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Water-Quality, Bed-Sediment, and Biological Data (October 2000 Through September 2001) and Statistical Summaries of Data for Streams in the Upper Clark Fork Basin, Montana

By Kent A. Dodge, Michelle I. Hornberger, and
Carlos Primo C. David

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CONVERSION FACTORS, DATUM, ABBREVIATED WATER-QUALITY UNITS, AND ACRONYMS

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:

$$^{o}F = 9/5\ (^{o}C) + 32$$

Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29).

Horizontal coordinate information is referenced to the North American Datum of 1927 (NAD 27).

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.

Acronyms used in the report:

ICAPES	Inductively Coupled Argon Plasma Emission Spectroscopy	RSD	relative standard deviation
LRL	laboratory reporting level	SRM	standard reference material
LT-MDL	long-term method detection level	USGS	U.S. Geological Survey
NWQL	USGS National Water Quality Laboratory, Denver, Colo.		

Water-Quality, Bed-Sediment, and Biological Data (October 2000 through September 2001) and Statistical Summaries of Data for Streams in the Upper Clark Fork Basin, Montana

By Kent A. Dodge, Michelle I. Hornberger[1], *and* Carlos Primo C. David[1]

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 2000 through September 2001 (water year 2001). Data for 16 bed-sediment and 15 biological stations were obtained in August 2001. 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. 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 were 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, transported downstream, 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 can 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 necessary 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,

[1]U.S. Geological Survey, Menlo Park, Calif.

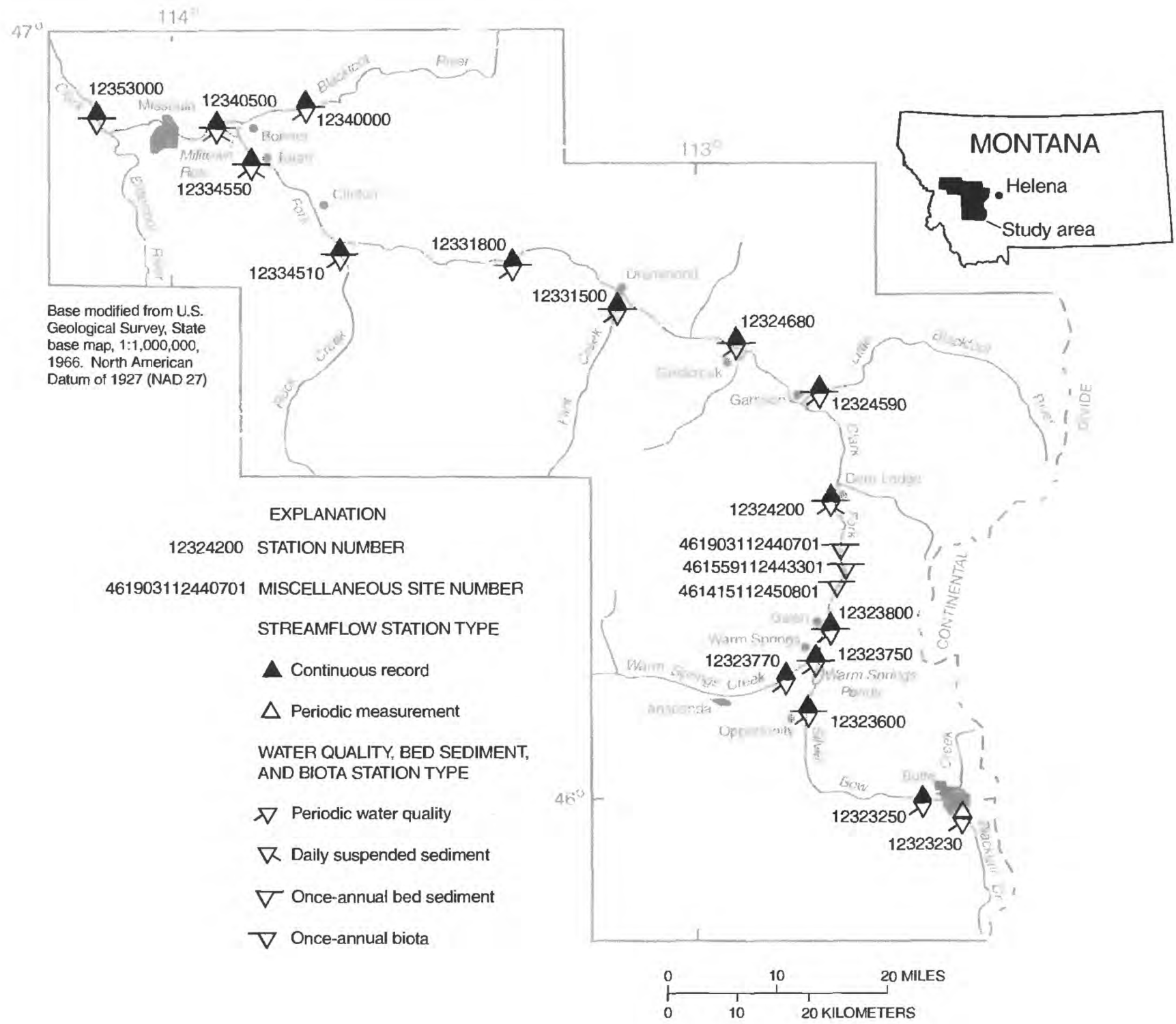

Figure 1. Location of study area.

and 1991; Lambing and others, 1994, 1995; and Dodge and others, 1996, 1997, 1998, 1999, 2000, 2001). 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 by the USGS in cooperation with the U.S. Environmental Protection Agency to provide systematic, long-term monitoring to better quantify the seasonal and annual variability in selected constituents.

The purpose of this report is to present water-quality data for 15 stations and trace-element data for 16 bed-sediment and 15 biological stations in the upper Clark Fork basin collected from October 2000 through September 2001 (water year 2001). 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 the Clark Fork mainstem and major tributaries from Butte to below Missoula (fig. 1). The stations, types of data collected, and period of record for each data type are listed in table 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. Trace-element data for 16 bed-sediment and 15 biological stations were obtained once-annually. Continuous streamflow data were collected at 15 stations.

A list of properties measured onsite 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 data for water year 2001 are listed in tables 4 through 20 at the back of the report. Statistical summaries of water-quality, bed-sediment, and biological data collected between March 1985 and September 2001 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 6 to 8 times per year on a schedule designed to describe seasonal and hydrologic variability.

Methods

Cross-sectional water samples were collected from multiple verticals across the stream using depth- and width-integration methods described by Knapton (1985), Ward and Harr (1990), Wilde and others (1998), and Edwards and Glysson (1999). These methods provide a vertically and laterally discharge-weighted composite 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 air and 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 Knapton (1985), Ward and Harr (1990), Horowitz and others (1994) and Wilde and others (1998). 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 Denver, 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).

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

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

[Abbreviations: P, present. 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-P	07/92, 08/94, 08/95, 08/97-P
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, 08/99	08/95, 08/97, 08/99	08/95, 08/97, 08/99
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, 08/98, 08/01	08/94, 08/98, 08/01	08/87, 08/94 08/98, 08/01
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, 08/91-99, 08/01	08/93-99, 08/01	08/87, 08/91-99, 08/01
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	07/86-04/87, 06/88-09/95	08/86, 08/87, 08/91, 08/93-96, 08/98-P	08/93, 08/94, 08/99-P	08/86, 08/87, 08/91, 08/93, 08/96, 08/98, 09/00
12340500	Clark Fork above Missoula	03/29-P	07/86-P[3]	07/86-04/87, 06/88-01/96, 03/96-P	08/97-P	08/97-P	08/97-P
12353000	Clark Fork below Missoula[4]	10/29-P	03/85-09/95	--	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. Prior to March 1993, laboratory analyses included only trace elements and suspended sediment, with the exception of Clark Fork below Missoula.
[2]Laboratory analyses of trace elements.
[3]Prior to October 1989, water-quality data for Clark Fork above Missoula only included suspended-sediment data.
[4]Bed sediment and biota sampled about 30 miles downstream from streamflow-gaging station to conform to previous sampling location. Water-quality sampling discontinued in 1995.

Table 2. Properties measured onsite 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		

2 to 8 times per week. These samples were collected by local contract 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 2000 through September 2001 (water year 2001) 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 2001 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 Ward and Harr (1990), Knapton and Nimick (1991), Horowitz and others (1994), Wilde and others, (1998), and Edwards and Glysson (1999). 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 (1995). 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, 1995). 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 USGS 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 (field replicate) by either repeating the collection process to obtain two or more independent composite samples, or by splitting a single composite sample into two or more subsamples. The individual replicate samples are then analyzed separately. 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, replicate stream samples for chemical analysis were obtained in the field by splitting a composite stream sample, and replicate stream samples for suspended-sediment analysis 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. Two independent 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 the reproducibility of laboratory analytical results independent of possible variability 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

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
	Laboratory reporting level[1]		Maximum relative standard deviation of laboratory replicate analyses, in percent	Maximum deviation of spike recovery, in percent
Calcium, dissolved	0.01	mg/L	20	--
Magnesium, dissolved	.008	mg/L	20	--
Arsenic, total recoverable	2	µg/L	20	25
Arsenic, dissolved	.2	µg/L	20	25
Cadmium, total recoverable	.10-.11	µg/L	20	25
Cadmium, dissolved	.10-.14	µg/L	20	25
Copper, total recoverable	.6	µg/L	20	25
Copper, dissolved	1.0-1.3	µg/L	20	25
Iron, total recoverable	10	µg/L	20	25
Iron, dissolved	10	µg/L	20	25
Lead, total recoverable	1	µg/L	20	25
Lead, dissolved	1	µg/L	20	25
Manganese, total recoverable	3	µg/L	20	25
Manganese, dissolved	.1-1	µg/L	20	25
Zinc, total recoverable	1	µg/L	20	25
Zinc, dissolved	1	µg/L	20	25
Sediment, suspended	1	mg/L	--	--
Sediment, suspended (percent finer than 0.062 mm)	1	percent	--	--

[1]For those constituents showing a range of values, the laboratory reporting level changed during water year 2001.

acceptable 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.

During water year 1999, the NWQL began implementation of a new, statistically based convention for establishing reporting levels and for reporting low-concentration data (Childress and others, 1999). Quality-control data are collected on a continuing basis to determine long-term method detection levels (LT-MDLs) and laboratory reporting levels (LRLs). These values are re-evaluated each year and, consequently, may change from year to year. The methods are designed to limit the possible occurrence of a false positive or false negative error to 1 percent or less. Accordingly, concentrations are reported as less than the LRL for samples in which the analyte was either not detected or did not pass identification criteria. Analytes that are detected at concentrations between the LT-MDL and LRL and that pass identification criteria are estimated. Estimated concentrations are noted with a remark code of "E." These data need to be used with the understanding that their uncertainty is greater than that of data reported without the "E" remark code.

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):

$$S = \sqrt{\frac{\Sigma d^2}{2k}} \qquad (1)$$

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):

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

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. The data-quality objective used to evaluate precision of results for field replicates was a maximum relative standard deviation of 20 percent. Precision estimates for the field replicate analysis were within the 20-percent relative standard deviation limit 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. 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 (table 10) were within the 20-percent relative standard deviation limit for all constituents except total-recoverable cadmium and dissolved lead. The exceedance of the data quality objective for both constituents does not necessarily impact precision as both exceedances were artifacts of comparing analytical results that were below detection capabilities of laboratory equipment and methodology.

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. 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, in percent, according to equation 3 below:

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

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 96.4 to 107.9 percent. The mean spike recovery for spiked stream samples ranged from 91.8 to 106.8 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.

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 total-recoverable copper (87.7-95.9), dissolved copper (104-110), and total-recoverable lead (95.3-99.3) percent. Because the mean spike recoveries for all constituents 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 LRL for the analytical method indicates that the entire process 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 LRL (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 were evaluated for a consistent trend that may indicate systematic contamination. Sporadic, infrequent exceedances of twice the LRL 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 LRL 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 LRL. Total-recoverable zinc had one minor exceedance of the LRL. There were no exceedances of LRLs for the same constituent in consecutive 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 (fine plus coarse) fractions of the bed-sediment sample. Bed-sediment samples are collected once-annually during low, stable flow conditions and the same season (typically August) to facilitate data comparisons among years.

Methods

Bed-sediment samples were collected in August 2001 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 two composite samples 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. The individual samples were combined to form a single composite sample. 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 were not sieved and generally were 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 Menlo Park, Calif. 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). Two aliquots were similarly 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 0.6N (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 2:10, 3:10, or 5:10 ratio with 0.6N hydrochloric acid. These final solutions were analyzed for cadmium, chromium, copper, iron, lead, manganese, nickel, silver, and zinc using Inductively Coupled Argon Plasma Emission Spectroscopy (ICAPES).

Results

Concentrations of trace elements measured in samples of fine-grained and bulk bed sediment collected during August 2001 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:

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

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, U.S. Geological Survey, 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 (SRMs) are commercially prepared materials that have certified concentrations of trace elements. Replicate analyses of SRMs 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 SRMs for bed sediment is summarized in table 16. Two SRMs 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 SRMs when using less than a total digestion is useful 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. Chromium for both low-concentration range (SRM 2709) and high-concentration range (SRM 2711) showed consistently low recoveries (76.4 and 47.6 percent, respectively). Zinc in SRM 2709 also displayed low recovery (71.8 percent). Cadmium and silver were below the analytical detection limit in SRM 2709. The reason for the lack of measurable recoveries for the low-range cadmium and silver is believed to be the result of analyzing concentrations very close to the detection limit coupled with signal enhancement resulting from matrix interference. Mean recoveries for all other constituents in both low and high concentration SRMs ranged from about 80 to 103 percent; thus, they were within 20 percent of complete recovery. 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, 0.6N hydrochloric acid was added to the dry residue. Procedural blanks, therefore, represent the same chemical matrix as the reagents used to digest and reconstitute bed-sediment samples. No dilution of the reagents is made prior to analysis in order to maximize and detect any 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. If a detectable blank concentration represents 10 percent or more of the ambient solid-phase concentration, then the blank concentration is subtracted to remove potential contamination bias. Two procedural blanks showed metal concentrations (for iron and zinc) above the analytical detection limit. However, both represented less than 1 percent of the ambient concentration in environmental samples; 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 analyses of trace-element concentrations 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 biological data among years and with bed-sediment data.

Methods

Insect samples were collected using protocols described in Hornberger and others (1997). Immature stages of 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., *Brachycentrus* spp., and *Arctopsyche grandis* of the Order Trichoptera (caddisflies), and *Claassenia sabulosa* of the Order Plecoptera (stoneflies). Samples of each taxon were sorted by genus and placed in acid-washed plastic containers. Samples were frozen on dry ice within 30 minutes of collection in a small amount of ambient river water. In previous years (1986-98), benthic insects were depurated for a period of 6-8 hours in an effort to evacuate gut contents. In 1998, a comparison of samples collected using both methods showed no significant difference in metal concentrations in benthic insects, with the exception of copper. Average copper concentrations in depurated samples were 8-25 percent lower than samples frozen within 30 minutes of collection (M.I. Hornberger, unpub. data, 2000). The change in the field protocol minimizes the chance of metal loss through cell membranes during depuration

and is consistent with methods established by Cain and Luoma (1998). However, caution should be exercised in comparing recent copper data for insects with earlier data because of the possibility of higher concentrations resulting from the change in field protocol.

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 0.6N 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 2001 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 with 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 species of *Hydropsyche* were targeted for collection in this study due to their occurrence at most, but not all, sites: *Hydropsyche occidentalis* and *Hydropsyche cockerelli*. *Hydropsyche* species that could not be positively identified were considered to belong to the *morosa* group and are categorized as *Hydropsyche* spp. or *Hydropsyche morosa* group. *Arctopsyche grandis*, *Brachycentrus* spp., and *Claasenia sabulosa* also were collected, where available, to represent additional insect taxa that are fairly widely distributed in the upper Clark Fork basin.

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 were used for the tributary stations. Biota samples were collected along an increasing concentration gradient to minimize effects from potential 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 SRM 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 the SRM 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 11 percent of certified values for cadmium, copper, nickel, and zinc. Recoveries for chromium, iron, and manganese were within 21 percent. Lead recoveries could not be measured due to the very low solution concentration of lead in the biota standard (less than 10 parts per billion). Additionally, a quality-control standard with a similar solution concentration as the SRM samples was analyzed throughout the analysis. Recoveries for all reported elements were within 10 percent of the quality-control standard. No adjustments were made to the trace-element concentrations for the insect samples on the basis of recovery efficiency.

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 all blanks were less than detection; thus, no contamination bias was indicated.

