.

Table 15. Trace-element analyses of bulk bed sediment, upper Clark Fork basin, Montana, August 1997

[Bulk bed sediment collected in this study generally is material smaller than about 10 millimeters in diameter. Concentrations are the mean of all analyses for replicate aliquots for each composite sample. Abbreviation: µg/g, micrograms per gram of dry sample weight. Symbol: <, less than]

Station number (fig. 1)	Station name	Number of composite samples	Concentration, in µg/g								
			Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Silver	Zinc
12323600	Silver Bow Creek at Opportunity	1	5.4	16.2	775	29,300	263	504	6.0	4.1	1,720
12323750	Silver Bow Creek at Warm Springs	1	1.3	11.6	66	11,000	<10	209	5.3	1.3	157
12323770	Warm Springs Creek at Warm Springs	1	<.8	11.8	203	10,900	18	1,220	5.7	1.1	146
12323800	Clark Fork near Galen	1	1.9	8.7	315	13,200	52	899	5.4	1.1	417
461415112450801	Clark Fork below Lost Creek, near Galen	1	3.1	17.5	763	21,000	104	1,260	8.2	2.8	787
461559112443301	Clark Fork near Racetrack	1	1.9	12.4	361	16,200	66	759	5.5	1.9	472
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	1	1.8	16.3	424	20,900	58	825	5.5	2.0	448
12324200	Clark Fork at Deer Lodge	1	2.9	24.5	691	25,000	84	1,020	10.4	2.8	777
12324680	Clark Fork at Goldcreek	1	4.4	33.2	858	24,900	86	1,570	15.2	3.7	927
12331500	Flint Creek near Drummond	1	.9	10.7	34	13,400	80	2,240	5.3	5.8	332
12331800	Clark Fork near Drummond	1	3.4	29.5	605	21,800	78	1,510	14.2	3.5	911
12334510	Rock Creek near Clinton	1	<.8	8.1	6	7,400	<10	186	5.1	.3	16
12334550	Clark Fork at Turah Bridge, near Bonner	1	1.6	16.6	247	14,100	35	347	10.7	1.5	508
12340500	Clark Fork above Missoula	1	<.8	9.7	43	11,500	7	228	8.2	.6	145
12353000	Clark Fork below Missoula[1]	1	<.8	7.8	49	8,830	<10	403	6.0	.4	121

[1]Samples collected about 30 miles downstream from water-quality station to conform to previous sampling location.

Table 16. Recovery efficiency for trace-element analyses of standard reference materials for bed sediment

[Abbreviations: µg/g, micrograms per gram of dry sample weight; SRM, standard reference material. Symbol: --, recovery could not be determined because all analyses were less than the analytical detection limit of 10.0 µg/g for lead]

Constituent	Number of measurements	Dilution ratio	Certified concentration (µg/g)	Mean SRM recovery (percent)	95-percent confidence interval for SRM recovery (percent)
			SRM sample 2709		
Cadmium	10	1:5	0.4	296	287-306
Chromium	10	1:5	130	64.0	60.7-67.3
Copper	10	1:5	35	98.5	92.6-104
Iron	10	1:5	35,000	82.7	81.2-84.2
Lead	10	1:5	19	--	--
Manganese	10	1:5	538	82.7	81.5-83.9
Nickel	10	1:5	88	81.6	80.5-82.7
Silver	10	1:1	.4	301	287-315
Zinc	10	1:5	106	88.8	86.2-91.4
			SRM sample 2711		
Cadmium	14	1:10	41.7	101	98.1-103
Chromium	14	1:10	47.0	60.6	55.8-65.4
Copper	14	1:10	114	103	95.9-110
Iron	14	1:10	28,900	83.1	78.8-87.4
Lead	14	1:10	1,160	101	98.6-104
Manganese	14	1:10	638	81.4	79.3-83.5
Nickel	14	1:10	20.6	80.7	77.7-83.7
Silver	14	1:1	4.6	106	99.0-114
Zinc	14	1:10	350	93.5	90.9-96.1

Table 17. Trace-element analyses of procedural blanks for bed sediment

[Abbreviation: µg/mL, micrograms per milliliter. Dilution ratio is the proportion of initial volume of concentrated nitric acid used as a digesting reagent to final volume of solution after addition of 0.6 N hydrochloric acid used for reconstituting dried residue. Symbols: <, less than; --, no data]

Sample identification	Dilution ratio	Trace-element concentration, in µg/mL								
		Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Silver	Zinc
A	1:1	--	--	--	--	--	--	--	<0.011	--
A	1:5	<0.005	<0.005	<0.011	0.057	<0.06	<0.005	<0.015	--	0.005
A	1:10	<.005	<.005	<.011	.031	<.06	<.005	<.015	--	<.005
B	1:1	--	--	--	--	--	--	--	<.011	--
B	1:5	<.005	<.005	<.011	<.015	<.06	<.005	<.015	--	<.005
B	1:10	<.005	<.005	<.011	.016	<.06	<.005	<.015	--	<.005
C	1:1	--	--	--	--	--	--	--	<.011	--
C	1:5	<.005	<.005	<.011	.022	<.06	<.005	<.015	--	<.005
C	1:10	<.005	<.005	<.011	.036	<.06	<.005	<.015	--	.005
D	1:1	--	--	--	--	--	--	--	<.011	--
D	1:5	<.005	<.005	<.011	.023	<.06	<.005	<.015	--	<.005
D	1:10	<.005	<.005	<.011	.022	<.06	<.005	<.015	--	.007
E	1:1	--	--	--	--	--	--	--	<.011	--
E	1:5	<.005	<.005	<.011	<.015	<.06	<.005	<.015	--	.006
E	1:10	<.005	<.005	<.011	<.015	<.06	<.005	<.015	--	<.005
F	1:1	--	--	--	--	--	--	--	<.011	--
F	1:5	<.005	<.005	<.011	<.015	<.06	<.005	<.015	--	<.005
F	1:10	<.005	<.005	<.011	<.015	<.06	<.005	<.015	--	<.005
G	1:1	--	--	--	--	--	--	--	<.011	--
G	1:5	<.005	<.005	<.011	.022	<.06	<.005	<.015	--	<.005
G	1:10	<.005	<.005	<.011	.308	1.11	.062	<.015	--	2.05
H	1:1	--	--	--	--	--	--	--	<.011	--
H	1:5	<.005	<.005	<.011	.017	<.06	<.005	<.015	--	.010
H	1:10	<.005	<.005	.014	<.015	<.06	<.005	<.015	--	<.005
I	1:1	--	--	--	--	--	--	--	<.011	--
I	1:5	<.005	<.005	<.011	.022	<.06	<.005	<.015	--	.006
I	1:10	<.005	<.005	<.011	<.015	<.06	<.005	<.015	--	<.005
J	1:1	--	--	--	--	--	--	--	<.011	--
J	1:5	<.005	<.005	<.011	.021	<.06	<.005	<.015	--	.005
J	1:10	<.005	<.005	<.011	<.015	<.06	<.005	<.015	--	<.005

Table 18. Trace-element analyses of biota, upper Clark Fork basin, Montana, August 1997

[Analyses are of whole-body tissue of aquatic insects. Composite samples made by combining similar-sized insects of the same species into a sample of sufficient mass for analysis. Concentrations for biota samples composed of two or more composite samples are the means of all analyses. Abbreviations: µg/g, micrograms per gram of dry sample weight. Symbol: <, less than minimum reporting level]

Taxon	Number of composite samples	Concentration, in µg/g							
		Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Zinc
12323600 Silver Bow Creek at Opportunity									
Brachycentrus spp.	1	11.6	0.7	587	335	7.4	231	1.0	888
12323750 Silver Bow Creek at Warm Springs									
Hydropsyche cockerelli	2	.6	.7	42.7	675	3.6	506	.4	214
Hydropsyche spp.	2	.5	.8	37.6	667	3.3	498	.5	167
12323770 Warm Springs Creek at Warm Springs									
Hydropsyche spp.	1	<9.3	1.6	94.8	1,150	<16.7	956	2.0	129
Arctopsyche grandis	1	2.1	1.4	95.6	1,040	<6.3	1,340	1.8	197
12323800 Clark Fork near Galen									
Hydropsyche cockerelli	1	2.1	2.6	72.8	1,510	11.0	1,070	1.9	182
Hydropsyche occidentalis	4	1.0	2.2	101	1,700	10.2	1,280	1.5	203
461415112450801 Clark Fork below Lost Creek, near Galen									
Hydropsyche cockerelli	1	2.5	2.5	141	1,840	12.1	1,250	1.2	250
Hydropsyche occidentalis	3	1.7	2.3	148	1,740	10.9	1,320	1.6	246
Hydropsyche spp.	1	1.2	1.5	122	1,410	7.2	799	1.4	179
461559112443301 Clark Fork near Racetrack									
Hydropsyche cockerelli	2	1.7	1.9	100	1,220	7.7	699	1.3	186
Hydropsyche occidentalis	4	2.0	2.4	151	1,720	10.8	1,100	1.5	250
461903112440701 Clark Fork at Dempsey Creek diversion, near Racetrack									
Hydropsyche cockerelli	1	1.6	1.3	143	1,290	8.4	487	1.6	180
Hydropsyche occidentalis	1	1.7	1.9	163	1,590	10.3	826	1.4	224
Hydropsyche spp.	1	1.7	2.1	140	1,610	13.2	638	1.6	212
12324200 Clark Fork at Deer Lodge									
Arctopsyche grandis	1	<4.2	1.0	34.9	537	3.8	379	<1.7	140
Hydropsyche cockerelli	1	<4.9	2.1	102	1,340	<8.9	396	.9	147
Hydropsyche occidentalis	3	1.0	2.3	152	1,750	11.8	667	1.2	210
12324680 Clark Fork at Goldcreek									
Arctopsyche grandis	4	1.7	2.9	108	1,980	8.9	679	1.6	207
Claassenia sabulosa	2	3.2	.6	67.0	286	1.4	85.9	.3	266
Hydropsyche cockerelli	3	1.3	4.3	170	2,980	14.7	662	2.1	229
Hydropsyche occidentalis	2	1.0	3.2	140	2,360	13.8	771	1.7	223
12331500 Flint Creek near Drummond									
Arctopsyche grandis	3	.3	1.2	10.7	798	5.6	831	.7	185
Hydropsyche cockerelli	1	<1.0	2.1	15.8	1,870	16.2	725	2.3	183
Hydropsyche occidentalis	1	.6	2.1	18.0	1,370	14.6	1,780	1.8	183
12331800 Clark Fork near Drummond									
Arctopsyche grandis	4	3.1	1.7	63.6	1,140	6.8	742	1.1	206
Claassenia sabulosa	3	2.2	.5	65.6	148	.8	92.6	.2	237
Hydropsyche cockerelli	4	2.2	3.4	134	2,440	14.4	704	1.9	235
Hydropsyche occidentalis	1	2.0	2.8	118	2,060	13.5	861	1.8	226

Table 18. Trace-element analyses of biota, upper Clark Fork basin, Montana, August 1997 (Continued)

Taxon	Number of composite samples	Concentration, in µg/g							
		Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Zinc
		12334510 Rock Creek near Clinton							
Arctopsyche grandis	3	.4	1.5	9.3	896	<2.3	402	1.0	131
Claassenia sabulosa	2	.2	.5	31.8	116	<.9	55.7	.4	228
Hydropsyche spp.	1	.3	1.7	16.2	1,030	<1.8	436	1.3	117
		12334550 Clark Fork at Turah Bridge, near Bonner							
Arctopsyche grandis	5	2.5	3.1	92.9	2,160	9.5	768	2.0	243
Claassenia sabulosa	3	1.8	.5	64.2	125	<1.1	93.4	.2	241
Hydropsyche cockerelli	3	1.7	3.2	109	2,350	11.3	706	1.7	218
Hydropsyche occidentalis	2	1.8	3.0	101	2,240	11.7	769	1.7	230
Hydropsyche spp.	1	1.3	2.4	84.1	1,800	<7.8	537	1.3	171
		12340500 Clark Fork above Missoula							
Arctopsyche grandis	3	1.4	2.2	54.6	1,690	5.7	724	1.5	188
Claassenia sabulosa	2	1.8	.8	44.4	116	<2.6	92.9	<.6	250
Hydropsyche cockerelli	3	1.2	3.5	89.2	2,890	6.0	823	2.2	218
Hydropsyche occidentalis	1	1.0	2.9	76.5	2,240	7.7	939	1.9	210
		12353000 Clark Fork below Missoula[1]							
Arctopsyche grandis	4	.8	1.6	28.6	1,170	2.3	607	1.3	145
Claassenia sabulosa	2	1.1	.5	49.7	219	.4	97	.2	205
Hydropsyche cockerelli	3	.7	2.3	42.1	1,800	2.9	649	1.4	146
Hydropsyche occidentalis	1	.7	1.7	38.2	1,380	2.0	637	1.2	144

[1]Samples collected about 30 miles downstream from water-quality station to conform to previous sampling location.

Table 19. Recovery efficiency for trace-element analyses of standard reference material for biota

[Abbreviations: µg/g, micrograms per gram of dry sample weight; SRM, standard reference material]

Constituent	Number of measurements	Certified concentration (µg/g)	Mean SRM recovery (percent)	95-percent confidence interval for SRM recovery (percent)
		SRM sample TORT-2		
Cadmium	9	26.7	92.0	86.4-97.6
Chromium	9	.77	110	100-121
Copper	9	106	93.3	89.0-97.7
Iron	9	105	86.2	80.9-91.6
Lead	9	.35	88.4	84.7-92.0
Manganese	9	13.6	88.2	82.9-93.6
Nickel	9	2.5	76.1	71.6-80.7
Zinc	9	180	91.4	85.9-96.9

Table 20. Trace-element analyses of procedural blanks for biota

[Procedural blanks were not diluted prior to analysis. Abbreviation: μg/mL, micrograms per milliliter. Symbol: <, less than]

Station number	Station name	Dilution ratio	Trace-element concentration, in μg/mL							
			Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Zinc
12323600	Silver Bow Creek at Opportunity	1:1	<0.004	0.02	<0.01	<0.10	<0.02	0.01	<0.01	0.01
12323750	Silver Bow Creek at Warm Springs	1:1	<.004	<.01	<.01	<.10	<.02	<.01	<.01	.02
12323770	Warm Springs Creek at Warm Springs	1:1	<.004	<.01	.05	<.10	<.02	.01	<.01	.03
12323800	Clark Fork near Galen	1:1	<.004	.04	<.01	<.10	<.02	.01	<.01	.01
461415112450801	Clark Fork below Lost Creek, near Galen	1:1	<.004	<.01	.03	.25	<.02	.02	<.01	.02
461559112443301	Clark Fork near Racetrack	1:1	<.004	.02	<.01	<.10	<.02	<.01	<.01	<.01
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	1:1	<.004	<.01	<.01	<.10	<.02	.02	<.01	<.01
12324200	Clark Fork at Deer Lodge	1:1	<.004	.02	<.01	.36	<.02	.02	<.01	.03
12324680	Clark Fork at Goldcreek	1:1	<.004	<.01	.04	.17	<.02	<.01	<.01	.02
12331500	Flint Creek near Drummond	1:1	<.004	<.01	<.01	.21	<.02	<.01	<.01	.04
12331800	Clark Fork near Drummond	1:1	<.004	<.01	<.01	.29	<.02	<.01	<.01	.19
12334510	Rock Creek near Clinton	1:1	<.004	<.01	<.01	<.10	<.02	<.01	<.01	<.01
12334550	Clark Fork at Turah Bridge, near Bonner	1:1	<.004	<.01	<.01	.17	<.02	<.01	<.01	<.01
12340500	Clark Fork above Missoula	1:1	<.004	<.01	<.01	<.10	<.02	.01	<.01	.03
12353000	Clark Fork below Missoula	1:1	<.004	<.01	<.01	<.10	<.02	<.01	<.01	.02

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1997

[Abbreviations: ft^3/s, cubic feet per second; °C, degrees Celsius; µg/L, micrograms per liter; µS/cm, microsiemens per centimeter at 25 °C; mg/L, milligrams per liter; mm, millimeter; ton/d, tons per day. Symbols: <, less than minimum reporting level[1]; --, indicates insufficient data greater than minimum reporting level to compute statistic]

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12323230--BLACKTAIL CREEK AT HARRISON AVENUE, AT BUTTE, MONT.					
Period of record for water-quality data: March 1993-August 1995, December 1996-September 1997					
Streamflow, instantaneous (ft^3/s)	36	156	3.1	19	9.2
Specific conductance, onsite (µS/cm)	36	412	116	253	248
Temperature, water (°C)	36	17.0	2.0	8.1	7.0
pH, onsite (standard units)	36	8.2	7.3	7.8	7.8
Hardness, total (mg/L as $CaCO_3$)	36	140	38	100	100
Calcium, dissolved (mg/L)	36	39	11	29	30
Magnesium, dissolved (mg/L)	36	11	2.7	6.9	6.8
Arsenic, total recoverable (µg/L)	36	18	2	7	7
Arsenic, dissolved (µg/L)	36	13	1	5	4
Cadmium, total recoverable (µg/L)	36	<1	<1	--	<1
Cadmium, dissolved (µg/L)	36	.1	<.1	--	<.1
Copper, total recoverable (µg/L)	36	52	2	10	7
Copper, dissolved (µg/L)	36	10	<1	[2]4	4
Iron, total recoverable (µg/L)	36	4,200	260	929	610
Iron, dissolved (µg/L)	36	440	24	190	180
Lead, total recoverable (µg/L)	36	47	<1	[2]4	1
Lead, dissolved (µg/L)	36	1	<.5	[2].2	<.5
Manganese, total recoverable (µg/L)	36	240	30	68	60
Manganese, dissolved (µg/L)	36	100	17	42	40
Zinc, total recoverable (µg/L)	36	130	<10	[2]15	<10
Zinc, dissolved (µg/L)	36	11	<3	[2]5	4
Sediment, suspended concentration (mg/L)	36	139	2	22	8
Sediment, suspended discharge (ton/d)	36	59	.04	2.8	.2
Sediment, suspended (percent finer than 0.062 mm)	36	96	50	83	87

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1997 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12323250--SILVER BOW CREEK BELOW BLACKTAIL CREEK, AT BUTTE, MONT. **Period of record for water-quality data: March 1993-August 1995, December 1996-September 1997**					
Streamflow, instantaneous (ft^3/s)	36	134	15	35	27
Specific conductance, onsite (μS/cm)	36	691	226	458	466
Temperature, water (°C)	36	17.0	1.5	10.0	9.0
pH, onsite (standard units)	36	7.8	7.2	7.5	7.5
Hardness, total (mg/L as $CaCO_3$)	36	180	66	142	145
Calcium, dissolved (mg/L)	36	50	19	41	42
Magnesium, dissolved (mg/L)	36	13	4.5	10	10
Arsenic, total recoverable (μg/L)	36	45	10	17	16
Arsenic, dissolved (μg/L)	36	13	4	8	8
Cadmium, total recoverable (μg/L)	36	6	1	3	3
Cadmium, dissolved (μg/L)	36	6.2	.5	2.4	2.1
Copper, total recoverable (μg/L)	36	550	85	207	185
Copper, dissolved (μg/L)	36	300	22	91	78
Iron, total recoverable (μg/L)	36	7,400	310	1,580	870
Iron, dissolved (μg/L)	36	270	26	116	110
Lead, total recoverable (μg/L)	36	250	3	33	13
Lead, dissolved (μg/L)	36	2.4	<.5	[2].9	.8
Manganese, total recoverable (μg/L)	36	1,600	320	780	750
Manganese, dissolved (μg/L)	36	1,700	210	708	690
Zinc, total recoverable (μg/L)	36	2,200	350	1,020	965
Zinc, dissolved (μg/L)	36	2,200	200	829	765
Sediment, suspended concentration (mg/L)	35	194	3	37	16
Sediment, suspended discharge (ton/d)	35	70	.14	5.3	1.2
Sediment, suspended (percent finer than 0.062 mm)	35	93	42	81	86

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1997 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12323600--SILVER BOW CREEK AT OPPORTUNITY, MONT. **Period of record for water-quality data: March 1993-August 1995, December 1996-September 1997**					
Streamflow, instantaneous (ft^3/s)	38	361	26	98	60
Specific conductance, onsite (μS/cm)	37	593	202	359	368
Temperature, water (°C)	37	18.0	0.0	8.5	8.5
pH, onsite (standard units)	37	8.9	7.2	8.2	8.1
Hardness, total (mg/L as $CaCO_3$)	37	200	60	128	130
Calcium, dissolved (mg/L)	37	54	18	38	40
Magnesium, dissolved (mg/L)	37	15	3.4	8.1	8.1
Arsenic, total recoverable (μg/L)	37	230	11	37	19
Arsenic, dissolved (μg/L)	37	34	1	10	9
Cadmium, total recoverable (μg/L)	37	49	1	4	2
Cadmium, dissolved (μg/L)	37	41	.5	2.4	1.2
Copper, total recoverable (μg/L)	37	3,900	79	355	160
Copper, dissolved (μg/L)	37	450	25	75	54
Iron, total recoverable (μg/L)	37	24,000	290	2,450	1,000
Iron, dissolved (μg/L)	37	310	3	67	45
Lead, total recoverable (μg/L)	37	650	7	60	18
Lead, dissolved (μg/L)	37	5.1	<.5	[2].9	.5
Manganese, total recoverable (μg/L)	37	10,000	230	890	610
Manganese, dissolved (μg/L)	37	9,300	190	754	500
Zinc, total recoverable (μg/L)	37	15,000	230	998	580
Zinc, dissolved (μg/L)	37	13,000	110	657	310
Sediment, suspended concentration (mg/L)	38	801	6	80	25
Sediment, suspended discharge (ton/d)	38	781	.42	41	4.2
Sediment, suspended (percent finer than 0.062 mm)	38	92	37	74	78

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1997 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT. **Period of record for water-quality data: March 1993-September 1997**					
Streamflow, instantaneous (ft^3/s)	44	662	24	191	148
Specific conductance, onsite (μS/cm)	42	614	265	434	431
Temperature, water (°C)	43	22.0	.5	11.0	12.0
pH, onsite (standard units)	42	9.3	8.0	8.8	8.8
Hardness, total (mg/L as $CaCO_3$)	42	260	110	182	175
Calcium, dissolved (mg/L)	42	78	34	54	52
Magnesium, dissolved (mg/L)	42	19	5.9	12	12
Arsenic, total recoverable (μg/L)	42	94	12	28	24
Arsenic, dissolved (μg/L)	42	60	8	22	20
Cadmium, total recoverable (μg/L)	42	<1	<1	--	<1
Cadmium, dissolved (μg/L)	42	.3	<.1	[2].1	<.1
Copper, total recoverable (μg/L)	42	80	10	29	24
Copper, dissolved (μg/L)	42	40	6	15	12
Iron, total recoverable (μg/L)	42	3,000	130	479	385
Iron, dissolved (μg/L)	42	93	3	19	15
Lead, total recoverable (μg/L)	42	15	<1	[2]3	2
Lead, dissolved (μg/L)	42	1.0	<.5	--	<.5
Manganese, total recoverable (μg/L)	42	600	70	210	180
Manganese, dissolved (μg/L)	42	530	12	135	98
Zinc, total recoverable (μg/L)	42	180	<10	[2]64	50
Zinc, dissolved (μg/L)	42	73	<3	[2]14	9
Sediment, suspended concentration (mg/L)	44	229	2	17	8
Sediment, suspended discharge (ton/d)	44	279	.26	14	2.6
Sediment, suspended (percent finer than 0.062 mm)	43	97	43	81	82