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 1986. 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, near Bonner, Blackfoot River near Bonner, and Clark Fork above Missoula from 1997 to 1999. Inclusion of supplemental sample results targeted for high-flow conditions or maintenance drawdowns of Milltown Reservoir would disproportionately skew the long-term statistics at these three sites relative to the other sites in the network. 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 a compilation of single annual mean concentrations determined from the combined results of multiple composite samples for a given year. Therefore, sample sizes for bed sediment represent the number of years sampled. In contrast, sample sizes and statistics for biological data are based on individual analyses for each composite sample collected in an individual year, rather than on a single annual mean concentration from all composites combined. Biota sample sizes reflect differences in species abundances at each site and among all years. As a result, the statistics for biota describe a wider range of variation in trace-element concentrations than would be evident if results from individual composite samples were averaged. 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 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 between 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 2000 through September 2001

[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)	pH, onsite (standard units)	Specific conductance, onsite (µS/cm)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, dissolved (µg/L)
OCT 2000									
30...	1420	5.1	7.9	286	7.0	112	32	7.7	1.9
JAN 2001									
06...	0830	3.6	7.7	315	2.0	120	34	8.4	1.2
MAR									
28...	0930	8.5	7.7	283	4.5	109	31	7.6	2.8
MAY									
02...	0750	15	7.8	232	3.0	89	26	6.0	2.9
22...	0830	5.0	7.8	300	7.5	114	32	8.0	2.4
JUN									
04...	0730	9.2	7.7	243	5.5	98	28	6.9	3.1
JUL									
23...	1315	4.5	8.2	313	14.5	124	35	8.7	2.9
SEP									
04...	0915	1.9	7.7	364	10.5	146	42	10	2.0

Date	Arsenic, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverable (µg/L)	Lead, dissolved (µg/L)
OCT 2000								
30...	3	<0.14	<0.11	1.9	5.1	50	460	<1
JAN 2001								
06...	2	<.14	E.05	E.8	4.5	30	680	<1
MAR								
28...	4	<.14	<.11	4.5	7.4	170	540	<1
MAY								
02...	4	<.14	<.11	3.5	6.3	160	560	<1
22...	3	<.10	<.10	3.0	3.7	80	250	<1
JUN								
04...	4	E.08	<.10	9.3	6.3	110	350	<1
JUL								
23...	5	<.10	<.10	2.2	5.1	30	220	<1
SEP								
04...	2	E.11	<.10	1.5	2.1	20	210	<1

Date	Lead, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Sediment, suspended (percent finer than 0.062 mm)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)
OCT 2000								
30...	2	30	43	4	11	88	9	0.12
JAN 2001								
06...	1	42	67	3	9	76	14	.14
MAR								
28...	1	90	99	5	8	77	10	.23
MAY								
02...	<1	35	50	3	4	77	10	.41
22...	<1	48	51	2	3	70	4	.05
JUN								
04...	1	34	44	5	9	77	8	.20
JUL								
23...	<1	20	24	2	5	87	3	.04
SEP								
04...	<1	78	82	2	3	73	3	.02

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2000 through September 2001 (Continued)

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

Date	Time	Streamflow, instantaneous (ft^3/s)	pH, onsite (standard units)	Specific conductance, onsite (µS/cm)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, dissolved (µg/L)
OCT 2000									
30...	1540	24	7.5	450	7.5	134	39	9.2	5.1
JAN 2001									
06...	0915	13	7.5	567	1.0	173	48	13	5.1
MAR									
28...	1100	24	7.4	506	7.5	156	44	11	6.3
MAY									
02...	0830	30	7.6	409	4.5	134	39	9.1	5.4
22...	0940	18	7.5	524	10.0	158	45	11	6.6
JUN									
04...	0845	36	7.4	385	5.5	123	35	8.6	7.3
JUL									
23...	1400	18	8.0	547	18.0	177	51	12	8.9
SEP									
04...	0945	14	7.5	573	15.5	177	50	13	8.1

Date	Arsenic, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverable (µg/L)	Lead, dissolved (µg/L)
OCT 2000								
30...	12	.78	1.6	15	66	30	1,480	<1
JAN 2001								
06...	10	.71	1.3	6.3	37	30	940	<1
MAR								
28...	8	1.0	1.2	24	37	100	460	<1
MAY								
02...	8	.46	.66	12	23	90	570	<1
22...	8	.78	.86	16	25	30	270	<1
JUN								
04...	10	.88	1.2	21	51	60	630	<1
JUL								
23...	13	.62	.68	12	21	E10	120	<1
SEP								
04...	9	.57	.73	11	23	20	120	<1

Date	Lead, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Sediment, suspended (percent finer than 0.062 mm)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)
OCT 2000								
30...	18	246	432	277	419	90	48	3.1
JAN 2001								
06...	9	297	380	267	334	81	26	.91
MAR								
28...	2	379	388	325	376	82	10	.65
MAY								
02...	3	258	291	181	191	90	13	1.1
22...	2	294	308	240	235	83	8	.39
JUN								
04...	7	246	293	313	366	84	24	2.3
JUL								
23...	1	151	162	198	209	87	3	.15
SEP								
04...	2	137	160	303	334	77	8	.30

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2000 through September 2001 (Continued)

12323600--SILVER BOW CREEK AT OPPORTUNITY, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	pH, onsite (standard units)	Specific conductance, onsite (µS/cm)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, dissolved (µg/L)
OCT 2000									
30...	1640	31	8.7	510	5.0	174	51	11	8.4
JAN 2001									
04...	1715	36	8.0	525	0.0	177	52	12	8.9
MAR									
28...	1215	49	8.2	503	5.5	172	50	12	10
MAY									
02...	1015	67	8.2	365	3.0	132	40	8.1	9.7
22...	1040	46	8.7	400	10.0	138	41	8.5	9.7
JUN									
04...	0950	74	8.0	373	6.0	127	38	7.9	9.3
JUL									
23...	1550	23	9.2	528	18.5	192	57	12	15
SEP									
04...	1110	13	8.8	602	15.0	217	63	15	16

Date	Arsenic, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverable (µg/L)	Lead, dissolved (µg/L)
OCT 2000								
30...	15	.74	1.3	39	122	<10	550	<1
JAN 2001								
04...	17	1.3	1.8	36	145	<10	860	<1
MAR								
28...	24	1.4	2.5	58	225	40	1,400	<1
MAY								
02...	18	.44	1.3	20	121	40	1,000	<1
22...	14	.37	.74	22	60	10	460	<1
JUN								
04...	47	.67	4.6	40	684	100	3,570	3
JUL								
23...	28	.47	1.2	42	156	10	480	<1
SEP								
04...	20	.32	.84	31	71	<10	260	<1

Date	Lead, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Sediment, suspended (percent finer than 0.062 mm)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)
OCT 2000								
30...	13	395	477	202	403	82	12	1.0
JAN 2001								
04...	23	518	621	406	538	80	17	1.7
MAR								
28...	37	763	861	362	662	86	31	4.1
MAY								
02...	24	284	420	178	323	82	28	5.1
22...	9	247	311	94	192	82	14	1.7
JUN								
04...	151	934	1,520	397	1,180	86	125	25
JUL								
23...	15	262	341	41	245	70	8	.50
SEP								
04...	7	369	400	58	161	75	7	.25

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2000 through September 2001 (Continued)

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

Date	Time	Streamflow, instantaneous (ft^3/s)	pH, onsite (standard units)	Specific conductance, onsite (µS/cm)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, dissolved (µg/L)
OCT 2000									
30...	1730	31	8.4	683	6.0	277	78	20	11
JAN 2001									
05...	0740	39	8.1	783	2.0	314	90	21	6.8
MAR									
28...	1320	72	8.8	598	7.0	239	69	16	9.1
MAY									
02...	1115	87	8.4	511	8.0	204	60	13	12
22...	1140	81	8.7	456	13.5	168	48	12	16
JUN									
04...	1100	114	8.4	448	9.0	181	50	14	47
JUL									
23...	1630	42	9.2	531	19.0	220	62	16	32
SEP									
04...	1145	21	9.1	647	16.5	283	81	20	32

Date	Arsenic, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverable (µg/L)	Lead, dissolved (µg/L)
OCT 2000								
30...	15	<.14	<.11	1.9	3.4	<10	140	<1
JAN 2001								
05...	10	.16	.15	5.0	5.6	<10	180	<1
MAR								
28...	12	<.14	E.06	4.6	9.5	<10	240	<1
MAY								
02...	18	<.14	.14	2.8	11	10	390	<1
22...	19	<.10	E.09	4.8	8.0	10	220	<1
JUN								
04...	52	<.10	.15	9.1	16	50	300	<1
JUL								
23...	41	<.10	<.10	3.0	6.0	10	160	<1
SEP								
04...	34	<.10	<.10	3.3	4.6	<10	80	<1

Date	Lead, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Sediment, suspended (percent finer than 0.062 mm)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)
OCT 2000								
30...	<1	310	327	11	10	82	3	.25
JAN 2001								
05...	<1	875	899	26	27	80	2	.21
MAR								
28...	2	126	215	9	24	80	8	1.6
MAY								
02...	2	227	329	7	25	86	10	2.3
22...	1	77	141	4	13	80	8	1.7
JUN								
04...	2	58	145	9	24	84	13	4.0
JUL								
23...	<1	62	159	2	7	47	5	.57
SEP								
04...	<1	23	55	1	4	67	3	.17

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2000 through September 2001 (Continued)

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

Date	Time	Streamflow, instantaneous (ft^3/s)	pH, onsite (standard units)	Specific conductance, onsite (µS/cm)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, dissolved (µg/L)
OCT 2000									
31...	0735	45	8.2	341	4.5	163	49	9.7	3.9
MAR 2001									
28...	1305	33	8.6	384	5.0	187	57	11	4.6
MAY									
02	1050	40	8.4	318	4.5	154	47	9.1	4.3
22...	1115	56	8.4	246	10.0	110	33	6.5	4.4
JUN									
04...	1045	57	8.3	228	5.5	108	33	6.4	3.8
SEP									
04...	1210	14	8.4	349	14.0	167	51	9.4	5.4

Date	Arsenic, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverable (µg/L)	Lead, dissolved (µg/L)
OCT 2000								
31...	5	<.14	<.11	1.6	5.0	<10	60	<1
MAR 2001								
28...	5	<.14	<.11	2.1	5.7	10	60	<1
MAY								
02	5	<.14	<.11	2.2	6.4	<10	80	<1
22...	5	<.10	<.10	3.4	8.3	<10	110	<1
JUN								
04...	5	<.10	<.10	5.6	10	20	120	<1
SEP								
04...	6	<.10	<.10	3.1	6.2	<10	40	<1

Date	Lead, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Sediment, suspended (percent finer than 0.062 mm)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)
OCT 2000								
31...	<1	202	229	2	4	74	3	.36
MAR 2001								
28...	<1	214	237	2	2	79	4	.36
MAY								
02	<1	127	183	2	2	80	11	1.2
22...	<1	48	110	1	3	71	7	1.1
JUN								
04...	<1	68	130	2	4	65	6	.92
SEP								
04...	<1	29	57	<1	1	67	3	.11

Table 4. Water-quality data for the upper Clark Fork basin, Montana. October 2000 through September 2001 (Continued)

12323800--CLARK FORK NEAR GALEN, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	pH, onsite (standard units)	Specific conductance, onsite (µS/cm)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, dissolved (µg/L)
OCT 2000									
31...	0815	80	8.1	498	5.0	210	62	14	6.2
JAN 2001									
04...	1750	71	8.5	607	2.5	250	74	17	5.7
MAR									
28...	1430	115	8.6	542	7.5	220	66	14	7.5
MAY									
02...	1320	129	8.4	457	7.0	190	58	12	9.6
22...	1230	133	8.6	379	13.0	150	43	10	12
JUN									
04...	1155	170	8.4	383	9.0	160	45	11	30
JUL									
23...	1740	82	8.9	411	18.0	180	52	12	18
SEP									
04...	1330	33	8.6	536	17.5	230	68	15	18

Date	Arsenic, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverable (µg/L)	Lead, dissolved (µg/L)
OCT 2000								
30...	8.2	<.14	<.11	2.4	5.8	E7.1	100	<1
JAN 2001								
04...	9.1	.19	E.08	4.0	8.0	<10	150	<1
MAR								
28...	10	<.14	E.08	4.3	12	<10	240	<1
MAY								
02...	14	<.14	E.10	3.3	12	E9.6	300	<1
22...	14	<.10	E.07	4.7	9.7	E9.7	196	<1
JUN								
04...	35	E.08	E.11	7.6	17	33	260	1
JUL								
23...	23	<.10	<.10	5.5	8.4	E8.2	139	<1
SEP								
04...	20	<.10	<.10	4.2	6.0	<10	56	<1

Date	Lead, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Sediment, suspended (percent finer than 0.062 mm)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)
OCT 2000								
30...	<1	154	193	6	9	79	2	.43
JAN 2001								
04...	<1	460	522	12	16	80	4	.77
MAR								
28...	2	138	240	7	20	74	9	2.8
MAY								
02...	2	157	258	6	18	76	9	3.1
22...	1	54	128	3	10	76	8	2.9
JUN								
04...	2	54	162	6	18	80	11	5.0
JUL								
23...	<1	41	145	2	7	69	4	.89
SEP								
04...	<1	25	47	2	4	67	3	.27

Table 4. Water-quality data for the upper Clark Fork basin, Montana. October 2000 through September 2001 (Continued)

12324200--CLARK FORK AT DEER LODGE, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	pH, onsite (standard units)	Specific conductance, onsite (µS/cm)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, dissolved (µg/L)
OCT 2000									
31...	0910	194	8.2	585	5.5	252	73	17	8.3
JAN 2001									
05...	0845	186	8.3	533	.5	227	67	15	6.0
MAR									
28...	1535	225	8.3	580	8.5	248	73	16	11
MAY									
02...	1410	217	8.6	497	10.0	218	64	14	11
22...	1325	113	8.6	445	15.0	182	53	12	12
JUN									
04...	1255	291	8.2	488	8.5	197	57	13	16
JUL									
23...	1820	119	8.6	493	19.0	218	64	14	17
SEP									
04...	1410	43	8.6	553	17.5	224	66	14	11

Date	Arsenic, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverable (µg/L)	Lead, dissolved (µg/L)
OCT 2000								
31...	12	<.14	E.07	4.4	21	<10	270	<1
JAN 2001								
05...	9	E.11	.18	4.1	23	<10	390	<1
MAR								
28...	19	<.14	.22	7.5	62	<10	800	<1
MAY								
02...	15	<.14	.17	5.6	27	<10	390	<1
22...	14	<.10	E.06	7.8	18	<10	200	<1
JUN								
04...	31	E.13	.50	19	119	40	1,310	<1
JUL								
23...	22	<.10	E.10	8.7	28	<10	330	<1
SEP								
04...	12	<.10	<.10	6.0	8.2	<10	30	<1

Date	Lead, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Sediment, suspended (percent finer than 0.062 mm)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)
OCT 2000								
31...	2	34	98	10	27	80	15	7.9
JAN 2001								
05...	3	60	156	14	34	79	16	8.0
MAR								
28...	7	48	185	10	53	72	43	26
MAY								
02...	3	40	111	5	24	73	18	11
22...	2	55	87	5	14	78	10	3.1
JUN								
04...	16	82	410	12	109	67	110	86
JUL								
23...	3	24	132	4	24	80	6	1.9
SEP								
04...	<1	5.7	12	1	4	54	6	.70

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2000 through September 2001 (Continued)

12324590--LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	pH, onsite (standard units)	Specific conductance, onsite (µS/cm)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, dissolved (µg/L)
NOV 2000									
01...	1010	58	8.3	291	4.5	140	40	8.8	4
MAR 2001									
21...	0910	128	8.0	253	0.0	100	30	6.8	6
MAY									
03...	0730	383	8.0	174	2.5	79	23	5.3	4
22...	1430	319	8.2	188	13.0	83	24	5.8	4
JUN									
05...	1015	455	8.1	268	7.5	120	34	8.3	6
SEP									
04...	1515	19	8.4	326	19.5	140	41	9.5	5

Date	Arsenic, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverable (µg/L)	Lead, dissolved (µg/L)
NOV 2000								
01...	5	<.14	<.11	<1.3	1.8	<10	51	<1
MAR 2001								
21...	8	<.14	<.11	2.6	4.2	120	690	<1
MAY								
03...	6	<.14	<.11	1.4	3.0	78	700	<1
22...	5	<.10	<.10	1.7	1.8	26	269	<1
JUN								
05...	7	<.10	E.05	3.9	2.7	38	430	E.7
SEP								
04...	6	<.10	<.10	<1.0	1.3	E6	42	<1

Date	Lead, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Sediment, suspended (percent finer than 0.062 mm)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)
NOV 2000								
01...	<1	4.8	11	<1	<1	85	2	.31
MAR 2001								
21...	1	45	90	3	8	67	39	13
MAY								
03...	2	7.9	48	2	6	75	33	34
22...	<1	10	24	1	3	72	13	11
JUN								
05...	1	14	47	1	6	54	47	58
SEP								
04...	<1	6.6	13	<1	<1	81	3	.15

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2000 through September 2001 (Continued)

12324680--CLARK FORK AT GOLDCREEK, MONT.

Date	Time	Streamflow, instan-taneous (ft^3/s)	pH, onsite (standard units)	Specific conductance, onsite (µS/cm)	Temper-ature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissoived (mg/L)	Magne-sium, dissoived (mg/L)	Arsenic, dissoived (µg/L)
OCT 2000									
31...	1015	322	8.5	498	6.0	210	63	14	7.2
JAN 2001									
05...	1030	330	8.3	485	0.0	210	62	13	5.8
MAR									
20...	1250	483	8.5	432	7.0	180	53	12	11
MAY									
02...	1615	675	8.5	314	7.5	140	40	8.9	6.8
22...	1520	513	8.7	274	14.0	120	34	7.7	6.4
JUN									
04...	1415	895	8.3	353	8.5	160	46	9.9	9.1
JUL									
24...	0720	303	8.3	435	14.5	200	58	13	11
SEP									
04...	1630	115	8.7	469	20.0	200	57	13	10

Date	Arsenic, total recoverabie (µg/L)	Cadmium, dissoived (µg/L)	Cadmium, totai recoverable (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverabie (µg/L)	Lead, dissoived (µg/L)
OCT 2000								
31...	10	<.14	E.10	2.8	22	<10	320	<1
JAN 2001								
05...	8	E.08	E.09	3.0	12	<10	180	<1
MAR								
20...	20	<.14	.46	13	95	50	2,030	<1
MAY								
02...	10	<.14	.19	3.7	21	50	860	<1
22...	7	<.10	<.10	3.9	8.1	10	220	<1
JUN								
04...	14	<.10	.41	5.6	55	20	870	<1
JUL								
24...	15	<.10	E.07	4.3	12	<10	250	<1
SEP								
04...	10	<.10	<.10	4.1	5.2	<10	30	<1

Date	Lead, total recoverabie (µg/L)	Manga-nese, dissoived (µg/L)	Manga-nese, total recoverabie (µg/L)	Zinc, dissolved (µg/L)	Zinc, totai recoverable (µg/L)	Sediment, suspended (percent finer than 0.062 mm)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)
OCT 2000								
31...	3	18	106	4	29	85	19	17
JAN 2001								
05...	1	21	63	11	22	79	9	8.0
MAR								
20...	13	57	312	11	114	64	118	154
MAY								
02...	4	14	108	3	26	58	60	109
22...	1	13	38	1	9	80	12	17
JUN								
04...	8	48	285	5	61	91	64	155
JUL								
24...	1	32	73	3	14	88	13	11
SEP								
04...	<1	4.0	10	<1	2	48	5	1.6

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2000 through September 2001 (Continued)

12331500--FLINT CREEK NEAR DRUMMOND, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	pH, onsite (standard units)	Specific conductance, onsite (µS/cm)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, dissolved (µg/L)
NOV 2000									
01...	0910	114	8.4	357	4.5	161	44	13	6.1
MAR 2001									
20...	1820	226	8.1	294	4.0	115	30	9.6	12
MAY									
03...	0840	76	8.4	278	3.0	127	34	9.8	6.5
22...	1615	19	8.8	338	19.5	157	43	12	11
JUN									
04...	1520	331	8.3	333	10.0	148	39	12	12
JUL									
24...	0820	76	8.3	456	12.0	213	58	16	9.1
SEP									
04...	1710	5.4	8.5	527	19.0	238	64	19	11

Date	Arsenic, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverable (µg/L)	Lead, dissolved (µg/L)
NOV 2000								
01...	8	<.14	<.11	<1.3	1.5	<10	150	<1
MAR 2001								
20...	22	<.14	.15	3.1	11	110	2,050	E.6
MAY								
03...	11	<.14	E.05	E.9	3.1	50	470	<1
22...	11	<.10	<.10	E1.1	1.8	<10	190	<1
JUN								
04...	35	<.10	.30	2.1	11	40	1,330	E.5
JUL								
24...	13	<.10	<.10	1.4	2.3	20	300	<1
SEP								
04...	12	<.10	<.10	E1.1	1.6	<10	60	<1