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1997 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12323770--WARM SPRINGS CREEK AT WARM SPRINGS, MONT. Period of record for water quality data: March 1993-September 1997					
Streamflow, instantaneous (ft^3/s)	28	420	2.8	127	92
Specific conductance, onsite (μS/cm)	27	795	139	309	267
Temperature, water (°C)	28	16.0	.5	8.3	8.0
pH, onsite (standard units)	27	8.6	7.4	8.2	8.2
Hardness, total (mg/L as $CaCO_3$)	27	420	72	152	130
Calcium, dissolved (mg/L)	27	130	22	46	40
Magnesium, dissolved (mg/L)	27	22	3.8	8.8	7.3
Arsenic, total recoverable (μg/L)	27	27	3	9	6
Arsenic, dissolved (μg/L)	27	14	3	5	5
Cadmium, total recoverable (μg/L)	27	<1	<1	--	<1
Cadmium, dissolved (μg/L)	27	<.1	<.1	--	<.1
Copper, total recoverable (μg/L)	27	97	4	29	11
Copper, dissolved (μg/L)	27	16	1	5	3
Iron, total recoverable (μg/L)	27	1,700	40	461	160
Iron, dissolved (μg/L)	27	30	3	12	10
Lead, total recoverable (μg/L)	27	14	<1	[2]3	1
Lead, dissolved (μg/L)	27	1.8	<.5	--	<.5
Manganese, total recoverable (μg/L)	27	1,400	90	307	270
Manganese, dissolved (μg/L)	27	570	43	172	110
Zinc, total recoverable (μg/L)	27	60	<10	[2]17	10
Zinc, dissolved (μg/L)	27	10	<3	[2]3	<3
Sediment, suspended concentration (mg/L)	28	100	3	28	12
Sediment, suspended discharge (ton/d)	27	87	.14	17	3.0
Sediment, suspended (percent finer than 0.062 mm)	28	88	55	76	76

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1997 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12323800--CLARK FORK NEAR GALEN, MONT.					
Period of record for water-quality data: July 1988-September 1997					
Streamflow, instantaneous (ft^3/s)	85	1,050	14	231	136
Specific conductance, onsite (μS/cm)	73	720	220	434	438
Temperature, water (°C)	84	22.5	.0	9.5	9.2
pH, onsite (standard units)	72	9.0	7.5	8.4	8.4
Hardness, total (mg/L as $CaCO_3$)	71	370	96	191	190
Calcium, dissolved (mg/L)	71	110	29	57	57
Magnesium, dissolved (mg/L)	71	22	5.5	12	12
Arsenic, total recoverable (μg/L)	71	78	3	21	16
Arsenic, dissolved (μg/L)	71	53	4	15	12
Cadmium, total recoverable (μg/L)	71	3	<1	[2].3	<1
Cadmium, dissolved (μg/L)	71	1	<.1	[2].1	<1
Copper, total recoverable (μg/L)	70	240	8	42	30
Copper, dissolved (μg/L)	71	50	3	12	10
Iron, total recoverable (μg/L)	71	9,200	90	711	350
Iron, dissolved (μg/L)	71	110	3	19	12
Lead, total recoverable (μg/L)	71	28	<1	[2]5	3
Lead, dissolved (μg/L)	71	3	<.5	[2].4	<.5
Manganese, total recoverable (μg/L)	71	1,400	80	304	250
Manganese, dissolved (μg/L)	71	380	31	130	110
Zinc, total recoverable (μg/L)	71	360	10	67	50
Zinc, dissolved (μg/L)	71	110	3	17	12
Sediment, suspended concentration (mg/L)	85	338	2	24	9
Sediment, suspended discharge (ton/d)	85	459	.12	30	2.9
Sediment, suspended (percent finer than 0.062 mm)	84	97	41	78	78

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1997 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12324200--CLARK FORK AT DEER LODGE, MONT.					
Period of record for water-quality data: March 1985-September 1997					
Streamflow, instantaneous (ft^3/s)	137	1,920	23	308	219
Specific conductance, onsite (μS/cm)	120	642	242	495	514
Temperature, water (°C)	136	23.0	.0	9.3	10.0
pH, onsite (standard units)	85	8.7	7.4	8.2	8.2
Hardness, total (mg/L as $CaCO_3$)	77	270	100	207	210
Calcium, dissolved (mg/L)	77	81	32	61	62
Magnesium, dissolved (mg/L)	77	18	5.9	13	14
Arsenic, total recoverable (μg/L)	87	220	8	29	18
Arsenic, dissolved (μg/L)	87	39	7	15	13
Cadmium, total recoverable (μg/L)	87	5	<1	[2].7	<1
Cadmium, dissolved (μg/L)	87	2	<.1	[2].1	<1
Copper, total recoverable (μg/L)	86	1,500	11	121	52
Copper, dissolved (μg/L)	87	120	4	14	10
Iron, total recoverable (μg/L)	87	29,000	60	2,400	820
Iron, dissolved (μg/L)	87	190	<3	[2]18	10
Lead, total recoverable (μg/L)	87	200	<1	[2]16	6
Lead, dissolved (μg/L)	87	6	<.5	[2].6	<1
Manganese, total recoverable (μg/L)	87	4,600	30	350	190
Manganese, dissolved (μg/L)	87	400	1	47	34
Zinc, total recoverable (μg/L)	87	1,700	10	138	70
Zinc, dissolved (μg/L)	87	230	3	18	13
Sediment, suspended concentration (mg/L)	137	2,250	2	94	25
Sediment, suspended discharge (ton/d)	137	8,690	.29	223	15
Sediment, suspended (percent finer than 0.062 mm)	128	99	40	70	71

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1997 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12324590–LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT. **Period of record for water-quality data: March 1985-September 1997**					
Streamflow, instantaneous (ft^3/s)	72	2,080	21	319	186
Specific conductance, onsite (µS/cm)	60	300	120	219	215
Temperature, water (°C)	71	22	.0	7.5	7.0
pH, onsite (standard units)	59	8.5	7.0	8.0	8.0
Hardness, total (mg/L as $CaCO_3$)	54	140	51	100	99
Calcium, dissolved (mg/L)	54	43	14	29	28
Magnesium, dissolved (mg/L)	54	9.4	3.3	6.8	6.8
Arsenic, total recoverable (µg/L)	59	17	4	7	6
Arsenic, dissolved (µg/L)	59	7	3	5	5
Cadmium, total recoverable (µg/L)	59	2	<1	[2].3	<1
Cadmium, dissolved (µg/L)	59	1	<.1	--	<1
Copper, total recoverable (µg/L)	58	45	<1	[2]5	3
Copper, dissolved (µg/L)	59	7	<1	[2]2	2
Iron, total recoverable (µg/L)	59	25,000	20	1,520	330
Iron, dissolved (µg/L)	59	120	<3	[2]38	26
Lead, total recoverable (µg/L)	59	25	<1	[2]4	1
Lead, dissolved (µg/L)	58	6	<.5	[2].5	<1
Manganese, total recoverable (µg/L)	59	1,100	<10	[2]88	30
Manganese, dissolved (µg/L)	59	30	1	8	7
Zinc, total recoverable (µg/L)	59	140	<10	[2]17	<10
Zinc, dissolved (µg/L)	59	24	<3	[2]4	3
Sediment, suspended concentration (mg/L)	72	1,410	1	63	10
Sediment, suspended discharge (ton/d)	72	7,920	.08	184	6.6
Sediment, suspended (percent finer than 0.062 mm)	72	95	49	74	78

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1997 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12324680--CLARK FORK AT GOLDCREEK MONT. Period of record for water-quality data: March 1993-September 1997					
Streamflow, instantaneous (ft^3/s)	43	3,920	87	954	721
Specific conductance, onsite (μS/cm)	42	496	207	360	372
Temperature, water (°C)	43	20.0	.0	8.8	8.0
pH, onsite (standard units)	42	8.7	7.9	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	42	230	86	158	160
Calcium, dissolved (mg/L)	42	68	26	47	49
Magnesium, dissolved (mg/L)	42	15	5.1	10	10
Arsenic, total recoverable (μg/L)	42	75	8	19	16
Arsenic, dissolved (μg/L)	42	20	6	11	10
Cadmium, total recoverable (μg/L)	42	2	<1	--	<1
Cadmium, dissolved (μg/L)	42	<.2	<.1	--	<.1
Copper, total recoverable (μg/L)	41	440	8	64	43
Copper, dissolved (μg/L)	41	36	3	9	7
Iron, total recoverable (μg/L)	42	12,000	60	1,430	810
Iron, dissolved (μg/L)	42	100	<3	[2]24	16
Lead, total recoverable (μg/L)	41	73	<1	[2]9	6
Lead, dissolved (μg/L)	41	.6	<.5	--	<.5
Manganese, total recoverable (μg/L)	42	1,100	30	177	130
Manganese, dissolved (μg/L)	42	43	10	22	20
Zinc, total recoverable (μg/L)	42	510	10	76	50
Zinc, dissolved (μg/L)	42	26	<3	[2]9	8
Sediment, suspended concentration (mg/L)	43	752	2	84	39
Sediment, suspended discharge (ton/d)	43	7,960	.94	456	53
Sediment, suspended (percent finer than 0.062 mm)	43	93	43	74	78

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1997 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12331500--FLINT CREEK NEAR DRUMMOND, MONT. Period of record for water-quality data: March 1985-September 1997					
Streamflow, instantaneous (ft^3/s)	92	892	4.2	201	126
Specific conductance, onsite (µS/cm)	81	507	134	293	294
Temperature, water (°C)	90	21.0	.0	8.5	9.0
pH, onsite (standard units)	78	8.8	7.5	8.2	8.3
Hardness, total (mg/L as $CaCO_3$)	71	260	59	138	140
Calcium, dissolved (mg/L)	71	73	16	37	38
Magnesium, dissolved (mg/L)	71	20	4.3	11	11
Arsenic, total recoverable (µg/L)	78	57	7	19	15
Arsenic, dissolved (µg/L)	78	20	5	9	9
Cadmium, total recoverable (µg/L)	78	3	<1	[2].2	<1
Cadmium, dissolved (µg/L)	78	.1	<.1	--	<.1
Copper, total recoverable (µg/L)	77	32	1	8	7
Copper, dissolved (µg/L)	78	7	<1	[2]2	2
Iron, total recoverable (µg/L)	78	7,200	70	1,120	610
Iron, dissolved (µg/L)	78	240	3	45	28
Lead, total recoverable (µg/L)	78	87	<1	[2]14	9
Lead, dissolved (µg/L)	78	7	<.5	[2]1	<5
Manganese, total recoverable (µg/L)	78	1,600	50	245	160
Manganese, dissolved (µg/L)	78	120	14	41	36
Zinc, total recoverable (µg/L)	78	290	<10	[2]47	30
Zinc, dissolved (µg/L)	78	27	<3	[2]6	4
Sediment, suspended concentration (mg/L)	92	556	3	59	32
Sediment, suspended discharge (ton/d)	92	904	.03	55	9.6
Sediment, suspended (percent finer than 0.062 mm)	92	98	28	80	84

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1997 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12331800–CLARK FORK NEAR DRUMMOND, MONT. Period of record for water-quality data: March 1993-September 1997					
Streamflow, instantaneous (ft^3/s)	43	3,860	149	1,310	985
Specific conductance, onsite (µS/cm)	42	630	189	384	401
Temperature, water (°C)	43	21.0	.5	9.8	9.0
pH, onsite (standard units)	42	8.5	7.8	8.2	8.2
Hardness, total (mg/L as $CaCO_3$)	42	300	74	173	180
Calcium, dissolved (mg/L)	42	83	21	50	52
Magnesium, dissolved (mg/L)	42	22	5.2	12	12
Arsenic, total recoverable (µg/L)	42	62	8	21	16
Arsenic, dissolved (µg/L)	42	20	7	11	11
Cadmium, total recoverable (µg/L)	42	2	<1	--	<1
Cadmium, dissolved (µg/L)	42	.2	<.1	--	<.1
Copper, total recoverable (µg/L)	40	360	5	66	40
Copper, dissolved (µg/L)	40	21	1	8	6
Iron, total recoverable (µg/L)	42	8,800	50	1,580	895
Iron, dissolved (µg/L)	42	150	<3	[2]27	14
Lead, total recoverable (µg/L)	38	56	<1	[2]13	9
Lead, dissolved (µg/L)	38	1.2	<.5	[2].3	<.5
Manganese, total recoverable (µg/L)	42	880	20	209	150
Manganese, dissolved (µg/L)	42	50	8	19	16
Zinc, total recoverable (µg/L)	42	490	<10	[2]99	65
Zinc, dissolved (µg/L)	42	21	<3	[2]9	7
Sediment, suspended concentration (mg/L)	43	530	2	98	45
Sediment, suspended discharge (ton/d)	43	4,720	1.9	576	107
Sediment, suspended (percent finer than 0.062 mm)	43	91	38	72	72

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1997 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12334510--ROCK CREEK NEAR CLINTON, MONT.					
Period of record for water-quality data: March 1985-September 1997					
Streamflow, instantaneous (ft^3/s)	71	5,060	113	1,040	558
Specific conductance, onsite (µS/cm)	62	155	55	104	94
Temperature, water (°C)	71	18	.0	7.9	8.0
pH, onsite (standard units)	61	8.6	6.9	7.9	7.9
Hardness, total (mg/L as $CaCO_3$)	53	90	22	49	49
Calcium, dissolved (mg/L)	53	23	5.9	13	13
Magnesium, dissolved (mg/L)	53	8.0	1.9	4.2	4.0
Arsenic, total recoverable (µg/L)	59	3	<1	[2].9	<1
Arsenic, dissolved (µg/L)	59	1	<1	[2]1	<1
Cadmium, total recoverable (µg/L)	59	3	<1	[2].4	<1
Cadmium, dissolved (µg/L)	59	1	<.1	--	<1
Copper, total recoverable (µg/L)	57	41	<1	[2]5	3
Copper, dissolved (µg/L)	58	6	<1	[2]1	1
Iron, total recoverable (µg/L)	59	2,100	20	381	200
Iron, dissolved (µg/L)	59	160	5	40	35
Lead, total recoverable (µg/L)	57	19	<1	[2]2	<5
Lead, dissolved (µg/L)	57	5	<.5	[2].7	<1
Manganese, total recoverable (µg/L)	59	90	<10	[2]19	10
Manganese, dissolved (µg/L)	59	8	<1	[2]2	2
Zinc, total recoverable (µg/L)	59	60	<10	[2]10	<10
Zinc, dissolved (µg/L)	59	15	<3	[2]2	<3
Sediment, suspended concentration (mg/L)	71	223	1	25	6
Sediment, suspended discharge (ton/d)	71	3,050	.31	173	14
Sediment, suspended (percent finer than 0.062 mm)	71	95	35	69	70

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1997 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.					
Period of record for water-quality data: March 1985-September 1997					
Streamflow, instantaneous (ft^3/s)	140	9,560	296	1,900	1,120
Specific conductance, onsite (μS/cm)	115	483	140	311	329
Temperature, water (°C)	139	22.0	.0	9.0	9.5
pH, onsite (standard units)	86	8.7	7.4	8.2	8.2
Hardness, total (mg/L as $CaCO_3$)	76	210	58	136	140
Calcium, dissolved (mg/L)	76	59	17	38	39
Magnesium, dissolved (mg/L)	76	14	3.9	9.6	9.5
Arsenic, total recoverable (μg/L)	85	110	5	12	8
Arsenic, dissolved (μg/L)	85	17	4	6	6
Cadmium, total recoverable (μg/L)	85	4	<1	[2].5	<1
Cadmium, dissolved (μg/L)	85	1	<.1	--	<1
Copper, total recoverable (μg/L)	83	500	3	52	27
Copper, dissolved (μg/L)	84	25	2	6	5
Iron, total recoverable (μg/L)	85	19,000	60	1,560	590
Iron, dissolved (μg/L)	85	190	<3	[2]29	16
Lead, total recoverable (μg/L)	81	100	<1	[2]11	6
Lead, dissolved (μg/L)	81	7	<.5	[2].5	<1
Manganese, total recoverable (μg/L)	85	2,000	10	178	90
Manganese, dissolved (μg/L)	85	37	1	9	7
Zinc, total recoverable (μg/L)	85	1,100	<10	[2]91	40
Zinc, dissolved (μg/L)	85	39	<3	[2]9	7
Sediment, suspended concentration (mg/L)	140	1,370	2	70	23
Sediment, suspended discharge (ton/d)	140	34,700	3.5	828	66
Sediment, suspended (percent finer than 0.062 mm)	129	98	27	71	72

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1997 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12340000--BLACKFOOT RIVER NEAR BONNER, MONT. Period of record for water-quality data: March 1985-September 1997					
Streamflow, instantaneous (ft^3/s)	101	13,400	344	2,750	1,260
Specific conductance, onsite (µS/cm)	78	294	130	205	202
Temperature, water (°C)	101	20.5	.0	8.8	8.5
pH, onsite (standard units)	61	8.7	7.5	8.2	8.3
Hardness, total (mg/L as $CaCO_3$)	54	140	55	100	94
Calcium, dissolved (mg/L)	54	37	14	26	24
Magnesium, dissolved (mg/L)	54	13	4.9	8.9	8.4
Arsenic, total recoverable (µg/L)	61	4	<1	[2]1	1
Arsenic, dissolved (µg/L)	61	2	<1	[2].9	<1
Cadmium, total recoverable (µg/L)	61	2	<1	[2].4	<1
Cadmium, dissolved (µg/L)	61	1	<.1	--	<1
Copper, total recoverable (µg/L)	58	34	<1	[2]9	6
Copper, dissolved (µg/L)	59	7	<1	[2]2	2
Iron, total recoverable (µg/L)	61	3,600	20	628	260
Iron, dissolved (µg/L)	61	100	<3	[2]21	14
Lead, total recoverable (µg/L)	57	25	<1	[2]5	2
Lead, dissolved (µg/L)	57	8	<.5	[2]1	<1
Manganese, total recoverable (µg/L)	61	180	<10	[2]40	20
Manganese, dissolved (µg/L)	61	11	<1	[2]3	2
Zinc, total recoverable (µg/L)	61	60	<10	[2]11	<10
Zinc, dissolved (µg/L)	61	15	<3	[2]4	<3
Sediment, suspended concentration (mg/L)	101	271	1	35	8
Sediment, suspended discharge (ton/d)	101	7,670	1.1	639	29
Sediment, suspended (percent finer than 0.062 mm)	99	98	42	78	80

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 1997 (Continued)

Property or constituent and reporting unit	Number of samples	Maximum	Minimum	Mean	Median
12340500--CLARK FORK ABOVE MISSOULA, MONT.					
Period of record for water-quality data: July 1986-September 1997					
Streamflow, instantaneous (ft^3/s)	106	21,600	720	4,570	2,320
Specific conductance, onsite (µS/cm)	83	399	145	257	261
Temperature, water (°C)	103	19.5	.0	9.0	8.5
pH, onsite (standard units)	63	8.6	7.9	8.2	8.3
Hardness, total (mg/L as $CaCO_3$)	63	170	61	118	120
Calcium, dissolved (mg/L)	63	46	14	32	32
Magnesium, dissolved (mg/L)	63	13	5.3	9.2	9.2
Arsenic, total recoverable (µg/L)	63	69	2	6	4
Arsenic, dissolved (µg/L)	63	9	1	3	3
Cadmium, total recoverable (µg/L)	63	5	<1	--	<1
Cadmium, dissolved (µg/L)	63	.1	<.1	--	<.1
Copper, total recoverable (µg/L)	61	400	2	21	8
Copper, dissolved (µg/L)	62	11	1	3	2
Iron, total recoverable (µg/L)	63	13,000	60	811	310
Iron, dissolved (µg/L)	63	200	<3	[2]26	16
Lead, total recoverable (µg/L)	58	78	<1	[2]4	2
Lead, dissolved (µg/L)	58	1	<.5	[2].6	<.5
Manganese, total recoverable (µg/L)	63	1,100	10	80	50
Manganese, dissolved (µg/L)	63	230	7	19	15
Zinc, total recoverable (µg/L)	63	1,100	<10	[2]43	20
Zinc, dissolved (µg/L)	63	16	<3	[2]5	4
Sediment, suspended concentration (mg/L)	106	824	2	43	10
Sediment, suspended discharge (ton/d)	106	21,900	6.1	1,190	60
Sediment, suspended (percent finer than 0.062 mm)	101	99	44	86	89

[1]Multiple minimum reporting levels during the period of record may result in varying values identified with a less-than (<) symbol.

[2]Value is estimated by using a log-probability regression to predict the values of data less than the minimum reporting level (Helsel and Cohn, 1988).

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through August 1997

[Fine-grained bed sediment is material less than 0.064 millimeter in diameter. Concentrations are in micrograms per gram dry weight. Symbols: <, less than minimum reporting level; --, indicates either too few samples or insufficient data greater than the minimum reporting level to compute statistic. Number of samples represents the number of years that the constituent was analyzed, with each year represented by a single mean concentration of composite samples. Values for single samples are arbitrarily listed in the "Mean" column]

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12323600--SILVER BOW CREEK AT OPPORTUNITY, MONT. Period of record for fine-grained bed-sediment data: 1992-97					
Cadmium	6	42.0	25.5	33.1	33.0
Chromium	5	31.0	23.2	27.2	27.6
Copper	6	6,280	4,560	4,980	4,740
Iron	6	41,200	34,400	38,600	39,000
Lead	6	1,030	752	856	833
Manganese	6	3,940	1,680	2,590	2,440
Nickel	5	21.4	14.5	16.9	16.2
Silver	6	19.6	13.7	16.5	16.8
Zinc	6	10,800	6,850	8,480	8,340
12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT. Period of record for fine-grained bed-sediment data: 1992-97					
Cadmium	6	12.2	5.3	8.2	7.4
Chromium	5	24.8	12.8	20.3	22.9
Copper	6	769	259	482	440
Iron	6	26,000	19,500	21,500	20,800
Lead	6	99	58	75	74
Manganese	6	17,700	1,470	7,460	7,630
Nickel	5	16.5	12.5	14.8	14.6
Silver	6	2.1	.3	1.3	1.1
Zinc	6	2,220	620	1,300	1,150
12323770--WARM SPRINGS CREEK AT WARM SPRINGS, MONT. Period of record for fine-grained bed-sediment data: 1995, 1997					
Cadmium	2	3.9	2.6	3.2	--
Chromium	2	33.4	30.8	32.1	--
Copper	2	892	848	870	
Iron	2	22,400	21,900	22,100	--
Lead	2	86	85	86	--
Manganese	2	8,790	2,020	5,400	--
Nickel	2	21.9	17.6	19.8	--
Silver	2	3.7	3.2	3.4	--
Zinc	2	421	372	396	--

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12323800--CLARK FORK NEAR GALEN, MONT.					
Period of record for fine-grained bed-sediment data: 1987, 1991-97					
Cadmium	8	20.1	7.5	11.7	11.2
Chromium	5	33.9	22.1	28.0	29.9
Copper	8	2,300	1,140	1,430	1,250
Iron	8	39,800	22,600	29,300	28,400
Lead	8	235	116	155	144
Manganese	8	15,600	2,780	9,150	10,400
Nickel	5	23.2	17.7	20.1	19.7
Silver	8	5.5	2.8	4.1	3.9
Zinc	8	3,560	1,160	2,100	2,080
461415112450801--CLARK FORK BELOW LOST CREEK, NEAR GALEN, MONT					
Period of record for fine-grained bed-sediment data: 1996-97					
Cadmium	2	9.0	8.4	8.7	--
Chromium	2	34.5	32.9	33.7	--
Copper	2	2,050	1,730	1,890	--
Iron	2	31,400	30,800	31,100	--
Lead	2	197	190	194	--
Manganese	2	5,900	3,540	4,720	--
Nickel	2	19.9	18.7	19.3	--
Silver	2	7.0	6.8	6.9	--
Zinc	2	1,680	1,460	1,570	--
461559112443301--CLARK FORK NEAR RACETRACK, MONT.					
Period of record for fine-grained bed-sediment data: 1996-97					
Cadmium	2	8.5	7.5	8.0	--
Chromium	2	33.3	30.1	31.7	--
Copper	2	1,610	1,370	1,490	--
Iron	2	29,800	29,000	29,400	--
Lead	2	155	153	154	--
Manganese	2	2,680	2,390	2,540	--
Nickel	2	18.4	16.5	17.4	--
Silver	2	6.1	6.0	6.0	--
Zinc	2	1,550	1,190	1,370	--
461903112440701--CLARK FORK AT DEMPSEY CREEK DIVERSION, NEAR RACETRACK, MONT.					
Period of record for fine-grained bed-sediment data: 1996-97					
Cadmium	2	8.1	6.9	7.5	--
Chromium	2	31.1	28.9	30.0	--
Copper	2	1,550	1,280	1,420	--
Iron	2	30,200	28,200	29,200	--
Lead	2	152	152	152	--
Manganese	2	3,910	2,630	3,270	--
Nickel	2	16.9	15.8	16.4	--
Silver	2	6.2	6.2	6.2	--
Zinc	2	1,570	1,260	1,420	--