Date	Lead, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Sediment, suspended (percent finer than 0.062 mm)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)
NOV 2000								
01...	2	25	61	1	7	84	8	2.5
MAR 2001								
20...	17	128	376	7	53	77	155	95
MAY								
03...	6	46	139	2	15	92	26	5.3
22...	1	40	75	<1	5	94	10	.51
JUN								
04...	34	139	595	3	87	69	195	174
JUL								
24...	3	56	125	1	10	89	19	3.9
SEP								
04...	<1	60	79	1	2	30	27	.39

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2000 through September 2001 (Continued)

12331800--CLARK FORK NEAR DRUMMOND, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	pH, onsite (standard units)	Specific conductance, onsite (µS/cm)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, dissolved (µg/L)
OCT 2000									
31...	1130	516	8.4	506	7.5	221	63	15	7.2
JAN 2001									
05...	1130	432	8.3	504	2.0	221	64	15	6.6
MAR									
20...	1415	985	8.1	397	5.5	166	48	11	11
MAY									
03...	1040	835	8.3	356	7.0	158	46	10	7.7
23...	0745	593	8.2	366	14.0	157	45	11	8.3
JUN									
04...	1630	1,510	8.3	400	8.5	177	51	12	9.9
JUL									
24...	0940	529	8.4	510	17.0	234	67	16	12
SEP									
04...	1745	157	8.5	601	19.5	266	72	21	9.4

Date	Arsenic, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverable (µg/L)	Lead, dissolved (µg/L)
OCT 2000								
31...	9	<.14	E.07	2.2	12	<10	240	<1
JAN 2001								
05...	8	E.07	E.07	2.8	7.0	<10	130	<1
MAR								
20...	32	<.14	1.4	13	185	60	4,490	<1
MAY								
03...	13	<.14	.21	4.1	36	20	1,000	<1
23...	10	<.10	E.09	5.2	15	<10	290	<1
JUN								
04...	16	<.10	.28	7.0	41	20	790	E.5
JUL								
24...	15	<.10	E.09	3.4	16	<10	340	<1
SEP								
04...	10	<.10	<.10	3.4	4.6	<10	20	<1

Date	Lead, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Sediment, suspended (percent finer than 0.062 mm)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)
OCT 2000								
31...	2	9.7	68	5	21	89	14	20
JAN 2001								
05...	1	8.7	32	9	17	80	7	8.2
MAR								
20...	31	55	691	13	270	75	300	798
MAY								
03...	6	11	143	4	47	74	61	138
23...	2	11	53	5	19	87	15	24
JUN								
04...	8	61	225	6	63	90	70	285
JUL								
24...	3	23	98	4	23	76	24	34
SEP								
04...	<1	4.5	8	1	3	65	4	1.7

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2000 through September 2001 (Continued)

12334510--ROCK CREEK NEAR CLINTON, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	pH, onsite (standard units)	Specific conductance, onsite (µS/cm)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, dissolved (µg/L)
NOV 2000									
01...	0730	209	8.0	148	4.5	69	18	5.9	.5
MAR 2001									
29...	1225	209	8.3	139	6.0	60	16	5.3	.5
MAY									
03..	1150	676	8.0	88	6.0	39	10	3.4	.6
23...	1545	1,000	8.2	85	14.5	37	9.7	3.2	.5
JUN									
05...	1730	886	8.2	104	10.0	47	12	3.9	.5
SEP									
05...	1250	149	8.6	152	16.0	67	17	5.9	.6

Date	Arsenic, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverable (µg/L)	Lead, dissolved (µg/L)
NOV 2000								
01...	<2	<.14	<.11	<1.3	<.6	<10	40	<1
MAR 2001								
29...	<2	<.14	<.11	<1.3	E.5	<10	60	<1
MAY								
03..	<2	<.14	<.11	<1.3	.7	60	180	<1
23...	<2	<.10	<.10	E.8	1.8	20	120	<1
JUN								
05...	<2	<.10	<.10	E1.3	1.7	30	90	<1
SEP								
05...	<2	<.10	<.10	<1.0	E.4	<10	40	<1

Date	Lead, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Sediment, suspended (percent finer than 0.062 mm)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)
NOV 2000								
01...	<1	.9	3	<1	<1	76	2	1.1
MAR 2001								
29...	<1	.9	3	<1	1	74	3	1.7
MAY								
03..	<1	1.6	8	<1	<1	74	10	18
23...	<1	1.6	7	<1	<1	70	9	24
JUN								
05...	<1	1.4	6	<1	<1	76	5	12
SEP								
05...	<1	1.8	5	<1	<1	84	5	2.0

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2000 through September 2001 (Continued)

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

Date	Time	Streamflow, instantaneous (ft^3/s)	pH, onsite (standard units)	Specific conductance, onsite (µS/cm)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, dissolved (µg/L)
OCT 2000									
31...	1250	837	8.5	401	6.5	174	49	12	5.1
JAN 2001									
05...	1330	682	8.5	416	1.5	182	52	13	4.5
MAR									
20...	1615	1,480	8.1	315	5.5	127	36	9.0	9.1
MAY									
03...	1430	1,820	8.4	252	8.5	111	31	7.8	4.8
23...	1320	1,810	8.6	211	14.0	92	26	6.8	4.0
JUN									
05...	1540	2.700	8.3	311	12.0	134	38	9.6	8.3
JUL									
24...	1050	1,010	8.5	360	17.0	164	46	12	7.2
SEP									
05...	1010	331	8.4	359	15.0	159	42	13	4.1

Date	Arsenic, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverable (µg/L)	Lead, dissolved (µg/L)
OCT 2000								
31...	7	<.14	<.11	1.5	6.6	<10	120	<1
JAN 2001								
05...	6	<.14	<.11	1.5	5.0	<10	80	<1
MAR								
20...	28	<.14	1.0	7.4	117	90	4,250	<1
MAY								
03...	8	<.14	.14	3.3	23	30	720	<1
23...	4	<.10	<.10	2.9	8.1	<10	200	<1
JUN								
05...	14	<.10	.34	4.6	46	20	790	<1
JUL								
24...	9	<.10	E.07	2.9	12	<10	240	<1
SEP								
05...	5	<.10	<.10	2.0	3.6	<10	60	<1

Date	Lead, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Sediment, suspended (percent finer than 0.062 mm)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)
OCT 2000								
31...	<1	3.4	32	4	12	90	7	16
JAN 2001								
05...	<1	5.5	19	4	12	85	7	13
MAR								
20...	30	30	622	10	236	87	302	1,210
MAY								
03...	4	9.0	97	3	36	77	44	216
23...	1	5.9	29	2	11	72	13	64
JUN								
05...	8	15	179	4	71	82	73	532
JUL								
24...	2	7.9	59	3	17	81	16	44
SEP								
05...	<1	5.0	12	2	6	83	6	5.4

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2000 through September 2001 (Continued)

12340000--BLACKFOOT RIVER NEAR BONNER, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	pH, onsite (standard units)	Specific conductance, onsite (µS/cm)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, dissolved (µg/L)
OCT 2000									
31...	1400	577	8.6	267	6.5	130	33	12	.9
MAR 2001									
29...	0915	750	8.4	253	4.5	119	31	10	1.4
MAY									
04..	0840	2,300	8.1	163	8.0	77	20	6.6	.7
23...	0940	2,590	8.4	168	12.0	83	21	7.3	.7
JUN									
05...	1240	2,990	8.4	205	11.0	97	25	8.6	1.0
SEP									
05...	0900	450	8.4	273	12.5	133	32	13	1.3

Date	Arsenic, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverable (µg/L)	Lead, dissolved (µg/L)
OCT 2000								
31...	E1	<.14	<.11	<1.3	E.4	<10	30	<1
MAR 2001								
29...	E2	<.14	<.11	E.7	1.6	50	270	<1
MAY								
04..	E1	<.14	<.11	<1.3	1.0	20	170	<1
23...	<2	<.10	E.06	E1.0	1.0	<10	110	<1
JUN								
05...	E1	<.10	<.10	E1.3	1.9	10	240	<1
SEP								
05...	E1	<.10	<.10	<1.0	.6	<10	30	<1

Date	Lead, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Sediment, suspended (percent finer than 0.062 mm)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)
OCT 2000								
31...	<1	1.1	3	<1	<1	79	2	3.1
MAR 2001								
29...	<1	4.2	22	1	2	89	15	30
MAY								
04..	<1	2.1	19	<1	<1	84	12	75
23...	<1	1.6	13	<1	1	85	9	63
JUN								
05...	<1	2.1	28	<1	2	92	19	153
SEP								
05...	<1	1.2	3	<1	<1	80	4	4.9

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2000 through September 2001 (Continued)

12340500--CLARK FORK ABOVE MISSOULA, MONT.

Date	Time	Streamflow, instantaneous (ft^3/s)	pH, onsite (standard units)	Specific conductance, onsite (µS/cm)	Temperature, water (°C)	Hardness, total (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, dissolved (µg/L)
OCT 2000									
31...	1540	1,310	8.5	346	6.0	157	43	12	3.4
JAN 2001									
05...	1545	1,080	8.5	351	0.5	158	43	12	3.2
MAR									
29...	1015	1,620	8.5	339	6.0	153	42	12	4.3
MAY									
04...	1015	3,810	8.2	205	8.5	93	25	7.3	2.5
23...	1135	4,090	8.3	189	12.5	85	23	6.9	2.0
JUN									
05...	1400	5,410	8.3	240	10.0	111	30	8.8	4.1
JUL									
24...	1335	1,830	8.5	307	18.5	147	39	12	4.4
AUG									
*17...	1310	950	8.6	290	21.0	138	36	12	3.6
*21...	1115	920	8.4	301	18.5	138	36	12	3.6
SEP									
05...	0745	772	8.3	305	13.0	138	35	12	3.0

Date	Arsenic, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverable (µg/L)	Lead, dissolved (µg/L)
OCT 2000								
31...	4	<.14	<.11	E1.2	3.6	<10	60	<1
JAN 2001								
05...	4	E.07	E.07	1.7	3.4	<10	40	<1
MAR								
29...	6	<.14	<.11	2.5	8.8	20	230	<1
MAY								
04...	4	<.14	E.06	3.0	10	30	300	<1
23...	E2	<.10	E.05	1.8	5.1	10	160	<1
JUN								
05...	6	<.10	.14	4.3	17	20	330	<1
JUL								
24...	6	<.10	<.10	2.6	5.8	<10	110	<1
AUG								
*17...	4	<.10	<.10	E1.3	3.4	<10	70	<1
*21...	4	E.12	E.06	1.6	4.6	<10	130	<1
SEP								
05...	3	<.10	<.10	E.9	2.7	<10	70	<1

Date	Lead, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Sediment, suspended (percent finer than 0.062 mm)	Sediment, suspended (mg/L)	Sediment discharge, suspended (ton/d)
OCT 2000								
31...	<1	10	16	2	6	96	3	11
JAN 2001								
05...	<1	9.5	13	3	8	96	2	5.8
MAR								
29...	1	37	56	2	13	94	13	57
MAY								
04...	2	21	48	2	13	93	21	216
23...	<1	17	31	2	7	88	11	121
JUN								
05...	3	13	74	3	26	97	25	365
JUL								
24...	<1	20	43	2	7	92	7	35
AUG								
*17...	<1	--	28	<1	3	--	4	10
*21...	<1	--	38	1	6	--	7	17
SEP								
05...	<1	10	27	<1	4	88	6	13

*Supplemental samples collected to better define changes in trace-element concentrations and transport during the lowering of Milltown Reservoir water levels.

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 2000 through September 2001

[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)
					2000				
		October			November			December	
1	143	23	8.9	191	15	7.7	e185	21	10
2	164	24	11	189	15	7.7	e180	18	8.7
3	152	18	7.4	186	16	8.0	e190	16	8.2
4	150	18	7.3	196	29	15	e185	13	6.5
5	145	21	8.2	199	20	11	e195	11	5.8
6	174	23	11	196	15	7.9	e195	10	5.3
7	173	23	11	192	14	7.3	e195	10	5.3
8	168	22	10	189	14	7.1	e190	9	4.6
9	162	21	9.2	e180	15	7.3	e180	9	4.4
10	162	20	8.7	e170	15	6.9	e150	9	3.6
11	160	19	8.2	e180	17	8.3	e100	9	2.4
12	189	24	12	184	24	12	e90	10	2.4
13	217	31	18	e180	16	7.8	e130	18	6.3
14	217	30	18	e160	14	6.0	e180	20	9.7
15	200	28	15	e170	14	6.4	e160	20	8.6
16	188	25	13	185	14	7.0	e155	20	8.4
17	181	20	9.8	194	13	6.8	e190	21	11
18	179	18	8.7	192	12	6.2	e160	21	9.1
19	177	14	6.7	e190	11	5.6	e150	21	8.5
20	176	14	6.7	e185	11	5.5	e130	21	7.4
21	187	14	7.1	e185	11	5.5	e120	21	6.8
22	185	14	7.0	e180	11	5.3	e140	21	7.9
23	186	14	7.0	e175	11	5.2	e160	21	9.1
24	180	13	6.3	192	19	9.8	177	21	10
25	183	13	6.4	192	22	11	185	20	10
26	180	13	6.3	e190	24	12	184	16	7.9
27	180	12	5.8	e185	25	12	188	14	7.1
28	179	13	6.3	e170	26	12	e180	15	7.3
29	180	13	6.3	e170	24	11	e180	15	7.3
30	198	14	7.5	e190	22	11	186	15	7.5
31	196	14	7.4	--	--	--	195	15	7.9
TOTAL	5,511	--	282.2	5,537	--	252.3	5,185	--	225.0
MEAN	178	19	9.1	185	17	8.4	167	16	7.3
MAX	217	31	18	199	29	15	195	21	11
MIN	143	12	5.8	160	11	5.2	90	9	2.4

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 2000 through September 2001 (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)
					2001				
	January			February			March		
1	193	15	7.8	177	30	14	e165	53	24
2	e190	16	8.2	182	31	15	182	52	26
3	188	16	8.1	185	36	18	170	49	22
4	187	16	8.1	e170	42	19	170	50	23
5	189	16	8.2	e180	48	23	179	48	23
6	e180	16	7.8	e180	44	21	191	42	22
7	e170	13	6.0	e165	40	18	205	55	30
8	e170	10	4.6	e150	35	14	206	61	34
9	e180	9	4.4	e160	33	14	207	44	25
10	e175	11	5.2	e180	33	16	197	32	17
11	e170	14	6.4	e170	34	16	197	35	19
12	182	17	8.4	e165	34	15	190	37	19
13	180	22	11	e155	35	15	200	39	21
14	e170	30	14	e140	35	13	208	40	22
15	e175	38	18	e145	37	14	197	37	20
16	e155	32	13	e150	42	17	198	39	21
17	e150	23	9.3	e160	50	22	196	50	26
18	e160	16	6.9	e170	56	26	193	60	31
19	e170	12	5.5	e165	58	26	215	56	33
20	e170	16	7.3	e170	61	28	229	49	30
21	e170	23	11	e185	63	31	208	39	22
22	e180	32	16	e180	65	32	201	38	21
23	e170	36	17	e175	62	29	194	38	20
24	e170	33	15	e170	57	26	197	36	19
25	e180	30	15	e160	52	22	206	43	24
26	e180	29	14	e165	57	25	254	69	47
27	e170	29	13	e155	45	19	244	52	34
28	e155	29	12	e155	45	19	236	45	29
29	e140	29	11	--	--	--	228	41	25
30	e160	30	13	--	--	--	221	38	23
31	e170	30	14	--	--	--	213	40	23
TOTAL	5,349	--	319.2	4,664	--	567	6,297	--	775
MEAN	173	22	10	167	45	20	203	45	25
MAX	193	38	18	185	65	32	254	69	47
MIN	140	9	4.4	140	30	13	165	32	17

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 2000 through September 2001 (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)
					2001				
		April			May			June	
1	210	39	22	216	22	13	102	9	2.5
2	209	29	16	220	21	12	92	9	2.2
3	214	35	20	212	14	8.0	117	18	5.7
4	209	33	19	205	18	10	279	86	65
5	199	33	18	194	18	9.4	265	54	39
6	194	36	19	183	15	7.4	220	25	15
7	192	31	16	181	12	5.9	204	17	9.4
8	194	29	15	178	11	5.3	182	12	5.9
9	196	29	15	173	10	4.7	176	11	5.2
10	188	30	15	164	9	4.0	192	14	7.3
11	181	35	17	153	6	2.5	200	12	6.5
12	183	33	16	143	9	3.5	194	9	4.7
13	192	30	16	150	15	6.1	253	38	26
14	186	32	16	168	16	7.3	269	38	28
15	182	31	15	200	24	13	235	23	15
16	178	27	13	219	38	22	207	12	6.7
17	179	26	13	203	23	13	184	8	4.0
18	178	25	12	170	14	6.4	166	9	4.0
19	182	22	11	156	14	5.9	161	10	4.3
20	186	26	13	142	10	3.8	139	8	3.0
21	186	42	21	131	11	3.9	117	6	1.9
22	185	33	16	114	11	3.4	117	4	1.3
23	184	22	11	105	6	1.7	99	5	1.3
24	181	24	12	102	8	2.2	96	10	2.6
25	177	29	14	120	16	5.2	87	15	3.5
26	176	21	10	167	26	12	76	16	3.3
27	181	20	9.8	192	35	18	71	9	1.7
28	189	20	10	200	36	19	82	8	1.8
29	206	22	12	191	34	18	92	11	2.7
30	213	22	13	162	21	9.2	78	7	1.5
31	--	--	--	125	10	3.4	--	--	--
TOTAL	5,710	--	445.8	5,239	--	259.2	4,752	--	281.0
MEAN	190	29	15	169	17	8.4	158	17	9.4
MAX	214	42	22	220	38	22	279	86	65
MIN	176	20	9.8	102	6	1.7	71	4	1.3

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 2000 through September 2001 (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)
					2001				
	January			February			March		
1	193	15	7.8	177	30	14	e165	53	24
2	e190	16	8.2	182	31	15	182	52	26
3	188	16	8.1	185	36	18	170	49	22
4	187	16	8.1	e170	42	19	170	50	23
5	189	16	8.2	e180	48	23	179	48	23
6	e180	16	7.8	e180	44	21	191	42	22
7	e170	13	6.0	e165	40	18	205	55	30
8	e170	10	4.6	e150	35	14	206	61	34
9	e180	9	4.4	e160	33	14	207	44	25
10	e175	11	5.2	e180	33	16	197	32	17
11	e170	14	6.4	e170	34	16	197	35	19
12	182	17	8.4	e165	34	15	190	37	19
13	180	22	11	e155	35	15	200	39	21
14	e170	30	14	e140	35	13	208	40	22
15	e175	38	18	e145	37	14	197	37	20
16	e155	32	13	e150	42	17	198	39	21
17	e150	23	9.3	e160	50	22	196	50	26
18	e160	16	6.9	e170	56	26	193	60	31
19	e170	12	5.5	e165	58	26	215	56	33
20	e170	16	7.3	e170	61	28	229	49	30
21	e170	23	11	e185	63	31	208	39	22
22	e180	32	16	e180	65	32	201	38	21
23	e170	36	17	e175	62	29	194	38	20
24	e170	33	15	e170	57	26	197	36	19
25	e180	30	15	e160	52	22	206	43	24
26	e180	29	14	e165	57	25	254	69	47
27	e170	29	13	e155	45	19	244	52	34
28	e155	29	12	e155	45	19	236	45	29
29	e140	29	11	--	--	--	228	41	25
30	e160	30	13	--	--	--	221	38	23
31	e170	30	14	--	--	--	213	40	23
TOTAL	5,349	--	319.2	4,664	--	567	6,297	--	775
MEAN	173	22	10	167	45	20	203	45	25
MAX	193	38	18	185	65	32	254	69	47
MIN	140	9	4.4	140	30	13	165	32	17