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12324200–CLARK FORK AT DEER LODGE, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1990-97					
Cadmium	10	9.0	5.1	7.1	7.5
Chromium	5	36.5	19.5	31.1	35.4
Copper	10	4,180	837	1,610	1,220
Iron	10	31,700	22,600	27,900	28,900
Lead	10	242	121	165	159
Manganese	10	6,020	1,460	2,670	2,380
Nickel	5	19.0	15.0	16.7	16.8
Silver	10	7.9	2.4	4.8	4.9
Zinc	10	1,730	977	1,370	1,420
12324590–LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1994					
Cadmium	3	.9	.2	.6	.7
Chromium	1	--	--	22.1	--
Copper	3	85	38	54	40
Iron	3	26,400	16,100	22,100	23,800
Lead	3	53	37	43	40
Manganese	3	2,700	907	1,550	1,040
Nickel	1	--	--	13.6	--
Silver	3	.9	<.5	[1].5	.3
Zinc	3	180	161	170	170
12324680–CLARK FORK AT GOLDCREEK, MONT.					
Period of record for fine-grained bed-sediment data: 1992-97					
Cadmium	6	6.2	5.4	5.7	5.8
Chromium	5	37.8	31.6	34.5	34.5
Copper	6	1,080	653	849	797
Iron	6	28,600	20,500	25,200	25,400
Lead	6	152	88	113	112
Manganese	6	2,610	1,180	2,020	2,070
Nickel	5	17.8	15.0	16.7	17.0
Silver	6	4.8	2.3	3.5	3.5
Zinc	6	1,320	1,070	1,180	1,170
12331500–FLINT CREEK NEAR DRUMMOND, MONT.					
Period of record for fine-grained bed-sediment data: 1986, 1989, 1992-97					
Cadmium	8	4.5	<1.0	[1]2.6	2.8
Chromium	5	27.9	21.1	24.6	24.3
Copper	8	73	55	63	64
Iron	8	28,100	21,100	24,000	23,500
Lead	8	240	151	186	179
Manganese	8	5,510	2,360	3,790	3,740
Nickel	5	14.9	11.7	12.9	12.5
Silver	7	7.8	5.0	6.5	6.5
Zinc	8	777	610	679	673

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12331800--CLARK FORK NEAR DRUMMOND, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1991-97					
Cadmium	9	5.4	4.1	4.7	4.8
Chromium	5	35.4	17.0	29.8	32.6
Copper	9	747	469	578	579
Iron	9	26,100	16,500	22,400	23,800
Lead	9	135	83	102	102
Manganese	9	2,780	1,220	1,860	1,880
Nickel	5	16.8	14.0	15.6	15.7
Silver	9	4.7	2.1	3.2	3.1
Zinc	9	1,230	1,000	1,110	1,120
12334510--ROCK CREEK NEAR CLINTON, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 89, 1991-97					
Cadmium	10	<1.5	<.3	--[1]	[1]<.8
Chromium	5	27.9	16.5	22.3	21.4
Copper	10	15	3	12	13
Iron	10	21,400	13,100	17,700	17,800
Lead	10	16	<3	[1]8	8
Manganese	10	618	126	366	330
Nickel	5	13.7	10.8	12.4	12.7
Silver	9	.8	<.3	[1].3	<.5
Zinc	10	58	36	47	48
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.					
Period of record for fine-grained bed-sediment data: 1986, 1991-97					
Cadmium	8	5.2	3.1	3.8	3.6
Chromium	5	34.7	15.3	25.2	26.7
Copper	8	635	300	414	339
Iron	8	23,200	15,100	19,400	19,500
Lead	8	115	49	77	72
Manganese	8	1,700	671	1,160	1,200
Nickel	5	16.2	11.6	14.4	15.9
Silver	8	3.9	1.3	2.3	2.3
Zinc	8	1,160	775	927	898
12340000--BLACKFOOT RIVER NEAR BONNER, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1991, 1993-96					
Cadmium	7	<1.5	<.3	--[1]	[1]<.8
Chromium	4	24.7	15.1	19.3	18.6
Copper	7	25	16	21	21
Iron	7	19,100	12,400	16,300	15,800
Lead	7	20	<13	[1]12	11
Manganese	7	672	298	497	497
Nickel	4	13.3	11.7	12.6	12.6
Silver	7	.7	<.3	[1].3	[1]<.5
Zinc	7	73	54	63	61

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12340500--CLARK FORK ABOVE MISSOULA, MONT. Period of record for fine-grained bed-sediment data: 1997					
Cadmium	1	--	--	3.7	--
Chromium	1	--	--	28.5	--
Copper	1	--	--	516	--
Iron	1	--	--	21,800	---
Lead	1	--	--	63	--
Manganese	1	--	--	1,160	--
Nickel	1	--	--	14.5	--
Silver	1	--	--	2.9	--
Zinc	1	--	--	924	--
12353000--CLARK FORK BELOW MISSOULA, MONT.[2] Period of record for fine-grained bed-sediment data: 1986, 1990-97					
Cadmium	9	2.6	1.1	1.7	1.8
Chromium	5	27.6	18.8	22.9	21.5
Copper	9	293	98	166	138
Iron	9	21,100	14,500	18,600	19,500
Lead	9	58	12	37	35
Manganese	9	2,530	752	1,480	1,270
Nickel	5	14.1	11.8	13.2	13.3
Silver	9	2.1	.4	1.2	1.3
Zinc	9	675	319	433	436

[1]Value determined by arbitrarily substituting one-half of the detection level for censored (<) values, when both uncensored and censored values are used in determining the mean. When all data are below the detection level, the median is determined by ranking the censored values in order of detection level. No mean is reported when all values are below the detection level.

[2]Samples collected about 30 miles downstream from water-quality station to conform to previous sampling location.

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through August 1997

[Bulk bed sediment is material smaller than about 10 mm in diameter. Concentrations are in micrograms per gram dry weight. Symbols: <, less than minimum reporting level; --, indicates either too few samples or insufficient data greater than the minimum reporting level to compute statistic. Number of samples represents the number of years that the constituent was analyzed, with each year represented by a single mean concentration of composite samples. Values for single samples are arbitrarily listed in the "Mean" column]

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12323600--SILVER BOW CREEK AT OPPORTUNITY, MONT. Period of record for bulk bed-sediment data: 1993-95, 1997					
Cadmium	4	12.7	5.4	8.3	7.6
Chromium	4	16.2	9.6	13.3	13.8
Copper	4	1,550	775	1,030	904
Iron	4	29,300	18,600	23,700	23,400
Lead	4	300	221	258	255
Manganese	4	1,670	504	898	708
Nickel	4	8.9	6.0	6.9	6.4
Silver	4	4.8	3.4	4.0	4.0
Zinc	4	3,420	1,720	2,360	2,160
12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT. Period of record for bulk bed-sediment data: 1993, 1995-97					
Cadmium	4	1.7	<1.1	[1]1.2	[1]1.2
Chromium	4	11.8	9.9	10.8	10.9
Copper	4	111	42	76	76
Iron	4	12,300	9,160	10,900	11,100
Lead	4	33	<10	[1]18	16
Manganese	4	884	209	617	687
Nickel	4	9.2	5.3	7.0	6.8
Silver	4	1.3	<.3	[1].7	[1].6
Zinc	4	303	137	209	198
12327700--WARM SPRINGS CREEK AT WARM SPRINGS, MONT. Period of record for bulk bed-sediment data: 1995, 1997					
Cadmium	2	1.0	<.8	[1].7	--
Chromium	2	11.8	9.7	10.8	--
Copper	2	205	203	204	
Iron	2	10,900	8,980	9,960	--
Lead	2	34	18	26	--
Manganese	2	2,650	1,220	1,930	--
Nickel	2	7.8	5.7	6.8	--
Silver	2	1.1	.9	1.0	
Zinc	2	148	146	147	--

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through August 1997 (Continued)

Constituent	Number of samples	Maximum	Minimum	Mean	Median
12323800--CLARK FORK NEAR GALEN, MONT.					
Period of record for bulk bed-sediment data: 1993-97					
Cadmium	5	6.0	1.5	3.2	2.6
Chromium	5	23.0	4.2	13.8	14.8
Copper	5	685	223	435	408
Iron	5	31,300	9,930	20,600	22,500
Lead	5	87	41	65	64
Manganese	5	5,410	899	2,200	1,540
Nickel	5	12.5	4.9	8.3	8.8
Silver	5	1.9	.7	1.4	1.6
Zinc	5	1,280	417	709	653
461415112450801--CLARK FORK BELOW LOST CREEK, NEAR GALEN, MONT					
Period of record for bulk bed-sediment data: 1996-97					
Cadmium	2	3.1	2.5	2.8	--
Chromium	2	17.5	12.0	14.8	--
Copper	2	763	455	609	--
Iron	2	21,000	16,000	18,500	--
Lead	2	104	72	88	--
Manganese	2	1,740	1,260	1,500	--
Nickel	2	8.2	7.7	8.0	--
Silver	2	2.8	2.1	2.4	--
Zinc	2	787	632	710	--
461559112443301--CLARK FORK NEAR RACETRACK, MONT.					
Period of record for bulk bed-sediment data: 1996-97					
Cadmium	2	3.4	1.9	2.6	--
Chromium	2	16.4	12.4	14.4	--
Copper	2	594	361	478	--
Iron	2	18,200	16,200	17,200	--
Lead	2	87	66	76	--
Manganese	2	1,500	759	1,130	--
Nickel	2	9.9	5.5	7.7	--
Silver	2	2.6	1.9	2.2	--
Zinc	2	743	472	608	--
461903112440701--CLARK FORK AT DEMPSEY CREEK DIVERSION, NEAR RACETRACK, MONT.					
Period of record for bulk bed-sediment data: 1996-97					
Cadmium	2	3.9	1.8	2.8	--
Chromium	2	17.3	16.3	16.8	--
Copper	2	651	424	538	--
Iron	2	20,900	20,100	20,500	--
Lead	2	89	58	74	--
Manganese	2	1,860	825	1,340	--
Nickel	2	10.0	5.5	7.8	--
Silver	2	2.8	2.0	2.4	--
Zinc	2	804	448	626	--

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through August 1997 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12324200--CLARK FORK AT DEER LODGE, MONT.					
Period of record for bulk bed-sediment data: 1993-97					
Cadmium	5	3.1	2.0	2.5	2.4
Chromium	5	24.5	12.1	17.1	16.1
Copper	5	691	281	435	383
Iron	5	25,000	13,200	18,400	17,900
Lead	5	85	45	71	74
Manganese	5	2,060	653	1,160	1,020
Nickel	5	10.4	7.7	9.3	10.1
Silver	5	2.8	<.7	[1]1.6	1.6
Zinc	5	777	456	596	599
12324590--LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT.					
Period of record for bulk bed-sediment data: 1994					
Cadmium	1	--	--	<1.2	--
Chromium	1	--	--	14.7	--
Copper	1	--	--	19	--
Iron	1	--	--	15,600	--
Lead	1	--	--	12	--
Manganese	1	--	--	420	--
Nickel	1	--	--	8.6	--
Silver	1	--	--	<.7	--
Zinc	1	--	--	73	--
12324680--CLARK FORK AT GOLDCREEK, MONT.					
Period of record for bulk bed-sediment data: 1993-97					
Cadmium	5	5.2	2.3	3.5	3.4
Chromium	5	33.2	17.6	24.8	23.4
Copper	5	858	282	546	471
Iron	5	24,900	15,500	20,300	19,600
Lead	5	86	46	70	72
Manganese	5	2,600	649	1,350	1,190
Nickel	5	15.9	9.1	12.9	12.4
Silver	5	3.7	<.7	[1]2.2	1.6
Zinc	5	1,020	549	774	696
12331500--FLINT CREEK NEAR DRUMMOND, MONT.					
Period of record for bulk bed-sediment data: 1993-97					
Cadmium	5	3.2	.3	1.5	1.5
Chromium	5	13.9	4.9	10.2	10.7
Copper	5	40	19	30	30
Iron	5	15,000	8,630	13,000	13,400
Lead	5	120	51	83	80
Manganese	5	3,200	1,150	2,250	2,240
Nickel	5	8.0	5.3	6.4	6.0
Silver	5	5.8	3.3	4.7	5.1
Zinc	5	429	190	314	332