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 2000 through September 2001 (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)
					2001				
	April			May			June		
1	210	39	22	216	22	13	102	9	2.5
2	209	29	16	220	21	12	92	9	2.2
3	214	35	20	212	14	8.0	117	18	5.7
4	209	33	19	205	18	10	279	86	65
5	199	33	18	194	18	9.4	265	54	39
6	194	36	19	183	15	7.4	220	25	15
7	192	31	16	181	12	5.9	204	17	9.4
8	194	29	15	178	11	5.3	182	12	5.9
9	196	29	15	173	10	4.7	176	11	5.2
10	188	30	15	164	9	4.0	192	14	7.3
11	181	35	17	153	6	2.5	200	12	6.5
12	183	33	16	143	9	3.5	194	9	4.7
13	192	30	16	150	15	6.1	253	38	26
14	186	32	16	168	16	7.3	269	38	28
15	182	31	15	200	24	13	235	23	15
16	178	27	13	219	38	22	207	12	6.7
17	179	26	13	203	23	13	184	8	4.0
18	178	25	12	170	14	6.4	166	9	4.0
19	182	22	11	156	14	5.9	161	10	4.3
20	186	26	13	142	10	3.8	139	8	3.0
21	186	42	21	131	11	3.9	117	6	1.9
22	185	33	16	114	11	3.4	117	4	1.3
23	184	22	11	105	6	1.7	99	5	1.3
24	181	24	12	102	8	2.2	96	10	2.6
25	177	29	14	120	16	5.2	87	15	3.5
26	176	21	10	167	26	12	76	16	3.3
27	181	20	9.8	192	35	18	71	9	1.7
28	189	20	10	200	36	19	82	8	1.8
29	206	22	12	191	34	18	92	11	2.7
30	213	22	13	162	21	9.2	78	7	1.5
31	--	--	--	125	10	3.4	--	--	--
TOTAL	5,710	--	445.8	5,239	--	259.2	4,752	--	281.0
MEAN	190	29	15	169	17	8.4	158	17	9.4
MAX	214	42	22	220	38	22	279	86	65
MIN	176	20	9.8	102	6	1.7	71	4	1.3

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 2000 through September 2001 (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)
					2001				
	July			August			September		
1	73	9	1.8	79	5	1.1	45	12	1.5
2	63	13	2.2	73	19	3.7	43	9	1.0
3	56	15	2.3	62	35	5.9	41	9	1.0
4	51	14	1.9	55	30	4.5	43	9	1.0
5	56	12	1.8	60	21	3.4	48	9	1.2
6	61	10	1.6	52	16	2.2	114	16	4.9
7	62	8	1.3	43	15	1.7	159	21	9.0
8	59	6	.96	38	14	1.4	142	18	6.9
9	52	5	.70	35	15	1.4	126	14	4.8
10	65	6	1.1	35	17	1.6	116	11	3.4
11	60	9	1.5	32	22	1.9	109	9	2.6
12	53	14	2.0	32	28	2.4	109	8	2.4
13	73	17	3.4	33	32	2.9	107	8	2.3
14	84	18	4.1	31	34	2.8	106	8	2.3
15	76	18	3.7	32	36	3.1	106	7	2.0
16	80	19	4.1	38	35	3.6	113	7	2.1
17	100	19	5.1	42	31	3.5	122	6	2.0
18	124	19	6.4	38	27	2.8	124	4	1.3
19	123	18	6.0	37	24	2.4	123	4	1.3
20	113	16	4.9	38	23	2.4	119	4	1.3
21	107	13	3.8	37	24	2.4	120	5	1.6
22	125	9	3.0	37	26	2.6	114	5	1.5
23	121	6	2.0	33	29	2.6	113	5	1.5
24	120	6	1.9	33	31	2.8	108	6	1.7
25	110	5	1.5	32	26	2.2	103	8	2.2
26	96	5	1.3	34	21	1.9	96	9	2.3
27	88	5	1.2	35	19	1.8	95	9	2.3
28	83	5	1.1	40	20	2.2	98	9	2.4
29	76	5	1.0	45	24	2.9	98	9	2.4
30	75	5	1.0	47	22	2.8	98	9	2.4
31	92	4	.99	46	17	2.1	--	--	--
TOTAL	2,577	--	75.65	1,304	--	81.0	3,058	--	74.6
MEAN	83.1	11	2.4	42.1	24	2.6	102	9	2.5
MAX	125	19	6.4	79	36	5.9	159	21	9.0
MIN	51	4	.70	31	5	1.1	41	4	1.0

TOTAL FOR WATER YEAR 2001:

STREAMFLOW---55,183 ft^3/s
SEDIMENT DISCHARGE---3,637.95 tons

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 2000 through September 2001

[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)
				2000					
	October			November			December		
1	692	28	52	827	8	18	e630	10	17
2	978	56	148	809	8	17	e580	9	14
3	879	27	64	781	9	19	e550	8	12
4	778	15	32	779	8	17	e530	7	10
5	719	12	23	818	6	13	e520	6	8.4
6	684	11	20	824	7	16	e500	6	8.1
7	689	11	20	796	7	15	e500	6	8.1
8	697	11	21	737	8	16	e520	5	7.0
9	706	11	21	733	8	16	e530	5	7.2
10	711	11	21	689	7	13	e500	5	6.8
11	698	11	21	649	8	14	e450	5	6.1
12	736	13	26	675	9	16	e380	5	5.1
13	860	22	51	680	10	18	e350	5	4.7
14	962	27	70	639	10	17	e380	5	5.1
15	981	27	72	658	10	18	e500	5	6.8
16	934	23	58	716	9	17	e500	6	8.1
17	892	18	43	679	9	16	e550	6	8.9
18	862	17	40	676	8	15	e600	5	8.1
19	866	15	35	664	8	14	e570	4	6.2
20	871	13	31	611	7	12	e530	3	4.3
21	898	12	29	e550	7	10	e500	2	2.7
22	901	11	27	e550	7	10	561	3	4.5
23	889	10	24	e550	7	10	618	7	12
24	863	9	21	e570	8	12	654	14	25
25	841	8	18	723	13	25	683	21	39
26	827	8	18	697	12	23	694	20	37
27	814	8	18	e650	12	21	676	15	27
28	807	8	17	e600	11	18	663	13	23
29	810	8	17	e580	11	17	623	12	20
30	817	7	15	e600	10	16	618	11	18
31	833	7	16	--	--	--	632	9	15
TOTAL	25,495	--	1,089	20,510	--	479	17,092	--	385.2
MEAN	822	15	35	684	9	16	551	8	12
MAX	981	56	148	827	13	25	694	21	39
MIN	684	7	15	550	6	10	350	2	2.7

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 2000 through September 2001 (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)
					2001				
	January			February			March		
1	650	8	14	590	12	19	e550	22	33
2	e630	8	14	615	12	20	e580	20	31
3	601	8	13	620	12	20	e650	16	28
4	624	8	13	613	14	23	e650	10	18
5	676	8	15	626	16	27	645	9	16
6	690	8	15	644	14	24	660	10	18
7	e600	7	11	e630	10	17	674	12	22
8	514	6	8.3	562	6	9.1	709	14	27
9	514	6	8.3	518	4	5.6	746	19	38
10	569	6	9.2	525	4	5.7	767	21	43
11	633	7	12	559	5	7.5	748	19	38
12	617	7	12	577	6	9.3	735	17	34
13	632	8	14	569	6	9.2	778	26	55
14	623	8	13	e570	7	11	868	41	96
15	596	8	13	569	9	14	838	34	77
16	598	8	13	559	11	17	808	29	63
17	577	9	14	518	12	17	793	24	51
18	537	9	13	537	13	19	780	27	57
19	560	10	15	569	14	22	887	52	125
20	627	11	19	e580	14	22	1,410	283	1110
21	598	12	19	581	16	25	1,370	134	496
22	587	11	17	616	15	25	1,210	70	229
23	605	10	16	620	13	22	1,160	54	169
24	566	8	12	625	11	19	1,170	55	174
25	555	8	12	609	11	18	1,160	54	169
26	593	8	13	574	11	17	1,110	39	117
27	582	10	16	e570	10	15	1,110	34	102
28	557	11	17	e550	11	16	1,050	36	102
29	495	22	29	--	--	--	1,020	32	88
30	501	13	18	--	--	--	1,030	31	86
31	528	11	16	--	--	--	1,000	23	62
TOTAL	18,235	--	443.8	16,295	--	475.4	27,666	--	3,774
MEAN	588	9	14	582	11	17	892	41	122
MAX	690	22	29	644	16	27	1,410	283	1,110
MIN	495	6	8.3	518	4	5.6	550	9	16

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 2000 through September 2001 (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)
				2001					
	April			May			June		
1	958	22	57	2,100	98	556	1,580	11	47
2	958	24	62	2,110	84	479	1,420	10	38
3	955	17	44	1,850	54	270	1,430	12	46
4	913	16	39	1,670	41	185	2,050	34	188
5	896	14	34	1,600	35	151	2,670	71	512
6	868	13	30	1,590	27	116	2,370	45	288
7	864	10	23	1,520	24	98	2,160	30	175
8	883	11	26	1,480	19	76	1,990	22	118
9	877	15	36	1,550	22	92	2,020	22	120
10	857	9	21	1,650	28	125	2,190	25	148
11	837	10	23	1,680	26	118	2,220	28	168
12	824	8	18	1,690	26	119	2,220	26	156
13	813	8	18	1,870	33	167	2,370	31	198
14	802	6	13	2,250	82	498	2,590	40	280
15	786	5	11	2,630	92	653	2,480	39	261
16	764	8	17	3,320	113	1,010	2,250	31	188
17	784	13	28	3,150	86	731	2,070	26	145
18	824	17	38	2,710	53	388	1,950	22	116
19	911	19	47	2,410	33	215	1,860	20	100
20	961	20	52	2,240	27	163	1,740	19	89
21	955	13	34	2,080	22	124	1,590	17	73
22	909	12	29	1,910	19	98	1,450	14	55
23	881	19	45	1,840	16	79	1,360	12	44
24	891	16	38	1,850	17	85	1,300	10	35
25	935	24	61	1,880	16	81	1,240	8	27
26	1,070	42	121	1,990	20	107	1,190	6	19
27	1,290	68	237	2,140	26	150	1,160	6	19
28	1,590	94	404	2,160	23	134	1,160	7	22
29	1,880	110	558	2,120	23	132	1,210	6	20
30	2,020	126	687	1,940	17	89	1,200	5	16
31	--	--	--	1,750	14	66	--	--	--
TOTAL	29,756	--	2,851	62,730	--	7,355	54,490	--	3,711
MEAN	992	26	95	2,024	39	237	1,816	22	124
MAX	2,020	126	687	3,320	113	1,010	2,670	71	512
MIN	764	5	11	1,480	14	66	1,160	5	16

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 2000 through September 2001 (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)
				2001					
	July			August			September		
1	1,140	4	12	1,170	37	117	323	5	4.4
2	1,130	4	12	1,010	24	65	328	7	6.2
3	1,050	4	11	886	14	33	327	8	7.1
4	946	4	10	825	13	29	325	7	6.1
5	919	4	9.9	822	13	29	327	6	5.3
6	923	4	10	793	13	28	346	4	3.7
7	907	4	9.8	737	12	24	394	5	5.3
8	869	4	9.4	687	12	22	474	8	10
9	847	5	11	648	11	19	499	7	9.4
10	803	5	11	622	10	17	491	7	9.3
11	787	6	13	598	9	15	477	7	9.0
12	782	7	15	564	8	12	462	6	7.5
13	811	7	15	543	7	10	465	6	7.5
14	863	8	19	513	7	9.7	469	6	7.6
15	935	10	25	496	7	9.4	461	6	7.5
16	1,020	12	33	481	7	9.1	460	6	7.5
17	1,020	13	36	464	7	8.8	462	6	7.5
18	1,040	13	37	447	6	7.2	464	5	6.3
19	1,070	13	38	434	6	7.0	463	5	6.3
20	1,060	14	40	421	6	6.8	458	5	6.2
21	1,010	14	38	408	5	5.5	460	5	6.2
22	1,000	16	43	387	5	5.2	468	5	6.3
23	1,040	17	48	374	4	4.0	468	5	6.3
24	975	17	45	358	4	3.9	471	5	6.4
25	925	17	42	348	4	3.8	472	7	8.9
26	870	16	38	342	4	3.7	472	7	8.9
27	823	16	36	337	4	3.6	465	7	8.8
28	780	16	34	329	4	3.6	456	7	8.6
29	738	16	32	328	4	3.5	463	6	7.5
30	749	16	32	326	4	3.5	470	5	6.3
31	979	24	63	322	4	3.5	--	--	--
TOTAL	28,811	--	828.1	17,020	--	521.8	13,140	--	213.9
MEAN	929	11	27	549	9	17	438	6	7.1
MAX	1,140	24	63	1,170	37	117	499	8	10
MIN	738	4	9.4	322	4	3.5	323	4	3.7

TOTAL FOR WATER YEAR 2001:

STREAMFLOW---331,240 ft^3/s
SEDIMENT DISCHARGE---22,127.2 *tons*

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 2000 through September 2001

[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)
					2000				
	October			November			December		
1	1,240	6	20	1,300	5	18	1,140	4	12
2	1,640	9	40	1,290	5	17	1,020	5	14
3	1,480	6	24	1,250	5	17	e1,000	5	14
4	1,340	5	18	1,250	6	20	e980	6	16
5	1,250	5	17	1,310	6	21	e970	6	16
6	1,210	5	16	1,320	6	21	e950	6	15
7	1,200	4	13	1,270	5	17	e950	5	13
8	1,210	4	13	1,240	5	17	e950	4	10
9	1,200	4	13	1,210	4	13	e980	3	7.9
10	1,200	4	13	1,140	4	12	e1,000	2	5.4
11	1,190	4	13	1,100	4	12	e800	2	4.3
12	1,200	5	16	1,130	4	12	e650	2	3.5
13	1,340	7	25	1,170	4	13	e600	2	3.2
14	1,520	8	33	1,040	4	11	e700	2	3.8
15	1,540	7	29	1,100	5	15	e900	3	7.3
16	1,480	6	24	1,160	5	16	e900	3	7.3
17	1,400	6	23	e1,150	5	16	e1,000	3	8.1
18	1,350	6	22	1,100	5	15	e1,050	3	8.5
19	1,390	6	23	1,100	5	15	e1,000	3	8.1
20	1,350	6	22	988	5	13	e950	2	5.1
21	1,420	9	35	e940	4	10	e850	2	4.6
22	1,400	7	26	e930	4	10	e900	2	4.9
23	1,400	6	23	933	4	10	e1,000	2	5.4
24	1,360	5	18	943	4	10	e1,050	4	11
25	1,350	4	15	1,210	4	13	e1,100	9	27
26	1,320	4	14	1,190	4	13	e1,100	8	24
27	1,310	4	14	e1,150	4	12	e1,050	7	20
28	1,310	5	18	1,100	4	12	e1,050	6	17
29	1,310	5	18	e1,050	4	11	e1,000	5	14
30	1,310	4	14	e1,100	4	12	e1,000	4	11
31	1,310	3	11	--	--	--	e1,050	3	8.5
TOTAL	41,530	--	623	34,164	--	424	29,640	--	329.9
MEAN	1,340	5	20	1,139	5	14	956	4	11
MAX	1,640	9	40	1,320	6	21	1,140	9	27
MIN	1,190	3	11	930	4	10	600	2	3.2

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 2000 through September 2001 (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)
					2001				
	January			February			March		
1	e1,050	2	5.7	978	4	11	832	4	9.0
2	1,050	2	5.7	964	4	10	853	4	9.2
3	1,020	2	5.5	962	4	10	907	4	9.8
4	1,010	2	5.5	934	4	10	916	3	7.4
5	1,070	3	8.7	959	4	10	923	4	10
6	1,080	2	5.8	983	4	11	943	3	7.6
7	e950	2	5.1	956	4	10	967	4	10
8	e850	3	6.9	884	4	9.5	1,000	5	14
9	e850	3	6.9	e800	4	8.6	1,080	5	15
10	e900	4	9.7	e850	4	9.2	1,120	6	18
11	e1,000	5	14	920	4	9.9	1,060	4	11
12	e1,000	5	14	e900	4	9.7	1,040	4	11
13	1,010	6	16	932	4	10	1,110	7	21
14	1,010	6	16	e900	4	9.7	1,220	8	26
15	989	5	13	847	4	9.1	1,220	8	26
16	e950	3	7.7	837	4	9.0	1,150	9	28
17	e900	2	4.9	e850	4	9.2	1,180	8	25
18	e900	2	4.9	e870	4	9.4	1,140	7	22
19	e950	2	5.1	e920	4	9.9	1,230	9	30
20	980	2	5.3	e920	3	7.5	1,770	26	124
21	930	2	5.0	935	3	7.6	1,930	26	135
22	943	2	5.1	959	3	7.8	1,880	17	86
23	e930	2	5.0	972	3	7.9	1,880	15	76
24	e900	2	4.9	976	3	7.9	1,930	14	73
25	924	2	5.0	961	3	7.8	1,870	14	71
26	e950	2	5.1	930	3	7.5	1,810	14	68
27	e930	3	7.5	905	4	9.8	1,800	13	63
28	e900	3	7.3	843	6	14	1,720	12	56
29	e800	3	6.5	--	--	--	1,680	11	50
30	e850	4	9.2	--	--	--	1,690	11	50
31	879	4	9.5	--	--	--	1,720	10	46
TOTAL	29,455	--	236.5	25,647	--	263.0	41,571	--	1,208.0
MEAN	950	3	7.6	916	4	9.4	1,341	9	39
MAX	1,080	6	16	983	6	14	1,930	26	135
MIN	800	2	4.9	800	3	7.5	832	3	7.4

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 2000 through September 2001 (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)
					2001				
		April			May			June	
1	1,660	14	63	4,660	21	264	4,050	9	98
2	1,590	11	47	4,640	22	276	3,760	8	81
3	1,680	10	45	4,210	19	216	3,760	9	91
4	1,550	11	46	3,800	17	174	4,630	12	150
5	1,510	9	37	3,740	13	131	5,340	24	346
6	1,460	9	35	3,770	14	143	5,110	26	359
7	1,460	10	39	3,660	17	168	4,800	21	272
8	1,510	7	29	3,600	9	87	4,580	18	223
9	1,520	6	25	3,710	9	90	4,640	18	226
10	1,480	8	32	4,040	10	109	4,950	19	254
11	1,440	7	27	4,160	15	168	4,850	19	249
12	1,440	5	19	4,220	11	125	4,790	20	259
13	1,390	5	19	4,700	11	140	5,090	22	302
14	1,380	7	26	5,660	21	321	5,620	24	364
15	1,390	7	26	6,370	32	550	5,760	26	404
16	1,330	8	29	6,780	44	805	5,560	25	375
17	1,380	9	34	6,520	41	722	5,280	22	314
18	1,480	8	32	5,750	28	435	5,050	20	273
19	1,610	8	35	5,280	24	342	4,880	18	237
20	1,730	10	47	4,810	19	247	4,570	15	185
21	1,790	15	72	4,590	13	161	4,150	12	134
22	1,710	7	32	4,290	10	116	3,840	10	104
23	1,680	7	32	4,200	10	113	3,570	9	87
24	1,730	11	51	4,420	10	119	3,440	9	84
25	1,780	8	38	4,760	11	141	3,230	9	78
26	2,130	11	63	5,130	11	152	3,070	10	83
27	2,720	12	88	5,400	12	175	2,880	10	78
28	3,390	15	137	5,500	13	193	2,860	10	77
29	4,210	31	352	5,390	15	218	2,860	6	46
30	4,580	24	297	4,990	14	189	2,710	5	37
31	--	--	--	4,490	11	133	--	--	--
TOTAL	55,710	--	1,854	147,240	--	7,223	129,680	--	5,870
MEAN	1,857	10	62	4,750	17	233	4,323	16	196
MAX	4,580	31	352	6,780	44	805	5,760	26	404
MIN	1,330	5	19	3,600	9	87	2,710	5	37

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 2000 through September 2001 (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)
					2001				
	July			August			September		
1	2,530	5	34	1,970	9	48	691	3	5.6
2	2,410	5	33	1,860	8	40	735	3	6.0
3	2,300	5	31	1,690	7	32	749	3	6.1
4	2,140	6	35	1,570	6	25	766	4	8.3
5	2,080	6	34	1,490	6	24	719	5	9.7
6	2,020	6	33	1,470	5	20	769	4	8.3
7	1,980	6	32	1,380	4	15	811	4	8.8
8	1,940	6	31	1,260	3	10	888	3	7.2
9	1,860	6	30	1,260	3	10	953	3	7.7
10	1,800	6	29	1,190	3	9.6	924	3	7.5
11	1,720	6	28	1,190	4	13	914	3	7.4
12	1,740	7	33	1,140	3	9.2	894	4	9.7
13	1,680	7	32	1,080	4	12	908	4	9.8
14	1,750	6	28	1,090	4	12	876	4	9.5
15	1,780	6	29	1,020	4	11	873	4	9.4
16	1,820	6	29	1,050	4	11	872	4	9.4
17	1,900	6	31	989	4	11	891	4	9.6
18	1,960	6	32	988	4	11	852	4	9.2
19	2,000	7	38	1,020	5	14	863	4	9.3
20	1,900	6	31	983	6	16	860	4	9.3
21	1,880	5	25	932	7	18	854	4	9.2
22	1,810	5	24	904	8	20	870	4	9.4
23	1,800	6	29	869	9	21	854	4	9.2
24	1,760	6	29	850	10	23	859	4	9.3
25	1,640	5	22	823	11	24	857	4	9.3
26	1,610	5	22	813	10	22	866	4	9.4
27	1,510	6	24	757	8	16	851	4	9.2
28	1,450	6	23	735	6	12	834	4	9.0
29	1,390	6	23	696	4	7.5	847	4	9.1
30	1,400	6	23	684	3	5.5	844	4	9.1
31	1,670	7	32	676	3	5.5	--	--	--
TOTAL	57,230	--	909	34,429	--	528.3	25,344	--	260.0
MEAN	1,846	6	29	1,111	6	17	845	4	8.7
MAX	2,530	7	38	1,970	11	48	953	5	9.8
MIN	1,390	5	22	676	3	5.5	691	3	5.6

TOTAL FOR WATER YEAR 2001:

STREAMFLOW---651,640 ft^3/s
SEDIMENT DISCHARGE---19,728.7 tons

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

[Abbreviations: E, estimated; 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, dissolved (µg/L)	Arsenic, total recoverable (µg/L)
12323230	Blacktail Creek at Harrison Avenue, at Butte	03-28-01	0930	109	31	7.6	2.8	4
		03-28-01	0935	109	31	7.6	2.9	4
12323250	Silver Bow Creek below Blacktail Creek, at Butte	07-23-01	1400	177	51	12	8.9	13
		07-23-01	1405	178	51	12	9.1	13
12323770	Warm Springs Creek at Warm Springs	06-04-01	1045	108	33	6.4	3.8	5
		06-04-01	1050	--	--	--	4.0	5
12324200	Clark Fork at Deer Lodge	01-05-01	0845	227	67	15	6.0	9
		01-05-01	0850	231	69	14	6.0	9
12331800	Clark Fork near Drummond	09-04-01	1745	266	72	21	9.4	10
		09-04-01	1750	267	72	21	9.5	10
12334550	Clark Fork at Turah Bridge, near Bonner	05-03-01	1430	111	31	7.8	4.8	8
		05-03-01	1435	112	32	7.9	4.8	8
12340500	Clark Fork above Missoula	05-23-01	1135	85	23	6.9	2.0	E2
		05-23-01	1140	87	23	7.1	2.1	3

Station number	Date	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverable (µg/L)	Lead, dissolved (µg/L)
12323230	03-28-01	<0.14	<0.11	4.5	7.4	170	540	<1
	03-28-01	<.14	<.11	4.2	7.4	170	540	<1
12323250	07-23-01	.62	.68	12	21	E10	120	<1
	07-23-01	.63	.70	13	20	E10	140	<1
12323770	06-04-01	<.10	<.10	5.6	10	20	120	<1
	06-04-01	<.10	<.10	2.9	9.3	--	120	<1
12324200	01-05-01	E.11	.18	4.1	23	<10	390	<1
	01-05-01	<.14	.18	4.1	23	<10	390	<1
12331800	09-04-01	<.10	<.10	3.4	4.6	<10	20	<1
	09-04-01	<.10	<.10	3.6	4.5	<10	20	<1
12334550	05-03-01	<.14	.14	3.3	23	30	720	<1
	05-03-01	<.14	E.10	3.0	24	30	720	<1
12340500	05-23-01	<.10	E.05	1.8	5.1	10	160	<1
	05-23-01	<.10	<.10	2.0	7.0	10	170	<1

Station number	Date	Lead, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Sediment, suspended, diameter, percent finer than 0.062 mm	Sediment, suspended (mg/L)
12323230	03-28-01	1	90	99	5	8	77	10
	03-28-01	<1	92	100	5	8	--	--
12323250	07-23-01	1	151	162	198	209	87	3
	07-23-01	1	156	161	203	207	83	3
12323770	06-04-01	<1	68	130	2	4	65	6
	06-04-01	<1	69	130	2	4	81	6
12324200	01-05-01	3	60	156	14	34	79	16
	01-05-01	3	60	154	14	33	79	17
12331800	09-04-01	<1	4.5	8	1	3	65	4
	09-04-01	<1	4.5	9	1	3	--	--
12334550	05-03-01	4	9.0	97	3	36	77	44
	05-03-01	4	9.1	100	3	35	78	46
12340500	05-23-01	<1	17	31	2	7	88	11
	05-23-01	<1	17	30	1	7	90	10

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	6	0.64	1.4
Magnesium, dissolved, mg/L	6	.30	2.6
Arsenic, total recoverable, µg/L	7	.27	3.6
Arsenic, dissolved, µg/L	7	.09	1.6
Cadmium, total recoverable, µg/L	7	.01	7.3
Cadmium, dissolved, µg/L	7	.01	7.3
Copper, total recoverable, µg/L	7	.66	4.9
Copper, dissolved, µg/L	7	.78	16
Iron, total recoverable, µg/L	7	6.0	2.0
Iron, dissolved, µg/L	6	.0	.0
Lead, total recoverable, µg/L	7	.13	9.2
Lead, dissolved, µg/L	7	.0	.0
Manganese, total recoverable, µg/L	7	1.1	1.1
Manganese, dissolved, µg/L	7	1.5	2.5
Zinc, total recoverable, µg/L	7	.66	1.5
Zinc, dissolved, µg/L	7	1.4	4.2
Sediment, suspended, mg/L	5	.78	4.8
Sediment, suspended, percent finer than 0.062 mm	5	5.3	6.5

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,[1] in units (+/-)	Relative standard deviation, in percent (+/-)	Within limits of data-quality objective
Calcium, dissolved, mg/L	9	0.45	1.24	Yes
Magnesium, dissolved, mg/L	9	.09	.94	Yes
Arsenic, total recoverable, µg/L	9	.72	14	Yes
Arsenic, dissolved, µg/L	9	.09	2.5	Yes
Cadmium, total recoverable, µg/L	9	.01	43	Yes[2]
Cadmium, dissolved, µg/L	9	.01	13	Yes
Copper, total recoverable, µg/L	9	.29	5.4	Yes
Copper, dissolved, µg/L	9	.39	14	Yes
Iron, total recoverable, µg/L	9	2.4	.65	Yes
Iron, dissolved, µg/L	8	1.8	3.1	Yes
Lead, total recoverable, µg/L	9	.02	1.4	Yes
Lead, dissolved, µg/L	9	.12	54	Yes[2]
Manganese, total recoverable, µg/L	9	.78	1.2	Yes
Manganese, dissolved, µg/L	9	.45	1.1	Yes
Zinc, total recoverable, µg/L	9	.18	2.2	Yes
Zinc, dissolved, µg/L	9	.06	2.1	Yes

[1]Statistics calculated using laboratory reporting level for censored values less than the detection capability of the instrument.

[2]Exceedance of data-quality objective results (relative standard deviation of 20 percent) from a statistical artifact of calculating differences between paired values that are predominantly less than the laboratory reporting level. Because such differences are not fully quantified at very low concentrations, the precision estimate may not be representative of analytical performance at detectable concentrations.

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	4	86.6-109	97.7	Yes
Arsenic, dissolved, µg/L	4	92.3-106	99.2	Yes
Cadmium, total recoverable, µg/L	4	101-115	107.9	Yes
Cadmium, dissolved, µg/L	4	98.9-107	102.9	Yes
Copper, total recoverable, µg/L	4	93.7-99.9	96.8	Yes
Copper, dissolved, µg/L	4	98.6-112	105.2	Yes
Iron, total recoverable, µg/L	4	95.5-107	101.3	Yes
Iron, dissolved, µg/L	4	86.7-110	98.3	Yes
Lead, total recoverable, µg/L	4	93.7-99.1	96.4	Yes
Lead, dissolved, µg/L	4	91.9-103	97.3	Yes
Manganese, total recoverable, µg/L	4	79.0-125	101.9	Yes
Manganese, dissolved, µg/L	4	89.9-118	103.7	Yes
Zinc, total recoverable, µg/L	4	82.7-116	99.1	Yes
Zinc, dissolved, µg/L	4	87.9-116	102.0	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	4	96.7-104	100.1	Yes
Arsenic, dissolved, µg/L	4	95.1-110	102.8	Yes
Cadmium, total recoverable, µg/L	4	95.9-116	105.8	Yes
Cadmium, dissolved, µg/L	4	100-106	103.2	Yes
Copper, total recoverable, µg/L	4	87.7-95.9	91.8	Yes
Copper, dissolved, µg/L	4	104-110	106.8	Yes
Iron, total recoverable, µg/L	4	91.4-100	95.8	Yes
Iron, dissolved, µg/L	4	92.1-111	101.6	Yes
Lead, total recoverable, µg/L	4	95.3-99.3	97.3	Yes
Lead, dissolved, µg/L	4	95.2-104	99.7	Yes
Manganese, total recoverable, µg/L	4	84.4-116	100.0	Yes
Manganese, dissolved, µg/L	4	90.3-112	100.9	Yes
Zinc, total recoverable, µg/L	4	75.9-118	96.9	Yes
Zinc, dissolved, µg/L	4	85.7-116	100.8	Yes

Table 13. Chemical analyses of field blanks for water samples

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

Date	Time	Specific conductance, onsite (µS/cm)	pH, onsite (standard units)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Arsenic, dissolved (µg/L)	Arsenic, total recoverable (µg/L)	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)
OCT 2000										
31...	0600	2	5.6	E0.01	<0.01	<0.2	<2	<0.14	<0.11	<1.3
JAN 2001										
08...	1100	2	5.7	E.01	<.01	<.2	<2	<.14	<.11	<1.3
MAR										
21...	1100	2	6.3	E.01	<.01	<.2	<2	<.14	<.11	<1.3
MAY										
04...	1200	2	5.8	<.01	<.01	<.2	<2	<.14	<.11	<1.3
23...	0900	2	5.7	E.01	<.01	<.2	<2	<.10	<.10	<1.0
JUN										
05...	0630	2	5.5	E.01	<.01	<.2	<2	<.10	<.10	<1.0
JUL										
23...	2000	1	6.0	E.01	<.01	<.2	<2	<.10	<.10	<1.0
SEP										
05...	1600	2	5.8	E.01	<.01	<.2	<2	<.10	<.10	<1.0

Date	Copper, total recoverable (µg/L)	Iron, dissolved (µg/L)	Iron, total recoverable (µg/L)	Lead, dissolved (µg/L)	Lead, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Manganese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)
OCT 2000									
31...	<0.6	<10	<10	<1	<1	<0.1	<3	<1	<1
JAN 2001									
08...	<.6	<10	<10	<1	<1	<.1	<3	<1	2
MAR									
21...	<.6	<10	<10	<1	<1	<.1	<3	<1	<1
MAY									
04...	<.6	<10	<10	<1	<1	<.1	<3	<1	<1
23...	<.6	<10	<10	<1	<1	<.1	<3	<1	<1
JUN									
05...	<.6	<10	<10	<1	<1	<.1	<3	<1	<1
JUL								<1	
23...	<.6	<10	<10	<1	<1	E.1	<3		<1
SEP									
05...	<.6	<10	<10	<1	<1	<.1	<3	<1	<1

Table 14. Trace-element analyses of fine-grained bed sediment, upper Clark Fork basin, Montana, August 2001

[Fine-grained sediment is material less than 0.064 millimeter in diameter. Reported 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	41.4	16.8	9,020	37,400	833	3,590	12.7	20.0	10,300
12323750	Silver Bow Creek at Warm Springs	3	4.2	12.3	169	15,400	49	3,220	9.2	<3.8	636
12323800	Clark Fork near Galen	3	7.1	26.4	1,090	26,200	131	12,100	16.9	7.3	1,150
461415112450801	Clark Fork below Lost Creek, near Galen	3	7.3	22.3	1,420	26,300	182	4,650	13.4	6.4	1,300
461559112443301	Clark Fork near Racetrack	3	6.4	20.4	1,100	23,100	130	2,920	10.5	5.6	1,130
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	3	5.9	21.9	882	23,800	121	2,590	9.5	4.8	1,010
12324200	Clark Fork at Deer Lodge	3	5.0	28.2	839	26,100	125	2,150	12.2	4.0	940
12324590	Little Blackfoot River near Garrison	3	2.3	54.4	39	24,200	36	1,520	17.6	<1.5	165
12324680	Clark Fork at Goldcreek	3	3.8	28.3	393	19,900	61	1,160	11.7	2.8	590
12331500	Flint Creek near Drummond	3	7.0	27.2	59	19,800	149	2,950	11.2	7.4	517
12331800	Clark Fork near Drummond	3	7.7	31.6	387	18,300	72	1,150	11.6	3.9	785
12334510	Rock Creek near Clinton	3	3.7	21.3	11	14,900	12	213	9.8	1.9	37
12334550	Clark Fork at Turah Bridge, near Bonner	3	7.3	29.0	352	17,500	66	1,060	11.5	3.6	789
12340000	Blackfoot River near Bonner	3	<1.5	24.5	18	17,800	14	581	10.5	<1.5	53
12340500	Clark Fork above Missoula	3	2.6	30.1	233	19,200	47	767	11.8	2.9	511
12353000	Clark Fork below Missoula[1]	3	6.0	27.3	107	20,300	37	986	12.4	3.0	292

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

Table 15. Trace-element analyses of bulk bed sediment, upper Clark Fork basin, Montana, August 2001

[Bulk bed sediment collected in this study generally is material smaller than about 10 millimeters in diameter. Reported concentrations are the mean of all analyses for replicate aliquots of 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	2	22.2	14.5	2,780	27,500	363	2,590	9.2	7.1	5,110
12323750	Silver Bow Creek at Warm Springs	2	<2.6	5.3	32	9,910	12	698	5.4	<2.6	126
12323800	Clark Fork near Galen	2	3.5	15.8	584	16,300	79	6,810	9.3	3.5	649
461415112450801	Clark Fork below Lost Creek, near Galen	2	3.1	12.2	599	19,400	89	1,840	6.8	<2.6	598
461559112443301	Clark Fork near Racetrack	2	2.7	10.1	475	18,200	59	974	5.5	2.9	541
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	2	2.9	14.1	283	23,500	57	1,130	5.8	3.0	441
12324200	Clark Fork at Deer Lodge	2	<2.6	19.6	363	19,200	62	607	9.3	<2.6	499
12324590	Little Blackfoot River near Garrison	2	<1.5	32.1	12	17,300	14	333	11.7	<1.5	65
12324680	Clark Fork at Goldcreek	2	<2.6	15.0	197	15,400	37	706	9.0	<2.6	368
12331500	Flint Creek near Drummond	2	3.8	11.4	16	12.800	55	1,660	5.2	5.2	201
12331800	Clark Fork near Drummond	2	4.7	17.5	162	13,400	35	656	9.2	2.1	470
12334510	Rock Creek near Clinton	2	<1.5	8.0	3	7,170	4	74	4.5	<1.5	7
12334550	Clark Fork at Turah Bridge, near Bonner	2	4.9	20.3	198	13,400	41	642	9.0	2.6	485
1234000	Blackfoot River near Bonner	2	<1.5	19.2	16	17,000	11	368	9.6	<1.5	47
12340500	Clark Fork above Missoula	2	<1.5	17.2	64	16,200	20	388	9.1	<1.5	218
12353000	Clark Fork below Missoula[1]	2	2.0	7.4	17	8,850	9	249	4.9	<1.5	69

[1]Samples collected about 30 miles downstream from streamflow-gaging 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]