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through August 1997 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12331800--CLARK FORK NEAR DRUMMOND, MONT.					
Period of record for bulk bed-sediment data: 1993-97					
Cadmium	5	3.9	1.5	2.5	1.8
Chromium	5	29.5	13.8	22.0	23.1
Copper	5	605	173	356	276
Iron	5	21,800	14,100	17,800	16,600
Lead	5	78	35	55	58
Manganese	5	1,510	711	1,040	1,210
Nickel	5	14.2	9.0	11.7	11.0
Silver	5	3.5	.5	1.9	1.7
Zinc	5	939	434	680	621
12334510--ROCK CREEK NEAR CLINTON, MONT.					
Period of record for bulk bed-sediment data: 1993-97					
Cadmium	5	<1.5	<.8	--[1]	[1]<1.1
Chromium	5	14.3	6.6	9.7	8.9
Copper	5	7	4	6	6
Iron	5	11,100	6,380	8,740	8,960
Lead	5	<13	5	[1]5	[1]5
Manganese	5	258	91	175	186
Nickel	5	8.2	4.9	6.0	5.7
Silver	5	.4	.1	[1].3	[1].3
Zinc	5	29	16	20	20
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.					
Period of record for bulk bed-sediment data: 1993-97					
Cadmium	5	2.9	.5	[1]1.5	1.6
Chromium	5	23.8	6.9	14.4	15.5
Copper	5	336	75	192	182
Iron	5	17,900	9,530	13,100	13,200
Lead	5	49	21	34	35
Manganese	5	1,320	234	560	414
Nickel	5	14.0	6.4	9.3	8.8
Silver	5	2.0	<.3	[1].9	[1]<.7
Zinc	5	769	281	483	508
12340000--BLACKFOOT RIVER NEAR BONNER, MONT.					
Period of record for bulk bed-sediment data: 1993-94					
Cadmium	2	<1.2	<.8	--[1]	--
Chromium	2	17.7	6.7	12.2	--
Copper	2	19	14	16	--
Iron	2	16,600	10,300	13,400	--
Lead	2	10	8	9	--
Manganese	2	305	179	242	--
Nickel	2	9.8	7.6	8.7	--
Silver	2	<.7	<.5	--[1]	--
Zinc	2	58	33	46	--

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through August 1997 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12340500--CLARK FORK ABOVE MISSOULA, MONT. Period of record for bulk bed-sediment data: 1997					
Cadmium	1	--	--	<.8	--
Chromium	1	--	--	9.7	--
Copper	1	--	--	43	--
Iron	1	--	--	11,500	--
Lead	1	--	--	7	--
Manganese	1	--	--	228	--
Nickel	1	--	--	8.2	--
Silver	1	--	--	.6	--
Zinc	1	--	--	145	--
12353000--CLARK FORK BELOW MISSOULA, MONT.[2] Period of record for bulk bed-sediment data: 1993-97					
Cadmium	5	<1.5	<.8	[1].6	<1.1
Chromium	5	12.6	4.4	7.8	7.8
Copper	5	77	22	47	49
Iron	5	11,300	6,160	8,680	8,830
Lead	5	19	<10	[1]10	[1]8
Manganese	5	444	223	361	381
Nickel	5	7.1	3.5	5.6	6.0
Silver	5	.6	<.3	[1].4	[1].4
Zinc	5	172	88	129	121

[1]Value determined by arbitrarily substituting one-half of the detection level for censored (<) values, when both uncensored and censored values are used in determining the mean and/or median. When all data are below the detection level, the median is determined by ranking the censored values in order of detection level. No mean is reported when all values are below the detection level.

[2]Samples collected about 30 miles downstream from water-quality station to conform to previous sampling location.

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997

[Concentrations are in micrograms per gram dry weight. Symbols: <, less than minimum reporting level; --, indicates either too few samples or insufficient data greater than the minimum reporting level to compute statistic, or element not analyzed. Number of composite samples represents the total of all individual composite samples collected for every year that the constituent was analyzed. Values for single samples are arbitrarily listed in the "Mean" column. Because *Hydropsyche* insects were not sorted to the species level during 1986-89, statistics for stations sampled during those years are based on the results of all *Hydropsyche* species combined. At some sites, statistics for the *Hydropsyche morosa* group are based on the combined results for two or more species]

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12323600--SILVER BOW CREEK AT OPPORTUNITY, MONT. Period of record for biological data: 1992, 1994-95, 1997					
Brachycentrus spp.					
Cadmium	1	--	--	11.6	--
Chromium	1	--	--	.7	--
Copper	1	--	--	587	--
Iron	1	--	--	335	--
Lead	1	--	--	7.4	--
Manganese	1	--	--	231	--
Nickel	1	--	--	1.0	--
Zinc	1	--	--	888	--
Hydropsyche cockerelli					
Cadmium	5	6.3	4.1	4.9	4.7
Chromium	5	8.0	1.0	3.7	3.1
Copper	5	462	269	365	333
Iron	5	1,180	689	931	953
Lead	5	21.7	19.0	20.3	20.1
Manganese	5	718	180	460	434
Nickel	5	2.1	.7	1.4	1.6
Zinc	5	898	749	818	805
Hydropsyche tana					
Cadmium	6	9.2	4.8	6.8	6.9
Chromium	6	11.5	.9	4.5	1.8
Copper	6	456	10.5	236	298
Iron	6	1,520	857	1,100	1,050
Lead	6	21.0	15.6	18.6	18.3
Manganese	6	969	307	634	675
Nickel	6	1.8	.7	1.4	1.6
Zinc	6	1,070	760	961	1,020
12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT. Period of record for biological data: 1992-97					
Hydropsyche cockerelli					
Cadmium	16	2.1	.5	1.0	.7
Chromium	16	1.3	.5	.8	.8
Copper	16	96.9	25.1	51.0	43.9
Iron	16	1,240	553	783	758
Lead	16	5.7	.3	3.5	3.5
Manganese	16	2,450	491	1,060	873
Nickel	16	1.8	.4	.9	.8
Zinc	16	276	118	193	195

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT.--Continued					
Period of record for biological data: 1992-97					
Hydropsyche occidentalis					
Cadmium	3	1.1	.4	.8	.9
Chromium	3	.9	.3	.6	.7
Copper	3	46.5	38.6	41.5	39.4
Iron	3	1,040	372	803	998
Lead	3	<3.6	<2.3	[1]1.6	[1]1.7
Manganese	3	2,250	1,780	2,060	2,140
Nickel	3	1.5	.7	1.0	.9
Zinc	3	202	149	184	201
Hydropsyche spp.					
Cadmium	4	2.3	.4	1.1	.9
Chromium	4	1.4	.5	.8	1.2
Copper	4	47.6	34.9	40.9	40.6
Iron	4	773	561	680	693
Lead	4	5.1	1.9	2.9	4.7
Manganese	4	1,100	443	725	678
Nickel	4	1.9	<.4	[1].8	[1].5
Zinc	4	285	141	195	177
12323770--WARM SPRINGS CREEK AT WARM SPRINGS, MONT.					
Period of record for biological data: 1995, 1997					
Arctopsyche grandis					
Cadmium	2	2.4	2.1	2.2	--
Chromium	2	1.9	1.4	1.6	--
Copper	2	98.8	95.6	97.2	--
Iron	2	1,040	684	862	--
Lead	2	5.6	<6.3	[1]4.4	--
Manganese	2	2,280	1,340	1,810	--
Nickel	2	2.3	1.8	2.0	--
Zinc	2	222	197	210	--
Hydropsyche spp.					
Cadmium	1	--	--	<9.3	--
Chromium	1	--	--	1.6	--
Copper	1	--	--	94.8	--
Iron	1	--	--	1,150	--
Lead	1	--	--	<16.7	--
Manganese	1	--	--	956	--
Nickel	1	--	--	2.0	--
Zinc	1	--	--	129	--

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
	12323800--CLARK FORK NEAR GALEN, MONT. Period of record for biological data: 1987, 1991-97				
	Hydropsyche cockerelli				
Cadmium	12	2.7	1.3	1.8	1.8
Chromium	12	3.3	.8	1.4	1.2
Copper	12	181	72.8	100	98.1
Iron	12	1,510	902	1,200	1,170
Lead	12	11.0	1.2	6.3	7.6
Manganese	12	2,950	1,070	1,980	1,980
Nickel	12	3.1	1.0	1.6	1.5
Zinc	12	299	136	216	222
	Hydropsyche morosa group				
Cadmium	5	3.2	2.4	2.5	2.4
Chromium	5	4.6	1.8	2.6	2.2
Copper	5	185	156	173	175
Iron	5	1,890	1,360	1,510	1,430
Lead	5	12.4	7.1	8.5	7.9
Manganese	5	3,960	2,360	3,500	3,860
Nickel	5	3.6	1.9	2.3	2.1
Zinc	5	349	292	309	303
	Hydropsyche occidentalis				
Cadmium	20	1.7	.9	1.2	1.2
Chromium	20	6.6	.7	1.8	1.6
Copper	20	106	66.7	84.7	83.1
Iron	20	1,920	642	1,210	1,220
Lead	20	13.5	1.6	6.6	6.3
Manganese	20	4,070	1,220	2,480	2,360
Nickel	20	3.5	1.1	1.7	1.6
Zinc	20	278	170	206	201
	Hydropsyche tana				
Cadmium	1	--	--	1.5	--
Chromium	1	--	--	1.4	--
Copper	1	--	--	92.9	--
Iron	1	--	--	1,340	--
Lead	1	--	--	9.0	--
Manganese	1	--	--	2,160	--
Nickel	1	--	--	2.1	--
Zinc	1	--	--	206	--
	Hydropsyche spp.				
Cadmium	4	3.5	2.6	3.0	3.0
Chromium	0	--	--	--	--
Copper	4	154	135	148	152
Iron	4	1,540	1,190	1,400	1,450
Lead	4	13.5	10.5	12.2	12.4
Manganese	0	--	--	--	--
Nickel	0	--	--	--	--
Zinc	4	329	279	308	313

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
461415112450801--CLARK FORK BELOW LOST CREEK, NEAR GALEN, MONT.					
Period of record for biological data: 1996-97					
Hydropsyche cockerelli					
Cadmium	4	2.8	2.2	2.4	2.4
Chromium	4	2.5	1.8	2.1	2.0
Copper	4	147	121	138	142
Iron	4	1,900	1,560	1,760	1,780
Lead	4	14.8	12.1	13.1	12.7
Manganese	4	1,850	1,250	1,590	1,630
Nickel	4	1.9	1.1	1.6	1.6
Zinc	4	250	221	234	233
Hydropsyche occidentalis					
Cadmium	6	1.8	1.4	1.6	1.6
Chromium	6	2.5	1.7	2.0	1.9
Copper	6	157	121	136	135
Iron	6	1,920	1,360	1,600	1,580
Lead	6	12.4	9.8	11.2	11.1
Manganese	6	2,190	1,270	1,730	1,730
Nickel	6	1.7	1.4	1.5	1.5
Zinc	6	252	230	241	241
Hydropsyche spp.					
Cadmium	2	1.8	1.2	1.5	--
Chromium	2	2.4	1.5	2.0	--
Copper	2	122	120	121	--
Iron	2	1,410	1,340	1,380	--
Lead	2	20.5	7.2	13.8	--
Manganese	2	1,950	799	1,370	--
Nickel	2	2.8	1.4	2.1	--
Zinc	2	225	179	202	--
461559112443301--CLARK FORK NEAR RACETRACK, MONT.					
Period of record for biological data: 1996-97					
Hydropsyche cockerelli					
Cadmium	4	1.7	1.1	1.4	1.4
Chromium	4	2.5	.7	1.5	1.4
Copper	4	109	70.6	92.4	94.8
Iron	4	1,370	862	1,130	1,140
Lead	4	9.3	6.1	7.7	7.7
Manganese	4	1,050	646	831	815
Nickel	4	1.4	1.0	1.2	1.2
Zinc	4	199	139	175	180