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	9	1:5	0.4	--	--
Chromium	9	1:5	130	76.4	73.5-79.2
Copper	9	1:5	35	80.5	78.9-82.1
Iron	9	1:5	35,000	88.7	86.8-90.6
Lead	9	1:5	19	90.4	89.2-91.7
Manganese	9	1:5	538	86.5	84.8-88.1
Nickel	9	1:5	88	87.9	86.3-89.5
Silver	9	1:5	.4	--	--
Zinc	9	1:5	106	71.8	70.5-73.2
			SRM sample 2711		
Cadmium	9	1:10	41.7	99.7	99.1-100
Chromium	9	1:10	47.0	47.6	44.0-51.3
Copper	9	1:10	114	88.8	88.1-89.6
Iron	9	1:10	28,900	90.4	89.6-91.1
Lead	9	1:10	1,160	102.9	102-103
Manganese	9	1:10	638	81.1	80.6-81.7
Nickel	9	1:10	20.6	85.9	85.0-86.9
Silver	9	1:10	4.6	100.8	90.1-112
Zinc	9	1:10	350	90.0	88.5-91.4

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]

Station number	Station name	Dilution ratio	Trace-element concentration, in µg/mL								
			Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Silver	Zinc
12323600	Silver Bow Creek at Opportunity	1:1	<0.02	<0.012	<0.01	<0.03	<0.006	<0.05	<0.003	<0.02	<0.097
12323750	Silver Bow Creek at Warm Springs	1:1	<.02	<.012	<.01	<.03	<.006	<.05	<.003	<.02	<.097
12323800	Clark Fork near Galen	1:1	<.02	<.012	<.01	<.03	<.006	<.05	<.003	<.02	<.097
461415112450801	Clark Fork below Lost Creek, near Galen	1:1	<.02	<.012	<.01	<.03	<.006	<.05	<.003	<.02	<.097
461559112443301	Clark Fork near Racetrack	1:1	<.02	<.012	<.01	<.03	<.006	<.05	<.003	<.02	<.097
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	1:1	<.02	<.012	<.01	<.03	<.006	<.05	<.003	<.02	<.097
12324200	Clark Fork at Deer Lodge	1:1	<.02	<.012	<.01	<.03	<.006	<.05	<.003	<.02	<.097
12324590	Little Blackfoot River near Garrison	1:1	<.02	<.012	<.01	1.67	<.006	<.05	<.003	<.02	<.097
12324680	Clark Fork at Goldcreek	1:1	<.02	<.012	<.01	<.03	<.006	<.05	<.003	<.02	<.097
12331500	Flint Creek near Drummond	1:1	<.02	<.012	<.01	<.03	<.006	<.05	<.003	<.02	<.097
12331800	Clark Fork near Drummond	1:1	<.02	<.012	<.01	<.03	<.006	<.05	<.003	<.02	<.097
12334510	Rock Creek near Clinton	1:1	<.02	<.012	<.01	<.03	<.006	<.05	<.003	<.02	.110
12334550	Clark Fork at Turah Bridge, near Bonner	1:1	<.02	<.012	<.01	<.03	<.006	<.05	<.003	<.02	<.097
12340000	Blackfoot River near Bonner	1:1	<.02	<.012	<.01	<.03	<.006	<.05	<.003	<.02	<.097
12340500	Clark Fork above Missoula	1:1	<.02	<.012	<.01	<.03	<.006	<.05	<.003	<.02	<.097
12353000	Clark Fork below Missoula	1:1	<.02	<.012	<.01	<.03	<.006	<.05	<.003	<.02	<.097

Table 18. Trace-element analyses of biota, upper Clark Fork basin, Montana, August 2001

[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; spp, species. 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									
Hydropsyche spp.	2	10.6	1.2	864	1,510	42.7	893	2.0	1,210
12323750 Silver Bow Creek at Warm Springs									
Hydropsyche cockerelli	2	.4	.5	25.2	535	1.4	1,420	1.0	149
Hydropsyche occidentalis	1	.4	1.0	11.0	744	1.9	2,160	1.1	141
12323800 Clark Fork near Galen									
Hydropsyche cockerelli	2	2.0	1.9	79.5	1,230	6.1	3,270	1.5	204
Hydropsyche occidentalis	2	1.2	2.8	81.5	1,470	7.5	5,160	1.9	227
461415112450801 Clark Fork below Lost Creek, near Galen									
Hydropsyche cockerelli	1	2.2	1.0	81.6	691	4.5	1,720	1.0	181
461559112443301 Clark Fork near Racetrack									
Hydropsyche cockerelli	3	1.4	1.1	62.8	686	4.0	1,950	.7	164
Hydropsyche occidentalis	1	.8	1.8	66.8	1,140	7.2	3,770	1.3	200
461903112440701 Clark Fork at Dempsey Creek diversion, near Racetrack									
Hydropsyche cockerelli	3	1.5	.8	77.4	747	3.9	1,200	.7	183
Hydropsyche occidentalis	1	1.2	1.6	79.9	940	6.1	2,720	1.2	237
12324200 Clark Fork at Deer Lodge									
Hydropsyche cockerelli	1	2.2	1.1	97.7	1,040	7.1	1,200	.9	207
Hydropsyche occidentalis	3	1.2	1.8	92.0	1,130	9.2	2,270	1.3	259
12324590 Little Blackfoot River near Garrison									
Arctopsyche grandis	5	.7	.9	13.7	585	.8	997	1.1	197
Claassenia sabulosa	2	.2	.3	29.2	178	.2	76	.5	196
12324680 Clark Fork at Goldcreek									
Arctopsyche grandis	3	2.0	1.2	27.4	866	2.9	870	.8	235
Claassenia sabulosa	1	.3	.5	64.7	567	1.8	279	.5	203
Hydropsyche cockerelli	2	.8	.7	23.4	667	3.6	869	.5	140
12331500 Flint Creek near Drummond									
Arctopsyche grandis	1	.2	.3	8.9	412	7.6	424	1.2	93.3
Hydropsyche cockerelli	1	.2	2.0	21.0	2,320	20.5	1,450	1.8	205
12331800 Clark Fork near Drummond									
Arctopsyche grandis	2	1.2	.4	18.2	418	4.5	797	.5	196
Claassenia sabulosa	4	.6	.2	69.8	176	.9	152	.3	295
Hydropsyche cockerelli	4	.7	.8	32.7	846	8.0	1,070	.8	177
Hydropsyche occidentalis	1	.8	1.5	38.9	1,190	14.0	2,390	1.2	228

Table 18. Trace-element analyses of biota, upper Clark Fork basin, Montana, August 2001 (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	4	.2	1.3	9.1	977	.4	310	1.5	143
Claassenia sabulosa	2	.2	.2	22.5	104	.1	33	.4	150
12334550 Clark Fork at Turah Bridge, near Bonner									
Arctopsyche grandis	4	.7	1.0	29.2	856	4.9	729	1.0	190
Claassenia sabulosa	1	.4	.1	43.2	142	.5	57	.3	206
Hydropsyche cockerelli	2	.6	1.4	46.8	1,360	6.7	712	1.4	201
Hydropsyche occidentalis	1	.6	1.7	46.5	1,390	8.4	998	1.5	223
12340500 Clark Fork above Missoula									
Arctopsyche grandis	4	.5	.8	27.2	570	2.4	934	.9	144
Claassenia sabulosa	1	.4	.4	46.8	229	.8	394	.3	191
Hydropsyche cockerelli	1	.5	1.8	44.1	1,490	5.5	1,470	1.4	167
12353000 Clark Fork below Missoula[1]									
Arctopsyche grandis	1	.4	.8	13.2	682	1.4	870	.7	140
Claassenia sabulosa	2	.2	.3	60.8	139	.1	108	.2	206
Hydropsyche cockerelli	4	.3	1.7	23.2	1,520	2.4	833	1.4	136
Hydropsyche occidentalis	1	.3	1.4	20.0	1,200	2.7	491	1.3	137

[1]Samples collected about 30 miles downstream from streamflow-gaging 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	12	26.7	90.5	87.1-93.9
Chromium	12	.77	79.1	70.7-87.4
Copper	12	106	89.5	87.7-91.2
Iron	12	105	83.3	78.0-88.6
Lead	[1]0	.35	--	--
Manganese	12	13.6	83.9	78.4-89.4
Nickel	12	2.5	89.3	69.3-109
Zinc	12	180	89.5	83.1-96.0

[1]Certified lead concentration in SRM was below the analytical detection limit.

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	<0.05	<0.05	<0.02	<0.10	<0.01	<0.02	<0.05	<0.02
12323750	Silver Bow Creek at Warm Springs	1:1	<.05	<.05	<.02	<.10	<.01	<.02	<.05	<.02
12323800	Clark Fork near Galen	1:1	<.05	<.05	<.02	<.10	<.01	<.02	<.05	<.02
461415112450801	Clark Fork below Lost Creek, near Galen	1:1	<.05	<.05	<.02	<.10	<.01	<.02	<.05	<.02
461559112443301	Clark Fork near Racetrack	1:1	<.05	<.05	<.02	<.10	<.01	<.02	<.05	<.02
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	1:1	<.05	<.05	<.02	<.10	<.01	<.02	<.05	<.02
12324200	Clark Fork at Deer Lodge	1:1	<.05	<.05	<.02	<.10	<.01	<.02	<.05	<.02
12324590	Little Blackfoot River near Garrison	1:1	<.05	<.05	<.02	<.10	<.01	<.02	<.05	<.02
12324680	Clark Fork at Goldcreek	1:1	<.05	<.05	<.02	<.10	<.01	<.02	<.05	<.02
12331500	Flint Creek near Drummond	1:1	<.05	<.05	<.02	<.10	<.01	<.02	<.05	<.02
12331800	Clark Fork near Drummond	1:1	<.05	<.05	<.02	<.10	<.01	<.02	<.05	<.02
12334550	Clark Fork at Turah Bridge, near Bonner	1:1	<.05	<.05	<.02	<.10	<.01	<.02	<.05	<.02
12340500	Clark Fork above Missoula	1:1	<.05	<.05	<.02	<.10	<.01	<.02	<.05	<.02
12353000	Clark Fork below Missoula	1:1	<.05	<.05	<.02	<.10	<.01	<.02	<.05	<.02

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2001

[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 laboratory 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 2001					
Streamflow, instantaneous (ft^3/s)	67	156	1.9	16	8.3
Specific conductance, onsite (µS/cm)	67	412	116	261	262
Temperature, water (°C)	67	17.5	2.0	8.1	7.5
pH, onsite (standard units)	67	8.2	7.3	7.8	7.8
Hardness, total (mg/L as $CaCO_3$)	67	150	38	103	110
Calcium, dissolved (mg/L)	67	42	11	29	31
Magnesium, dissolved (mg/L)	67	11	2.7	7.2	7.3
Arsenic, total recoverable (µg/L)	67	18	2	6	4
Arsenic, dissolved (µg/L)	67	13	1	4	3
Cadmium, total recoverable (µg/L)	67	.05	<.1	--	<1
Cadmium, dissolved (µg/L)	67	.5	<.1	[2]<.1	<.1
Copper, total recoverable (µg/L)	67	52	2	7	6
Copper, dissolved (µg/L)	67	10	<.8	[2]4	3
Iron, total recoverable (µg/L)	67	4,200	140	743	570
Iron, dissolved (µg/L)	67	480	20	170	160
Lead, total recoverable (µg/L)	67	47	<1	[2]3	1
Lead, dissolved (µg/L)	67	1	<.5	[2].3	<.5
Manganese, total recoverable (µg/L)	67	240	24	62	55
Manganese, dissolved (µg/L)	67	100	17	42	40
Zinc, total recoverable (µg/L)	67	130	<10	[2]11	3
Zinc, dissolved (µg/L)	67	11	<3	[2]4	2
Sediment, suspended concentration (mg/L)	67	139	2	16	8
Sediment, suspended discharge (ton/d)	67	59	.02	1.7	.16
Sediment, suspended (percent finer than 0.062 mm)	67	97	50	83	86

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2001 (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 2001**					
Streamflow, instantaneous (ft^3/s)	67	134	13	32	26
Specific conductance, onsite (µS/cm)	67	691	226	463	470
Temperature, water (°C)	67	20.0	1.0	10.0	9.0
pH, onsite (standard units)	67	8.1	7.2	7.6	7.5
Hardness, total (mg/L as $CaCO_3$)	67	180	66	147	150
Calcium, dissolved (mg/L)	67	52	19	42	43
Magnesium, dissolved (mg/L)	67	13	4.5	10	11
Arsenic, total recoverable (µg/L)	67	45	7	14	12
Arsenic, dissolved (µg/L)	67	13	4	7	7
Cadmium, total recoverable (µg/L)	67	6	.7	2.4	2
Cadmium, dissolved (µg/L)	67	6.2	.2	1.8	1.4
Copper, total recoverable (µg/L)	67	550	16	138	106
Copper, dissolved (µg/L)	67	300	6	59	47
Iron, total recoverable (µg/L)	67	7,400	90	1,250	760
Iron, dissolved (µg/L)	67	270	<10	[2]97	84
Lead, total recoverable (µg/L)	67	250	1	22	10
Lead, dissolved (µg/L)	67	2.4	<.5	[2].7	<1
Manganese, total recoverable (µg/L)	67	1,600	160	597	590
Manganese, dissolved (µg/L)	67	1,700	137	539	500
Zinc, total recoverable (µg/L)	67	2,200	178	717	570
Zinc, dissolved (µg/L)	67	2,200	118	593	488
Sediment, suspended concentration (mg/L)	66	405	3	34	14
Sediment, suspended discharge (ton/d)	66	70	.14	4.2	1.1
Sediment, suspended (percent finer than 0.062 mm)	66	98	42	83	86

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2001 (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 2001**					
Streamflow, instantaneous (ft^3/s)	70	361	13	81	54
Specific conductance, onsite (µS/cm)	69	616	202	395	383
Temperature, water (°C)	69	22.5	0.0	9.0	9.0
pH, onsite (standard units)	69	9.5	7.2	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	69	220	60	140	140
Calcium, dissolved (mg/L)	69	63	18	41	41
Magnesium, dissolved (mg/L)	69	15	3.4	9.0	8.6
Arsenic, total recoverable (µg/L)	69	240	11	31	18
Arsenic, dissolved (µg/L)	69	34	1	10	9
Cadmium, total recoverable (µg/L)	69	49	.6	2.9	2.0
Cadmium, dissolved (µg/L)	69	41	.1	1.7	1.1
Copper, total recoverable (µg/L)	69	3,900	60	281	140
Copper, dissolved (µg/L)	69	450	19	58	46
Iron, total recoverable (µg/L)	69	24,000	260	1,900	890
Iron, dissolved (µg/L)	69	310	<10	[2]53	27
Lead, total recoverable (µg/L)	69	650	7	49	17
Lead, dissolved (µg/L)	69	5.1	<.5	[2].8	<1
Manganese, total recoverable (µg/L)	69	10,000	174	734	545
Manganese, dissolved (µg/L)	69	9,300	68	599	460
Zinc, total recoverable (µg/L)	69	15,000	144	751	480
Zinc, dissolved (µg/L)	69	13,000	27	450	260
Sediment, suspended concentration (mg/L)	70	801	6	63	20
Sediment, suspended discharge (ton/d)	70	781	.25	29	3.2
Sediment, suspended (percent finer than 0.062 mm)	70	95	37	77	82

'able 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 ırough September 2001 (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 2001					
Streamflow, instantaneous (ft^3/s)	76	662	16	155	99
Specific conductance, onsite (µS/cm)	74	783	249	460	458
Temperature, water (°C)	75	22.0	.5	10.9	11.5
pH, onsite (standard units)	74	9.3	8.0	8.8	8.8
Hardness, total (mg/L as $CaCO_3$)	74	310	97	190	190
Calcium, dissolved (mg/L)	74	90	28	55	55
Magnesium, dissolved (mg/L)	74	21	5.9	13	12
Arsenic, total recoverable (µg/L)	74	94	10	26	24
Arsenic, dissolved (µg/L)	74	60	7	21	21
Cadmium, total recoverable (µg/L)	74	.2	<.1	[2]<.1	<1
Cadmium, dissolved (µg/L)	74	.3	<.1	[2].1	<.1
Copper, total recoverable (µg/L)	74	80	3	21	16
Copper, dissolved (µg/L)	74	40	2	11	9
Iron, total recoverable (µg/L)	74	3,000	70	383	300
Iron, dissolved (µg/L)	74	90	<5	[2]20	20
Lead, total recoverable (µg/L)	74	15	<1	[2]2	2
Lead, dissolved (µg/L)	74	1.0	<.5	--	<.5
Manganese, total recoverable (µg/L)	74	900	60	201	159
Manganese, dissolved (µg/L)	74	880	12	130	96
Zinc, total recoverable (µg/L)	74	180	<10	[2]45	30
Zinc, dissolved (µg/L)	74	73	<3	[2]11	7
Sediment, suspended concentration (mg/L)	76	229	1	13	7
Sediment, suspended discharge (ton/d)	76	279	.11	9.7	1.9
Sediment, suspended (percent finer than 0.062 mm)	75	97	43	82	84

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2001 (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 2001					
Streamflow, instantaneous (ft^3/s)	52	420	2.8	104	57
Specific conductance, onsite (µS/cm)	51	795	139	304	269
Temperature, water (°C)	52	18	.5	8.9	9.0
pH, onsite (standard units)	51	8.7	7.4	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	51	420	66	147	130
Calcium, dissolved (mg/L)	51	130	20	45	40
Magnesium, dissolved (mg/L)	51	22	3.6	8.5	7.4
Arsenic, total recoverable (µg/L)	51	27	3	8	6
Arsenic, dissolved (µg/L)	51	14	2	5	4
Cadmium, total recoverable (µg/L)	51	.2	<.1	--	<1
Cadmium, dissolved (µg/L)	51	<.1	<.1	--	<.1
Copper, total recoverable (µg/L)	51	97	2	21	10
Copper, dissolved (µg/L)	51	16	1	4	3
Iron, total recoverable (µg/L)	51	1,700	40	336	130
Iron, dissolved (µg/L)	51	30	<5	[2]14	10
Lead, total recoverable (µg/L)	51	14	<1	[2]2	<1
Lead, dissolved (µg/L)	51	1.8	<.5	--	<.5
Manganese, total recoverable (µg/L)	51	1,400	57	241	200
Manganese, dissolved (µg/L)	51	570	29	148	110
Zinc, total recoverable (µg/L)	51	60	<10	[2]11	2
Zinc, dissolved (µg/L)	51	10	<1	[2]3	<20
Sediment, suspended concentration (mg/L)	52	100	2	20	10
Sediment, suspended discharge (ton/d)	51	87	.05	11	1.2
Sediment, suspended (percent finer than 0.062 mm)	52	88	55	74	75

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2001 (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 2001**					
Streamflow, instantaneous (ft^3/s)	117	1,050	14	216	129
Specific conductance, onsite (µS/cm)	105	720	197	430	438
Temperature, water (°C)	116	22.5	0.0	9.7	9.8
pH, onsite (standard units)	104	9.0	7.5	8.5	8.5
Hardness, total (mg/L as $CaCO_3$)	103	370	81	187	190
Calcium, dissolved (mg/L)	103	110	24	55	57
Magnesium, dissolved (mg/L)	103	22	5.1	12	12
Arsenic, total recoverable (µg/L)	103	78	3	20	16
Arsenic, dissolved (µg/L)	103	53	4	15	12
Cadmium, total recoverable (µg/L)	103	3	<.1	[2].2	<1
Cadmium, dissolved (µg/L)	103	1	<.1	[2].07	<.1
Copper, total recoverable (µg/L)	102	240	5	33	19
Copper, dissolved (µg/L)	103	50	2	10	8
Iron, total recoverable (µg/L)	103	9,200	60	574	300
Iron, dissolved (µg/L)	103	110	<3	[2]21	20
Lead, total recoverable (µg/L)	103	28	<1	[2]4	2
Lead, dissolved (µg/L)	103	3	<.5	[2].3	<.6
Manganese, total recoverable (µg/L)	103	1,400	47	265	200
Manganese, dissolved (µg/L)	103	460	25	121	89
Zinc, total recoverable (µg/L)	103	360	<10	[2]52	40
Zinc, dissolved (µg/L)	103	110	<3	[2]13	9
Sediment, suspended concentration (mg/L)	117	338	2	21	8
Sediment, suspended discharge (ton/d)	117	459	.12	24	2.5
Sediment, suspended (percent finer than 0.062 mm)	116	97	41	78	78

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2001 (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 2001**					
Streamflow, instantaneous (ft^3/s)	169	1,920	23	298	225
Specific conductance, onsite (µS/cm)	152	642	234	488	506
Temperature, water (°C)	168	23.0	0.0	9.6	10.0
pH, onsite (standard units)	117	8.9	7.4	8.2	8.3
Hardness, total (mg/L as $CaCO_3$)	109	270	95	205	210
Calcium, dissolved (mg/L)	109	81	28	60	62
Magnesium, dissolved (mg/L)	109	18	5.9	13	14
Arsenic, total recoverable (µg/L)	119	220	8	26	17
Arsenic, dissolved (µg/L)	119	39	6	14	13
Cadmium, total recoverable (µg/L)	119	5	<.1	[2].5	<1
Cadmium, dissolved (µg/L)	119	2	<.1	[2].06	<.1
Copper, total recoverable (µg/L)	118	1,500	8	99	44
Copper, dissolved (µg/L)	119	120	4	12	9
Iron, total recoverable (µg/L)	119	29,000	30	1,910	690
Iron, dissolved (µg/L)	119	190	<3	[2]21	10
Lead, total recoverable (µg/L)	119	200	<1	[2]13	5
Lead, dissolved (µg/L)	119	6	<.5	[2].5	<1
Manganese, total recoverable (µg/L)	119	4,600	12	293	170
Manganese, dissolved (µg/L)	119	400	1	45	33
Zinc, total recoverable (µg/L)	119	1,700	4	111	60
Zinc, dissolved (µg/L)	119	230	<10	[2]15	11
Sediment, suspended concentration (mg/L)	169	2,250	2	82	24
Sediment, suspended discharge (ton/d)	169	8,690	.29	186	12
Sediment, suspended (percent finer than 0.062 mm)	160	99	40	71	72

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2001 (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 2001**					
Streamflow, instantaneous (ft^3/s)	96	2,080	15	292	178
Specific conductance, onsite (µS/cm)	84	338	120	228	221
Temperature, water (°C)	95	22	0.0	8.3	9.0
pH, onsite (standard units)	83	8.5	7.0	8.1	8.1
Hardness, total (mg/L as $CaCO_3$)	78	160	51	105	100
Calcium, dissolved (mg/L)	78	47	14	30	30
Magnesium, dissolved (mg/L)	78	10	3.3	7.0	7.0
Arsenic, total recoverable (µg/L)	83	17	4	7	6
Arsenic, dissolved (µg/L)	83	7	3	5	5
Cadmium, total recoverable (µg/L)	83	2	<.1	[2].2	<1
Cadmium, dissolved (µg/L)	83	1	<.1	--	<.1
Copper, total recoverable (µg/L)	82	45	<1	[2]4	3
Copper, dissolved (µg/L)	83	7	<1	[2]2	2
Iron, total recoverable (µg/L)	83	25,000	20	1,170	260
Iron, dissolved (µg/L)	83	120	<3	[2]45	30
Lead, total recoverable (µg/L)	83	25	<1	[2]3	<5
Lead, dissolved (µg/L)	82	6	<.5	[2].4	<1
Manganese, total recoverable (µg/L)	83	1,100	<10	[2]71	30
Manganese, dissolved (µg/L)	83	45	1	9	8
Zinc, total recoverable (µg/L)	83	140	<1	[2]13	<40
Zinc, dissolved (µg/L)	83	24	<1	[2]3	<20
Sediment, suspended concentration (mg/L)	96	1,410	1	53	10
Sediment, suspended discharge (ton/d)	96	7,920	.08	144	4.4
Sediment, suspended (percent finer than 0.062 mm)	96	97	32	74	79

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2001 (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 2001**					
Streamflow, instantaneous (ft^3/s)	75	3,920	87	786	529
Specific conductance, onsite (µS/cm)	74	510	207	372	392
Temperature, water (°C)	75	21.5	0.0	9.5	9.5
pH, onsite (standard units)	74	8.8	7.9	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	74	230	86	163	170
Calcium, dissolved (mg/L)	74	68	26	48	51
Magnesium, dissolved (mg/L)	74	15	5.1	10	11
Arsenic, total recoverable (µg/L)	74	75	7	16	13
Arsenic, dissolved (µg/L)	74	20	6	10	10
Cadmium, total recoverable (µg/L)	74	2	<.1	[2].2	<1
Cadmium, dissolved (µg/L)	74	.2	<.1	--	<.1
Copper, total recoverable (µg/L)	73	440	5	48	33
Copper, dissolved (µg/L)	73	36	3	8	6
Iron, total recoverable (µg/L)	74	12,000	30	1,050	510
Iron, dissolved (µg/L)	74	100	<3	[2]23	20
Lead, total recoverable (µg/L)	73	73	<1	[2]7	4
Lead, dissolved (µg/L)	73	.8	<.5	--	<.5
Manganese, total recoverable (µg/L)	74	1,100	10	144	100
Manganese, dissolved (µg/L)	74	57	4	21	20
Zinc, total recoverable (µg/L)	74	510	2	57	39
Zinc, dissolved (µg/L)	74	26	<1	[2]7	5
Sediment, suspended concentration (mg/L)	75	752	2	62	23
Sediment, suspended discharge (ton/d)	75	7,960	.94	291	37
Sediment, suspended (percent finer than 0.062 mm)	75	93	43	75	78

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2001 (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 2001**					
Streamflow, instantaneous (ft^3/s)	123	892	2.8	189	121
Specific conductance, onsite (µS/cm)	112	529	134	301	300
Temperature, water (°C)	121	21.0	0.0	9.0	9.5
pH, onsite (standard units)	109	8.8	7.5	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	102	260	59	141	140
Calcium, dissolved (mg/L)	102	73	16	38	38
Magnesium, dissolved (mg/L)	102	20	4.3	11	11
Arsenic, total recoverable (µg/L)	109	57	7	18	13
Arsenic, dissolved (µg/L)	109	20	5	9	8
Cadmium, total recoverable (µg/L)	109	3	<.1	[2].2	<1
Cadmium, dissolved (µg/L)	109	.1	<.1	--	<.1
Copper, total recoverable (µg/L)	108	32	1	7	5
Copper, dissolved (µg/L)	109	7	<1	[2]2	2
Iron, total recoverable (µg/L)	109	7,200	60	928	480
Iron, dissolved (µg/L)	109	240	<10	[2]40	26
Lead, total recoverable (µg/L)	109	87	<1	[2]12	7
Lead, dissolved (µg/L)	109	7	<.5	[2].7	<1
Manganese, total recoverable (µg/L)	109	1,600	50	216	132
Manganese, dissolved (µg/L)	109	140	14	42	34
Zinc, total recoverable (µg/L)	109	290	<10	[2]39	28
Zinc, dissolved (µg/L)	109	27	<1	[2]5	3
Sediment, suspended concentration (mg/L)	123	556	3	53	27
Sediment, suspended discharge (ton/d)	120	904	.02	48	8.6
Sediment, suspended (percent finer than 0.062 mm)	123	98	28	80	84

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2001 (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 2001**					
Streamflow, instantaneous (ft^3/s)	75	3,860	149	1,100	817
Specific conductance, onsite (µS/cm)	74	630	189	406	429
Temperature, water (^oC)	75	22.5	.5	10.4	11.0
pH, onsite (standard units)	74	8.5	7.8	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	74	300	74	183	190
Calcium, dissolved (mg/L)	74	83	21	52	55
Magnesium, dissolved (mg/L)	74	22	5.2	13	13
Arsenic, total recoverable (µg/L)	74	62	8	17	14
Arsenic, dissolved (µg/L)	74	20	7	11	10
Cadmium, total recoverable (µg/L)	74	2	<.1	[2].2	<1
Cadmium, dissolved (µg/L)	74	.2	<.1	[2]<.1	<.1
Copper, total recoverable (µg/L)	72	360	5	50	24
Copper, dissolved (µg/L)	72	21	1	7	5
Iron, total recoverable (µg/L)	74	8,800	20	1,180	540
Iron, dissolved (µg/L)	74	150	<3	[2]25	20
Lead, total recoverable (µg/L)	70	56	<1	[2]9	4
Lead, dissolved (µg/L)	70	1.2	<.5	[2].3	<.5
Manganese, total recoverable (µg/L)	74	880	8	167	106
Manganese, dissolved (µg/L)	74	61	4	18	15
Zinc, total recoverable (µg/L)	74	490	3	74	42
Zinc, dissolved (µg/L)	74	21	<3	[2]7	5
Sediment, suspended concentration (mg/L)	75	530	2	75	29
Sediment, suspended discharge (ton/d)	75	4,720	1.7	393	64
Sediment, suspended (percent finer than 0.062 mm)	75	92	38	74	75

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2001 (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 2001**					
Streamflow, instantaneous (ft^3/s)	95	5,060	113	989	558
Specific conductance, onsite (µS/cm)	86	158	53	106	99
Temperature, water (^oC)	95	18	0.0	82	8.5
pH, onsite (standard units)	85	8.8	6.9	7.9	7.9
Hardness, total (mg/L as $CaCO_3$)	77	90	22	50	49
Calcium, dissolved (mg/L)	77	23	5.9	13	13
Magnesium, dissolved (mg/L)	77	8.0	1.9	4.2	4.0
Arsenic, total recoverable (µg/L)	83	3	<1	[2].9	<1
Arsenic, dissolved (µg/L)	83	1	<1	[2].6	<1
Cadmium, total recoverable (µg/L)	83	3	<.1	[2].3	<1
Cadmium, dissolved (µg/L)	83	1	<.1	--	<.1
Copper, total recoverable (µg/L)	81	41	<1	[2]4	2
Copper, dissolved (µg/L)	82	6	<1	[2]1	<1
Iron, total recoverable (µg/L)	83	2,100	20	317	140
Iron, dissolved (µg/L)	83	160	<10	[2]34	30
Lead, total recoverable (µg/L)	81	19	<1	[2]2	<1
Lead, dissolved (µg/L)	81	5	<.5	[2].5	<1
Manganese, total recoverable (µg/L)	83	90	<1	[2]16	9
Manganese, dissolved (µg/L)	83	8	<1	[2]2	2
Zinc, total recoverable (µg/L)	83	60	<1	[2]7	<10
Zinc, dissolved (µg/L)	83	15	<1	[2]2	<3
Sediment, suspended concentration (mg/L)	95	223	1	22	6
Sediment, suspended discharge (ton/d)	95	3,050	.31	152	12
Sediment, suspended (percent finer than 0.062 mm)	95	95	35	69	71

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2001 (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 2001**					
Streamflow, instantaneous (ft^3/s)	172	9,560	296	1,870	1,120
Specific conductance, onsite (µS/cm)	147	483	140	307	327
Temperature, water (°C)	171	22.0	0.0	9.3	9.5
pH, onsite (standard units)	118	8.8	7.4	8.2	8.3
Hardness, total (mg/L as $CaCO_3$)	108	210	58	134	140
Calcium, dissolved (mg/L)	108	59	16	38	39
Magnesium, dissolved (mg/L)	108	14	3.9	9.6	9.6
Arsenic, total recoverable (µg/L)	117	110	3	11	8
Arsenic, dissolved (µg/L)	117	17	3	6	5
Cadmium, total recoverable (µg/L)	117	4	<.1	[2].3	<1
Cadmium, dissolved (µg/L)	117	1	<.1	--	<.1
Copper, total recoverable (µg/L)	115	500	3	42	19
Copper, dissolved (µg/L)	116	25	2	5	4
Iron, total recoverable (µg/L)	117	19,000	50	1,270	450
Iron, dissolved (µg/L)	117	190	<3	[2]32	20
Lead, total recoverable (µg/L)	113	100	<1	[2]9	4
Lead, dissolved (µg/L)	113	7	<.5	[2].4	<1
Manganese, total recoverable (µg/L)	117	2,000	10	149	80
Manganese, dissolved (µg/L)	117	37	1	8	7
Zinc, total recoverable (µg/L)	117	1,100	<10	[2]76	40
Zinc, dissolved (µg/L)	117	39	<3	[2]7	5
Sediment, suspended concentration (mg/L)	172	1,370	2	64	20
Sediment, suspended discharge (ton/d)	172	34,700	3.5	722	61
Sediment, suspended (percent finer than 0.062 mm)	161	98	27	73	73

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2001 (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 2001**					
Streamflow, instantaneous (ft^3/s)	126	13,400	344	2,710	1,320
Specific conductance, onsite (µS/cm)	103	294	131	206	205
Temperature, water (°C)	126	21.0	0.0	9.1	9.2
pH, onsite (standard units)	86	8.7	7.5	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	79	140	55	101	97
Calcium, dissolved (mg/L)	79	37	14	26	25
Magnesium, dissolved (mg/L)	79	13	4.9	9.0	8.5
Arsenic, total recoverable (µg/L)	86	4	<1	[2]1	1
Arsenic, dissolved (µg/L)	86	2	<1	[2].9	.9
Cadmium, total recoverable (µg/L)	86	2	<.1	[2].2	<1
Cadmium, dissolved (µg/L)	86	1	<.1	--	<.1
Copper, total recoverable (µg/L)	83	34	<1	[2]6	3
Copper, dissolved (µg/L)	84	7	<1	[2]2	1
Iron, total recoverable (µg/L)	86	3,600	20	520	230
Iron, dissolved (µg/L)	86	100	<3	[2]23	20
Lead, total recoverable (µg/L)	82	25	<1	[2]4	<5
Lead, dissolved (µg/L)	82	8	<.5	[2].8	<1
Manganese, total recoverable (µg/L)	86	180	<10	[2]34	20
Manganese, dissolved (µg/L)	86	11	<1	[2]3	2
Zinc, total recoverable (µg/L)	86	60	<1	[2]7	<10
Zinc, dissolved (µg/L)	86	15	<1	[2]3	<3
Sediment, suspended concentration (mg/L)	126	271	1	32	9
Sediment, suspended discharge (ton/d)	126	7,670	1.1	586	31
Sediment, suspended (percent finer than 0.062 mm)	124	98	42	79	82

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2001 (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 2001					
Streamflow, instantaneous (ft^3/s)	138	21,600	720	4,430	2,330
Specific conductance, onsite (µS/cm)	115	399	142	256	267
Temperature, water (°C)	135	20.0	0.0	9.2	8.5
pH, onsite (standard units)	95	8.7	7.9	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	95	170	61	118	120
Calcium, dissolved (mg/L)	95	46	14	32	32
Magnesium, dissolved (mg/L)	95	13	5.3	9.3	9.5
Arsenic, total recoverable (µg/L)	95	69	1	5	4
Arsenic, dissolved (µg/L)	95	9	1	3	3
Cadmium, total recoverable (µg/L)	95	5	<.1	[2].2	<1
Cadmium, dissolved (µg/L)	95	.1	<.1	--	<.1
Copper, total recoverable (µg/L)	93	400	2	17	8
Copper, dissolved (µg/L)	94	11	.7	3	2
Iron, total recoverable (µg/L)	95	13,000	40	630	220
Iron, dissolved (µg/L)	95	200	<3	[2]25	20
Lead, total recoverable (µg/L)	90	78	<1	[2]3	1
Lead, dissolved (µg/L)	90	1	<.5	[2].6	<.6
Manganese, total recoverable (µg/L)	95	1,100	10	67	40
Manganese, dissolved (µg/L)	95	230	6	18	14
Zinc, total recoverable (µg/L)	95	1,100	<10	[2]32	13
Zinc, dissolved (µg/L)	95	16	<1	[2]4	2
Sediment, suspended concentration (mg/L)	138	824	2	38	10
Sediment, suspended discharge (ton/d)	138	21,900	5.8	1,010	60
Sediment, suspended (percent finer than 0.062 mm)	133	99	44	87	90

[1]Multiple less-than (<) values for an individual constituent are the result of changes in analytical laboratory reporting levels during the period of record.
[2]Value is estimated by using a log-probability regression to predict the values of data less than the laboratory 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 September 2001

[Fine-grained bed sediment is material less than 0.064 millimeter in diameter. Reported concentrations are in micrograms per gram dry weight. Symbols: <, less than minimum reporting level; --, indicates 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]

Constituent	Number of samples	Maximum	Minimum	Mean	Median
12323600--SILVER BOW CREEK AT OPPORTUNITY, MONT.					
Period of record for fine-grained bed-sediment data: 1992-2001					
Cadmium	10	42.0	23.7	32.5	32.0
Chromium	9	32.4	16.8	26.5	27.6
Copper	10	9,020	4,220	5,390	4,820
Iron	10	41,200	28,200	37,300	38,000
Lead	10	1,030	563	818	833
Manganese	10	9,220	1,690	3,310	2,530
Nickel	9	21.4	12.7	18.9	16.0
Silver	10	20.0	13.1	16.6	16.8
Zinc	10	13,400	6,660	8,820	8,340
12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT.					
Period of record for fine-grained bed-sediment data: 1992-2001					
Cadmium	10	12.2	4.2	7.4	6.7
Chromium	9	34.1	12.3	21.0	22.9
Copper	10	769	169	391	308
Iron	10	27,200	15,400	21,000	20,600
Lead	10	100	49	72	68
Manganese	10	17,700	1,470	6,980	5,590
Nickel	9	19.1	9.2	14.8	15.4
Silver	10	2.1	.3	[1]1.5	[1]1.6
Zinc	10	2,220	620	1,100	830
12323770--WARM SPRINGS CREEK AT WARM SPRINGS, MONT.					
Period of record for fine-grained bed-sediment data: 1995, 1997, 1999					
Cadmium	3	3.9	1.3	2.6	2.6
Chromium	3	33.4	27.5	30.6	30.8
Copper	3	892	779	840	848
Iron	3	22,400	20,600	21,600	21,900
Lead	3	86	85	85	85
Manganese	3	8,790	2,020	5,610	6,030
Nickel	3	21.9	17.6	19.7	19.6
Silver	3	3.7	3.1	3.3	3.2
Zinc	3	421	372	396	396
12323800--CLARK FORK NEAR GALEN, MONT.					
Period of record for fine-grained bed-sediment data: 1987, 1991-2001					
Cadmium	12	20.1	4.0	10.1	8.5
Chromium	9	33.9	19.1	27.1	27.0
Copper	12	2,300	991	1,310	1,220
Iron	12	39,800	22,600	28,800	28,100
Lead	12	235	116	149	139
Manganese	12	15,600	2,780	8,760	8,510
Nickel	9	23.2	15.4	19.0	19.0
Silver	12	7.3	<3.2	[1]4.3	3.9
Zinc	12	3,560	1,090	1,780	1,370