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
461559112443301–CLARK FORK NEAR RACETRACK, MONT.–Continued					
Period of record for biological data: 1996-97					
Hydropsyche occidentalis					
Cadmium	6	2.2	1.4	1.8	1.9
Chromium	6	2.6	1.5	2.1	2.3
Copper	6	160	93.5	134	145
Iron	6	1,880	1,300	1,580	1,600
Lead	6	11.7	9.7	10.6	10.4
Manganese	6	2,640	1,090	1,610	1,110
Nickel	6	1.7	1.2	1.4	1.4
Zinc	6	255	229	243	246
Hydropsyche spp.					
Cadmium	1	--	--	1.0	--
Chromium	1	--	--	.7	--
Copper	1	--	--	82.9	--
Iron	1	--	--	1,140	--
Lead	1	--	--	5.7	--
Manganese	1	--	--	910	--
Nickel	1	--	--	1.1	--
Zinc	1	--	--	151	--
461903112440701–CLARK FORK AT DEMPSEY CREEK DIVERSION, NEAR RACETRACK, MONT.					
Period of record for biological data: 1996-97					
Arctopsyche grandis					
Cadmium	1	--	--	1.7	--
Chromium	1	--	--	<2.4	--
Copper	1	--	--	30.8	--
Iron	1	--	--	340	--
Lead	1	--	--	<14.5	--
Manganese	1	--	--	510	--
Nickel	1	--	--	1.0	--
Zinc	1	--	--	87	--
Hydropsyche cockerelli					
Cadmium	2	1.6	.9	1.2	--
Chromium	2	1.3	1.0	1.2	--
Copper	2	143	87.6	115	--
Iron	2	1,290	831	1,060	--
Lead	2	8.4	6.8	7.6	--
Manganese	2	697	487	592	--
Nickel	2	1.9	1.6	1.8	--
Zinc	2	180	162	171	--

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
461903112440701--CLARK FORK AT DEMPSEY CREEK DIVERSION, NEAR RACETRACK, MONT.--Continued					
Period of record for biological data: 1996-97					
Hydropsyche occidentalis					
Cadmium	3	1.7	1.4	1.5	1.5
Chromium	3	1.9	1.2	1.5	1.3
Copper	3	163	117	135	125
Iron	3	1,590	1,100	1,290	1,180
Lead	3	10.3	9.7	10.0	10.1
Manganese	3	2,280	826	1,760	2,170
Nickel	3	1.4	1.2	1.3	1.2
Zinc	3	240	224	232	232
Hydropsyche spp.					
Cadmium	2	1.7	1.6	1.6	--
Chromium	2	2.1	1.4	1.8	--
Copper	2	140	104	122	--
Iron	2	1,610	1,070	1,340	--
Lead	2	13.2	10.5	11.8	--
Manganese	2	1,150	638	892	--
Nickel	2	1.6	1.6	1.6	--
Zinc	2	212	191	202	--
12324200--CLARK FORK AT DEER LODGE, MONT.					
Period of record for biological data: 1986-87, 1990-97					
Arctopsyche grandis					
Cadmium	2	2.4	<4.2	[1]2.2	--
Chromium	2	1.0	<1.3	[1].8	--
Copper	2	69.1	34.9	52.0	--
Iron	2	676	537	606	--
Lead	2	<7.8	3.8	[1]3.8	--
Manganese	2	727	380	554	--
Nickel	2	<1.7	<1.3	[1]--	--
Zinc	2	178	140	159	--
Hydropsyche cockerelli					
Cadmium	17	2.3	.8	1.3	1.3
Chromium	17	3.2	.4	1.7	1.9
Copper	17	136	54.7	96.8	102
Iron	17	3,340	490	1,180	1,050
Lead	17	18.2	4.3	8.9	8.9
Manganese	17	1,030	396	683	679
Nickel	17	2.4	.3	1.2	1.1
Zinc	17	391	132	186	184

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12324200--CLARK FORK AT DEER LODGE, MONT.--Continued					
Period of record for biological data: 1986-87, 1990-97					
Hydropsyche occidentalis					
Cadmium	22	2.7	.8	1.4	1.3
Chromium	22	2.6	.6	1.9	2.0
Copper	22	162	49.5	119	113
Iron	22	1,930	558	1,420	1,460
Lead	22	16.2	6.3	11.4	11.4
Manganese	22	2,840	649	1,640	1,740
Nickel	22	12.9	1.0	2.0	1.4
Zinc	22	299	196	239	230
Hydropsyche spp.					
Cadmium	3	2.0	1.2	1.6	1.6
Chromium	0	--	--	--	--
Copper	3	222	103	145	111
Iron	3	2,220	1,110	1,520	1,240
Lead	3	15.0	5.6	8.8	5.7
Manganese	0	--	--	--	--
Nickel	0	--	--	--	--
Zinc	3	203	185	195	197
12324590--LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT.					
Period of record for biological data: 1987, 1994					
Arctopsyche grandis					
Cadmium	9	.4	.2	.3	.3
Chromium	9	.8	.6	.7	.8
Copper	9	14.0	9.1	11.5	11.8
Iron	9	325	177	242	230
Lead	9	1.3	.5	.8	.8
Manganese	9	596	318	471	492
Nickel	9	.6	.4	.5	.5
Zinc	9	179	113	146	145
Claassenia sabulosa					
Cadmium	4	.3	.1	.2	.2
Chromium	4	.8	.7	.8	.8
Copper	4	34.0	20.0	27.9	28.8
Iron	4	200	98	138	127
Lead	4	<.7	<.4	--[1]	<.6
Manganese	4	62.1	46.7	53.4	51.3
Nickel	4	.7	.5	.6	.5
Zinc	4	233	191	206	201

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
12324590--LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT.--Continued					
Period of record for biological data: 1987, 1994					
Hydropsyche cockerelli					
Cadmium	1	--	--	.6	--
Chromium	1	--	--	1.6	--
Copper	1	--	--	28.4	--
Iron	1	--	--	478	--
Lead	1	--	--	3.6	--
Manganese	1	--	--	399	--
Nickel	1	--	--	1.2	--
Zinc	1	--	-	123	--
Hydropsyche occidentalis					
Cadmium	1	--	--	<.7	--
Chromium	1	--	--	1.3	--
Copper	1	--	--	15.1	--
Iron	1	--	--	426	--
Lead	1	--	--	<3.7	--
Manganese	1	--	--	434	--
Nickel	1	--	--	.8	--
Zinc	1	--	-	110	--
12324680--CLARK FORK AT GOLDCREEK, MONT.					
Period of record for biological data: 1992-97					
Arctopsyche grandis					
Cadmium	14	6.6	1.4	2.4	2.2
Chromium	14	3.3	.8	1.6	1.1
Copper	14	129	28.8	63.6	59.5
Iron	14	2,360	339	961	682
Lead	14	10.9	2.3	5.0	3.8
Manganese	14	1,100	592	810	776
Nickel	14	1.8	.2	.9	.8
Zinc	14	309	165	199	187
Claassenia sabulosa					
Cadmium	12	3.5	.6	1.7	1.4
Chromium	12	1.6	.3	.7	.6
Copper	12	67.7	33.0	54.5	53.5
Iron	12	296	63.0	173	174
Lead	12	1.7	.5	1.1	1.1
Manganese	12	179	65.1	101	91.0
Nickel	12	.7	.2	.3	.3
Zinc	12	296	166	244	258

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
12324680--CLARK FORK AT GOLDCREEK, MONT.--Continued					
Period of record for biological data: 1992-97					
Hydropsyche cockerelli					
Cadmium	12	2.6	.6	1.8	1.8
Chromium	12	4.7	.7	2.6	2.2
Copper	12	188	33.5	98.3	87.7
Iron	12	3,250	589	1,420	1,030
Lead	12	16.2	4.5	8.7	7.6
Manganese	12	954	538	699	650
Nickel	12	2.3	.6	1.4	1.3
Zinc	12	240	137	196	204
Hydropsyche morosa group					
Cadmium	4	1.7	1.1	1.4	1.4
Chromium	4	1.4	1.3	1.4	1.4
Copper	4	72.9	43.8	60.5	62.7
Iron	4	1,320	612	1,050	1,130
Lead	4	6.9	2.4	4.6	4.6
Manganese	4	1,030	538	804	822
Nickel	4	1.4	.9	1.2	1.2
Zinc	4	190	137	167	170
Hydropsyche occidentalis					
Cadmium	10	1.7	.7	1.2	1.2
Chromium	10	3.9	.4	1.5	1.2
Copper	10	156	26.4	65.2	47.0
Iron	10	2,720	466	1,100	787
Lead	10	15.7	2.9	7.2	5.8
Manganese	10	1,800	530	1,070	931
Nickel	10	1.9	.8	1.1	1.1
Zinc	10	242	97	179	180
12331500--FLINT CREEK NEAR DRUMMOND, MONT.					
Period of record for biological data: 1986, 1992-97					
Arctopsyche grandis					
Cadmium	30	.8	.2	.4	.4
Chromium	30	4.7	.6	1.9	1.8
Copper	30	21.7	8.7	15.2	15.1
Iron	30	2,460	606	1,370	1,360
Lead	30	17.5	3.7	9.1	8.1
Manganese	30	2,480	679	1,520	1,340
Nickel	30	2.7	.6	1.3	1.2
Zinc	30	275	151	202	195

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
	12331500--FLINT CREEK NEAR DRUMMOND, MONT.--Continued				
	Period of record for biological data: 1986, 1992-97				
	Hydropsyche cockerelli				
Cadmium	7	.7	.2	.4	.4
Chromium	7	2.2	1.0	1.5	1.2
Copper	7	28.3	9.5	18.1	18.0
Iron	7	2,180	996	1,560	1,500
Lead	7	17.9	3.1	10.6	11.1
Manganese	7	1,440	401	994	1,070
Nickel	7	2.3	.9	1.9	2.2
Zinc	7	193	85	153	180
	Hydropsyche occidentalis				
Cadmium	6	1.0	.2	.6	.6
Chromium	6	17.6	.7	4.6	1.8
Copper	6	26.4	15.1	19.3	18.0
Iron	6	2,550	912	1,720	1,780
Lead	6	29.2	5.8	17.7	19.3
Manganese	6	2,690	1,400	1,860	1,760
Nickel	6	6.9	.8	3.2	2.9
Zinc	6	243	128	182	185
	Hydropsyche tana				
Cadmium	2	<1.2	<.1	--[1]	--
Chromium	2	10.3	.6	5.4	--
Copper	2	16.0	5.4	10.7	--
Iron	2	1,320	729	1,020	--
Lead	2	15.3	5.0	10.2	--
Manganese	2	1,400	1,180	1,290	--
Nickel	2	3.1	.5	1.8	--
Zinc	2	139	107	123	--
	12331800--CLARK FORK NEAR DRUMMOND, MONT.				
	Period of record for biological data: 1986, 1991-97				
	Arctopsyche grandis				
Cadmium	21	3.8	.7	1.6	1.5
Chromium	21	2.5	.2	1.0	1.0
Copper	21	89.2	18.2	38.1	32.0
Iron	21	1,660	240	660	576
Lead	21	11.8	2.1	5.0	4.2
Manganese	21	2,010	462	844	710
Nickel	21	1.9	.2	.7	.7
Zinc	21	308	142	193	189

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
12331800--CLARK FORK NEAR DRUMMOND, MONT.--Continued					
Period of record for biological data: 1986, 1991-97					
Claassenia sabulosa					
Cadmium	27	2.8	.3	1.4	1.4
Chromium	27	3.3	.3	.8	.6
Copper	27	130	18.0	60.4	52.6
Iron	27	290	76.1	138	117
Lead	27	2.2	.2	.8	.8
Manganese	27	270	45.9	128	125
Nickel	27	1.1	.1	.3	.2
Zinc	27	469	140	258	241
Hydropsyche cockerelli					
Cadmium	15	2.3	.7	1.6	1.7
Chromium	15	3.5	.4	1.9	1.7
Copper	15	156	37.9	78.3	67.2
Iron	15	2,500	506	1,310	1,060
Lead	15	15.0	5.1	8.9	7.7
Manganese	15	929	549	745	743
Nickel	15	2.0	.5	1.2	1.1
Zinc	15	240	164	197	195
Hydropsyche morosa group					
Cadmium	6	1.3	1.1	1.2	1.2
Chromium	6	2.8	1.9	2.3	2.2
Copper	6	57.4	50.2	55.2	55.8
Iron	6	1,730	1,380	1,570	1,600
Lead	6	10.8	7.0	8.9	9.0
Manganese	6	1,940	1,260	1,610	1,620
Nickel	6	1.7	1.3	1.5	1.5
Zinc	6	250	227	239	240
Hydropsyche occidentalis					
Cadmium	10	2.0	.7	1.1	1.2
Chromium	10	8.1	.4	2.3	2.3
Copper	10	118	13.3	54.3	52.1
Iron	10	2,060	424	1,170	972
Lead	10	13.5	2.9	7.9	8.7
Manganese	10	2,920	619	1,500	1,160
Nickel	10	2.4	.5	1.4	1.7
Zinc	10	283	157	220	222
Hydropsyche spp.					
Cadmium	1	--	--	2.6	--
Chromium	0	--	--	--	--
Copper	1	--	--	85.0	--
Iron	1	--	--	940	--
Lead	1	--	--	9.1	--
Manganese	0	--	--	--	--
Nickel	0	--	--	--	--
Zinc	1	--	--	260	--

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
	12334510–ROCK CREEK NEAR CLINTON, MONT.				
	Period of record for biological data: 1987, 1991-97				
	Arctopsyche grandis				
Cadmium	28	.4	.06	.2	.2
Chromium	28	2.9	.5	1.2	1.0
Copper	28	12.3	4.7	8.3	8.1
Iron	28	991	191	508	436
Lead	28	<2.9	.1	[1].4	[1].4
Manganese	28	454	113	244	226
Nickel	28	1.6	.2	.8	.7
Zinc	28	189	84	125	122
	Claassenia sabulosa				
Cadmium	15	.3	.05	.2	.1
Chromium	15	1.8	.4	.8	.6
Copper	15	40.7	18.1	29.6	29.3
Iron	15	129	49.8	89.7	90.4
Lead	15	1.0	.1	.3	.3
Manganese	15	76.3	15.7	34.7	32.9
Nickel	15	.9	.1	.3	.3
Zinc	15	264	164	206	211
	Hydropsyche cockerelli				
Cadmium	3	<.2	<.2	--[1]	<.2
Chromium	3	1.0	.9	.9	.9
Copper	3	13.1	6.0	8.6	6.6
Iron	3	609	485	530	497
Lead	3	<1.1	<1.1	--[1]	<1.1
Manganese	3	258	192	219	208
Nickel	3	.9	.4	.6	.4
Zinc	3	99	82	89	86
	Hydropsyche occidentalis				
Cadmium	4	<1.0	<.3	--[1]	<.3
Chromium	4	2.4	.9	1.6	.9
Copper	4	17.6	9.6	12.0	10.2
Iron	4	752	520	642	648
Lead	4	6.0	1.2	3.0	1.2
Manganese	4	268	169	228	215
Nickel	4	1.7	.6	1.2	.9
Zinc	4	144	99	121	117

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12334510--ROCK CREEK NEAR CLINTON, MONT.--Continued					
Period of record for biological data: 1987, 1991-97					
Hydropsyche spp.					
Cadmium	2	.3	<.5	[1].3	--
Chromium	2	1.7	1.1	1.4	--
Copper	2	16.2	15.0	15.6	--
Iron	2	1,030	837	932	--
Lead	2	<3.1	<1.8	[1]--	--
Manganese	2	437	299	368	--
Nickel	2	1.3	.8	1.0	--
Zinc	2	135	117	126	--
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.					
Period of record for biological data: 1986, 1991-97					
Arctopsyche grandis					
Cadmium	25	2.7	.6	1.4	1.2
Chromium	25	4.1	.6	1.7	1.4
Copper	25	125	20.1	41.7	28.9
Iron	25	2,870	420	1,010	790
Lead	25	13.2	2.1	4.4	3.1
Manganese	25	893	351	599	593
Nickel	25	2.6	.4	1.0	.8
Zinc	25	276	152	196	187
Claassenia sabulosa					
Cadmium	20	2.5	.3	1.2	.9
Chromium	20	2.0	.4	.8	.6
Copper	20	76.5	38.3	56.0	53.9
Iron	20	181	58.6	103	101
Lead	20	1.1	.2	.5	.6
Manganese	20	125	42.0	72.1	68.5
Nickel	20	.6	.1	.2	.2
Zinc	20	283	144	222	232
Hydropsyche cockerelli					
Cadmium	18	1.7	.6	1.0	.8
Chromium	18	8.0	1.0	2.2	1.6
Copper	18	118	26.4	52.0	40.5
Iron	18	2,530	688	1,260	1,060
Lead	18	12.1	2.2	5.3	4.7
Manganese	18	788	426	578	549
Nickel	18	2.6	.6	1.2	1.1
Zinc	18	228	148	187	180

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.--Continued					
Period of record for biological data: 1986, 1991-97					
Hydropsyche morosa group					
Cadmium	1	--	--	1.1	--
Chromium	1	--	--	4.6	--
Copper	1	--	--	26.8	--
Iron	1	--	--	986	--
Lead	1	--	--	6.6	--
Manganese	1	--	--	1,320	--
Nickel	1	--	--	1.7	--
Zinc	1	--	--	231	--
Hydropsyche occidentalis					
Cadmium	12	1.8	.3	.9	.8
Chromium	12	3.1	.6	1.8	1.5
Copper	12	102	34.1	48.8	38.7
Iron	12	2,310	472	1,100	951
Lead	12	12.2	3.0	5.7	4.7
Manganese	12	1,510	454	774	672
Nickel	12	1.9	.6	1.0	.9
Zinc	12	235	145	190	183
Hydropsyche spp.					
Cadmium	1	--	--	1.3	--
Chromium	1	--	--	2.4	--
Copper	1	--	--	84.1	--
Iron	1	--	--	1,800	--
Lead	1	--	--	<7.8	--
Manganese	1	--	--	537	--
Nickel	1	--	--	1.3	--
Zinc	1	--	--	171	--
12340000--BLACKFOOT RIVER NEAR BONNER, MONT.					
Period of record for biological data: 1986-87, 1991, 1993, 1996					
Arctopsyche grandis					
Cadmium	6	.3	<.1	[1].2	[1].2
Chromium	0	--	--	--	--
Copper	6	17.9	12.1	14.3	13.1
Iron	6	483	108	327	431
Lead	6	2.1	<.6	[1]1.1	[1]<1.9
Manganese	0	--	--	--	--
Nickel	0	--	--	--	--
Zinc	6	366	123	223	136

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of composite samples	Maxi-mum	Minimum	Mean	Median
12340000--BLACKFOOT RIVER NEAR BONNER, MONT.--Continued					
Period of record for biological data: 1986-87, 1991, 1993, 1996					
Claassenia sabulosa					
Cadmium	9	.6	.1	.4	.5
Chromium	0	--	--	--	--
Copper	9	51.0	32.0	43.0	44.0
Iron	9	199	68.0	116	113
Lead	9	.6	<.3	[1].3	<.5
Manganese	0	--	--	--	--
Nickel	0	--	--	--	--
Zinc	9	233	184	203	197
Hydropsyche occidentalis					
Cadmium	9	.5	.1	.2	.2
Chromium	9	2.1	.8	1.5	1.5
Copper	9	20.6	13.0	14.9	14.5
Iron	9	1,530	1,060	1,270	1,260
Lead	9	1.9	1.1	1.3	1.6
Manganese	9	527	414	463	452
Nickel	9	1.8	.9	1.2	1.2
Zinc	9	150	123	138	144
Hydropsyche spp.					
Cadmium	1	--	--	.6	--
Chromium	1	--	--	1.6	--
Copper	1	--	--	13.9	--
Iron	1	--	--	1,120	--
Lead	1	--	--	2.9	--
Manganese	1	--	--	525	--
Nickel	1	--	--	2.8	--
Zinc	1	--	--	132	--
12340500--CLARK FORK ABOVE MISSOULA, MONT.					
Period of record for biological data: 1997					
Arctopsyche grandis					
Cadmium	3	1.8	1.2	1.4	1.2
Chromium	3	3.0	1.8	2.2	1.8
Copper	3	77.6	40.6	54.7	45.8
Iron	3	2,340	1,360	1,690	1,370
Lead	3	6.8	1.2	4.2	4.6
Manganese	3	924	585	725	665
Nickel	3	2.0	1.2	1.5	1.4
Zinc	3	235	155	188	173

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12340500--CLARK FORK ABOVE MISSOULA, MONT.--Continued					
Period of record for biological data: 1997					
Claassenia sabulosa					
Cadmium	2	2.0	1.7	1.8	--
Chromium	2	1.1	.5	.8	--
Copper	2	51.0	37.8	44.4	--
Iron	2	136	95.3	116	--
Lead	2	<3.8	<1.4	[1]--	--
Manganese	2	111	75.2	93.1	--
Nickel	2	<.9	<.3	[1]--	--
Zinc	2	273	226	250	--
Hydropsyche cockerelli					
Cadmium	3	1.3	1.1	1.2	1.1
Chromium	3	4.1	3.1	3.5	3.3
Copper	3	96.1	83.5	89.2	88.1
Iron	3	3,590	2,430	2,890	2,650
Lead	3	6.3	5.5	6.0	6.2
Manganese	3	878	781	823	809
Nickel	3	2.4	1.9	2.2	2.2
Zinc	3	226	207	218	220
Hydropsyche occidentalis					
Cadmium	1	--	--	1.0	--
Chromium	1	--	--	2.9	--
Copper	1	--	--	76.5	--
Iron	1	--	--	2,240	--
Lead	1	--	--	7.7	--
Manganese	1	--	--	939	-
Nickel	1	--	--	1.9	--
Zinc	1	--	--	210	--
12353000--CLARK FORK BELOW MISSOULA, MONT.[2]					
Period of record for biological data: 1986, 1990-97					
Arctopsyche grandis					
Cadmium	13	1.1	.3	.5	.5
Chromium	13	2.7	.5	1.3	1.2
Copper	13	38.0	9.4	19.1	17.1
Iron	13	1,500	343	714	545
Lead	13	3.2	.9	1.6	1.4
Manganese	13	1,090	511	685	640
Nickel	13	1.6	.4	.9	.8
Zinc	13	169	106	139	137

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 1997 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12353000--CLARK FORK BELOW MISSOULA, MONT.[2]--Continued Period of record for biological data: 1986, 1990-97					
Claassenia sabulosa					
Cadmium	27	1.3	.2	.5	.4
Chromium	27	1.2	.05	.5	.5
Copper	27	61.5	31.1	46.4	46.5
Iron	27	240	66.6	105	91.9
Lead	27	1.3	.1	.4	.3
Manganese	27	168	48.9	98.4	93.0
Nickel	27	.3	.1	.2	.2
Zinc	27	286	146	202	200
Hydropsyche cockerelli					
Cadmium	24	.9	.2	.5	.6
Chromium	24	3.4	.8	2.0	1.9
Copper	24	45.7	12.4	29.3	29.5
Iron	24	2,000	645	1,240	1,260
Lead	24	3.6	1.2	2.2	2.0
Manganese	24	1,180	353	715	663
Nickel	24	1.7	.5	1.2	1.2
Zinc	24	172	77.4	144	151
Hydropsyche occidentalis					
Cadmium	9	.9	.2	.4	.3
Chromium	9	3.5	.2	1.4	1.6
Copper	9	38.2	18.9	25.0	21.0
Iron	9	1,420	482	878	741
Lead	9	3.5	.7	1.9	1.9
Manganese	9	1,460	667	915	891
Nickel	9	2.2	.5	1.0	.9
Zinc	9	193	116	141	132
Hydropsyche spp.					
Cadmium	1	--	--	.5	--
Chromium	1	--	--	.8	--
Copper	1	--	--	20.8	--
Iron	1	--	--	894	--
Lead	1	--	--	1.1	--
Manganese	1	--	--	756	--
Nickel	1	--	--	1.1	--
Zinc	1	--	--	124	--

[1]Values determined by arbitrarily substituting one-half of the detection level for censored (<) values, when both uncensored and censored values are used in determining the mean. When all data are below the detection level, the median is determined by ranking the censored values in order of detection level. No mean is reported when all values are below the detection level.

[2]Samples collected about 30 miles downstream from water-quality station to conform to previous sampling location.

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