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through September 2001 (Continued)

Constituent	Number of samples	Maximum	Minimum	Mean	Median
461415112450801--CLARK FORK BELOW LOST CREEK, NEAR GALEN, MONT.					
Period of record for fine-grained bed-sediment data: 1996-2001					
Cadmium	6	10.5	6.5	8.1	7.9
Chromium	6	34.5	22.3	29.1	29.8
Copper	6	2,050	1,360	1,610	1,550
Iron	6	32,800	26,300	30,900	31,600
Lead	6	200	168	185	186
Manganese	6	5,900	3,540	4,800	4,830
Nickel	6	19.9	13.4	17.5	18.3
Silver	6	7.8	4.2	6.3	6.6
Zinc	6	1,680	1,280	1,450	1,470
461559112443301--CLARK FORK NEAR RACETRACK, MONT.					
Period of record for fine-grained bed-sediment data: 1996-2001					
Cadmium	6	8.6	5.0	6.9	7.0
Chromium	6	33.3	19.1	26.3	27.5
Copper	6	1,610	933	1,220	1,230
Iron	6	31,700	23,100	27,800	28,800
Lead	6	186	128	148	144
Manganese	6	4,120	2,390	3,210	3,020
Nickel	6	18.4	10.5	15.3	16.6
Silver	6	6.1	<3.3	[1]4.9	[1]5.3
Zinc	6	1,550	1,030	1,250	1,180
461903112440701--CLARK FORK AT DEMPSEY CREEK DIVERSION, NEAR RACETRACK, MONT.					
Period of record for fine-grained bed-sediment data: 1996-2001					
Cadmium	6	10.3	4.3	6.7	6.4
Chromium	6	34.1	16.0	26.4	27.6
Copper	6	1,550	766	1,070	990
Iron	6	33,700	22,000	27,700	28,200
Lead	6	152	115	131	126
Manganese	6	6,410	1,810	3,340	2,660
Nickel	6	16.9	9.5	14.1	15.5
Silver	6	6.2	2.7	4.8	5.0
Zinc	6	1,570	900	1,170	1,140
12324200--CLARK FORK AT DEER LODGE, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1990-2001					
Cadmium	14	10.0	4.4	6.9	6.8
Chromium	9	43.9	19.5	31.5	32.5
Copper	14	4,180	837	1,440	1,130
Iron	14	35,300	22,600	28,300	28,900
Lead	14	242	121	158	153
Manganese	14	6,020	1,460	2,800	2,380
Nickel	9	21.1	12.2	16.7	16.8
Silver	14	7.9	2.4	4.7	4.5
Zinc	14	1,730	940	1,310	1,330

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through September 2001 (Continued)

Constituent	Number of samples	Maximum	Minimum	Mean	Median
12324590--LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1994, 1998, 2001					
Cadmium	5	2.3	.2	1.1	.9
Chromium	3	54.4	22.1	43.1	52.9
Copper	5	85	38	56	40
Iron	5	30,700	16,100	24,200	24,200
Lead	5	53	36	40	37
Manganese	5	2,700	905	1,420	1,040
Nickel	5	21.9	13.6	17.7	17.6
Silver	5	.9	<.5	[1].6	[1].8
Zinc	5	204	161	176	170
12324680--CLARK FORK AT GOLDCREEK, MONT.					
Period of record for fine-grained bed-sediment data: 1992-2001					
Cadmium	10	8.1	3.5	5.5	5.7
Chromium	9	48.9	24.9	33.8	31.9
Copper	10	1,080	393	780	773
Iron	10	30,600	19,900	25,100	24,900
Lead	10	152	61	108	112
Manganese	10	2,610	1,160	1,850	1,810
Nickel	9	18.6	11.7	16.0	16.4
Silver	10	4.8	2.3	3.5	3.4
Zinc	10	1,320	590	1,090	1,120
12331500--FLINT CREEK NEAR DRUMMOND, MONT.					
Period of record for fine-grained bed-sediment data: 1986, 1989, 1992-2001					
Cadmium	12	7.0	<.2	[1]3.0	[1]2.8
Chromium	9	29.2	20.4	24.7	24.3
Copper	12	73	55	62	63
Iron	12	28,100	19,800	23,700	23,400
Lead	12	240	149	176	171
Manganese	12	5,510	2,370	3,760	3,740
Nickel	9	14.9	11.2	12.7	12.5
Silver	11	7.8	5.0	6.4	6.5
Zinc	12	777	517	647	649
12331800--CLARK FORK NEAR DRUMMOND, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1991-2001					
Cadmium	13	7.7	2.6	4.7	4.8
Chromium	9	35.4	17.0	29.5	31.6
Copper	13	747	387	534	550
Iron	13	27,000	16,500	22,300	23,200
Lead	13	135	72	97	97
Manganese	13	2,790	1,150	1,780	1,740
Nickel	9	16.8	11.6	14.2	15.7
Silver	13	4.7	<3.2	[1]3.0	[1]2.9
Zinc	13	1,230	785	1,050	1,040

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through September 2001 (Continued)

Constituent	Number of samples	Maximum	Minimum	Mean	Median
12334510--ROCK CREEK NEAR CLINTON, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1989, 1991-99, 2001					
Cadmium	13	3.7	<.2	[1].6	[1]<.4
Chromium	8	27.9	16.5	22.4	21.4
Copper	13	16	3	12	14
Iron	13	21,400	13,100	17,900	18,000
Lead	13	16	<3	[1]8	[1]9
Manganese	13	724	126	390	382
Nickel	8	14.8	9.8	12.5	12.9
Silver	12	1.9	<.3	[1].5	[1]<.3
Zinc	13	58	36	47	48
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.					
Period of record for fine-grained bed-sediment data: 1986, 1991-2001					
Cadmium	12	7.3	3.1	4.2	3.9
Chromium	9	34.7	15.3	25.6	27.7
Copper	12	635	277	403	354
Iron	12	24,400	15,100	19,700	19,600
Lead	12	115	49	77	72
Manganese	12	2,270	671	1,210	1,110
Nickel	9	19.1	9.3	14.2	15.9
Silver	12	3.9	<1.9	[1]2.2	[1]2.2
Zinc	12	1,160	775	915	894
12340000--BLACKFOOT RIVER NEAR BONNER, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1991, 1993-96, 1998-2001					
Cadmium	11	2.0	<.2	[1].6	[1]<1.2
Chromium	8	25.8	15.1	20.5	21.8
Copper	11	27	16	21	21
Iron	11	20,200	12,400	17,000	17,800
Lead	11	20	<13	[1]13	[1]13
Manganese	11	683	298	524	535
Nickel	8	14.3	9.4	12.2	12.6
Silver	11	1.0	<.3	[1].4	[1].3
Zinc	11	73	35	60	61
12340500--CLARK FORK ABOVE MISSOULA, MONT.					
Period of record for fine-grained bed-sediment data: 1997-2001					
Cadmium	5	4.2	1.5	2.8	2.6
Chromium	5	30.6	19.0	25.8	28.5
Copper	5	516	166	283	233
Iron	5	24,300	18,100	20,800	20,400
Lead	5	63	37	51	47
Manganese	5	1,370	480	1,010	1,160
Nickel	5	15.8	11.8	13.8	14.5
Silver	5	2.9	.8	[1]1.8	[1]1.6
Zinc	5	924	438	623	547

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through September 2001 (Continued)

Constituent	Number of samples	Maximum	Minimum	Mean	Median
12353000--CLARK FORK BELOW MISSOULA, MONT.[2]					
Period of record for fine-grained bed-sediment data: 1986, 1990-2001					
Cadmium	13	6.0	1.1	2.1	1.9
Chromium	9	27.6	12.3	21.7	21.5
Copper	13	293	87	152	138
Iron	13	21,100	13,400	18,400	19,500
Lead	13	58	12	37	37
Manganese	13	2,530	446	1,330	1,260
Nickel	9	14.1	8.9	12.5	12.8
Silver	13	3.0	.4	[1]1.3	[1]1.3
Zinc	13	675	252	405	409

[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 streamflow-gaging 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 September 2001

[Bulk bed sediment is material smaller than about 10 millimeters in diameter. Reported concentrations are in micrograms per gram dry weight. Symbols: <, less than minimum reporting level; --, indicates 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]

Constituent	Number of samples	Maximum	Minimum	Mean	Median
12323600--SILVER BOW CREEK AT OPPORTUNITY, MONT.					
Period of record for bulk bed-sediment data: 1993-95, 1997-2001					
Cadmium	8	22.2	4.2	10.7	7.6
Chromium	8	16.2	9.6	12.9	12.4
Copper	8	2,780	670	1,270	939
Iron	8	29,300	18,300	22,600	20,200
Lead	8	363	198	263	255
Manganese	8	5,480	504	1,640	747
Nickel	8	9.2	6.0	7.3	6.7
Silver	8	7.4	3.2	4.7	4.0
Zinc	8	5,690	1,720	2,970	2,160
12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT.					
Period of record for bulk bed-sediment data: 1993, 1995-2001					
Cadmium	8	1.7	<.9	[1]1.1	[1]1.3
Chromium	8	11.8	5.3	9.1	9.5
Copper	8	111	20	51	37
Iron	8	12,300	7,200	10,100	9,800
Lead	8	33	<10	[1]14	[1]12
Manganese	8	2,100	209	874	776
Nickel	8	9.2	4.8	6.2	5.5
Silver	8	1.3	<.3	[1].7	[1].8
Zinc	8	303	93	160	134
12327700--WARM SPRINGS CREEK AT WARM SPRINGS, MONT.					
Period of record for bulk bed-sediment data: 1995, 1997, 1999					
Cadmium	3	1.0	<.8	[1].6	[1]<.9
Chromium	3	12.0	9.7	11.2	11.8
Copper	3	238	203	215	205
Iron	3	12,700	8,980	10,900	10,900
Lead	3	38	18	30	34
Manganese	3	2,650	1,220	2,100	2,440
Nickel	3	8.5	5.7	7.3	7.8
Silver	3	1.1	<.8	[1].8	[1].9
Zinc	3	275	146	190	148
12323800--CLARK FORK NEAR GALEN, MONT.					
Period of record for bulk bed-sediment data: 1993-2001					
Cadmium	9	8.2	<.9	[1]3.7	[1]3.5
Chromium	9	23.7	4.2	15.0	15.0
Copper	9	902	223	470	408
Iron	9	31,300	9,930	20,500	20,600
Lead	9	158	41	80	79
Manganese	9	9,490	900	3,370	1,880
Nickel	9	15.2	4.9	8.7	8.8
Silver	9	5.2	.7	[1]2.0	[1]1.6
Zinc	9	1,280	417	721	653

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through September 2001 (Continued)

Constituent	Number of samples	Maximum	Minimum	Mean	Median
461415112450801--CLARK FORK BELOW LOST CREEK, NEAR GALEN, MONT					
Period of record for bulk bed-sediment data: 1996-2001					
Cadmium	6	3.3	<.9	[1]2.4	[1]2.8
Chromium	6	17.5	9.3	12.5	12.1
Copper	6	763	238	460	426
Iron	6	21,000	12,600	17,100	16,700
Lead	6	104	41	74	75
Manganese	6	1,840	1,260	1,490	1,420
Nickel	6	8.2	4.2	6.5	6.8
Silver	6	2.8	.8	[1]1.7	[1]1.6
Zinc	6	787	365	554	560
461559112443301--CLARK FORK NEAR RACETRACK, MONT.					
Period of record for bulk bed-sediment data: 1996-2001					
Cadmium	6	6.6	<.9	[1]2.8	[1]2.4
Chromium	6	19.1	10.1	14.2	13.7
Copper	6	603	361	475	458
Iron	6	25,900	16,200	19,300	18,200
Lead	6	87	59	75	77
Manganese	6	1,710	759	1,320	1,390
Nickel	6	9.9	5.5	7.3	6.9
Silver	6	2.9	1.4	[1]2.2	[1]2.3
Zinc	6	781	472	616	584
461903112440701--CLARK FORK AT DEMPSEY CREEK DIVERSION, NEAR RACETRACK, MONT.					
Period of record for bulk bed-sediment data: 1996-2001					
Cadmium	6	9.2	1.5	3.7	3.0
Chromium	6	21.1	13.0	17.1	16.8
Copper	6	1,000	244	530	501
Iron	6	25,400	16,400	21,900	22.200
Lead	6	115	47	76	73
Manganese	6	4,930	825	1.930	1.490
Nickel	6	12.8	5.5	8.6	8.2
Silver	6	4.4	<.8	[1]2.4	[1]2.4
Zinc	6	1,240	368	651	526
12324200--CLARK FORK AT DEER LODGE, MONT.					
Period of record for bulk bed-sediment data: 1993-2001					
Cadmium	9	7.8	1.0	[1]2.7	[1]2.1
Chromium	9	24.5	12.1	18.0	19.6
Copper	9	906	281	471	383
Iron	9	25,000	13,200	19,200	19,200
Lead	9	112	45	75	74
Manganese	9	2,530	653	1,200	1,020
Nickel	9	12.3	7.7	9.8	10.1
Silver	9	3.9	<.7	[1]1.7	[1]1.6
Zinc	9	1,060	456	613	529
12324590--LITTLE BLACKFOOT RIVER NEAR GARRISON, MONT.					
Period of record for bulk bed-sediment data: 1994, 1998, 2001					
Cadmium	3	<1.5	<1.2	[1].7	[1].7
Chromium	3	33.2	14.7	26.7	32.1
Copper	3	20	12	17	19
Iron	3	21,000	15,600	18,000	17,300
Lead	3	18	12	15	14
Manganese	3	420	308	354	333
Nickel	3	15.2	8.6	11.8	11.7
Silver	3	<1.6	<.7	[1].6	[1].8
Zinc	3	86	65	75	73

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through September 2001 (Continued)

Constituent	Number of samples	Maximum	Minimum	Mean	Median
12324680--CLARK FORK AT GOLDCREEK, MONT.					
Period of record for bulk bed-sediment data: 1993-2001					
Cadmium	9	7.6	1.1	[1]3.3	[1]2.4
Chromium	9	33.2	15.0	22.2	21.1
Copper	9	858	197	462	370
Iron	9	24,900	15,400	19,200	18,600
Lead	9	92	37	65	71
Manganese	9	2,930	554	1,360	1,190
Nickel	9	15.9	9.0	11.8	12.0
Silver	9	3.7	<.7	[1]1.9	[1]1.6
Zinc	9	1,020	368	708	676
12331500--FLINT CREEK NEAR DRUMMOND, MONT.					
Period of record for bulk bed-sediment data: 1993-2001					
Cadmium	9	3.8	<.2	[1]1.6	[1]1.5
Chromium	9	13.9	4.9	9.4	10.7
Copper	9	40	16	24	20
Iron	9	15,700	8,630	12,800	13,400
Lead	9	120	51	76	79
Manganese	9	3,200	1,150	2,110	2,190
Nickel	9	8.0	4.5	5.8	5.8
Silver	9	5.8	2.5	4.3	4.1
Zinc	9	429	178	277	284
12331800--CLARK FORK NEAR DRUMMOND, MONT.					
Period of record for bulk bed-sediment data: 1993-2001					
Cadmium	9	4.7	<1.6	[1]2.4	[1]1.8
Chromium	9	29.5	6.9	19.0	17.5
Copper	9	605	114	275	223
Iron	9	21,800	12,100	16,200	15,900
Lead	9	78	32	49	47
Manganese	9	1,510	656	1,050	980
Nickel	9	14.2	7.8	10.6	9.8
Silver	9	3.5	.5	[1]1.7	[1]1.6
Zinc	9	939	397	598	515
12334510--ROCK CREEK NEAR CLINTON, MONT.					
Period of record for bulk bed-sediment data: 1993-99, 2001					
Cadmium	8	<1.5	<.2	[1]--	[1]<.8
Chromium	8	14.3	6.4	9.0	8.5
Copper	8	7	3	5	5
Iron	8	11,100	5,290	7,930	7,340
Lead	8	<13	<3	[1]5	[1]5
Manganese	8	270	72	160	166
Nickel	8	8.2	3.6	5.3	5.0
Silver	8	<1.6	.1	[1].4	[1].3
Zinc	8	29	7	17	17
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.					
Period of record for bulk bed-sediment data: 1993-2001					
Cadmium	9	4.9	.4	[1]2.0	[1]1.8
Chromium	9	23.8	6.9	15.1	15.5
Copper	9	336	75	190	186
Iron	9	19,100	9,270	13,300	13,200
Lead	9	67	21	38	37
Manganese	9	1,470	234	680	487
Nickel	9	14.0	6.4	9.2	8.8
Silver	9	2.9	<.3	[1]1.2	[1].9
Zinc	9	769	271	479	501

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through September 2001 (Continued)

Constituent	Number of samples	Maximum	Minimum	Mean	Median
12340000--BLACKFOOT RIVER NEAR BONNER, MONT.					
Period of record for bulk bed-sediment data: 1993-94, 1999-2001					
Cadmium	5	<1.9	<.2	[1]--	[1]<1.2
Chromium	5	19.2	6.7	13.0	12.5
Copper	5	19	12	16	16
Iron	5	17,000	10,300	14,000	14,600
Lead	5	11	6	9	10
Manganese	5	650	179	340	305
Nickel	5	9.8	7.5	8.8	9.3
Silver	5	<1.9	<.4	[1]--	[1]<.7
Zinc	5	58	33	41	35
12340500--CLARK FORK ABOVE MISSOULA, MONT.					
Period of record for bulk bed-sediment data: 1997-2001					
Cadmium	5	3.4	<.8	[1]1.2	[1].8
Chromium	5	18.2	9.7	14.0	15.0
Copper	5	130	43	87	72
Iron	5	16,800	11,500	14,900	16,020
Lead	5	30	7	21	20
Manganese	5	810	228	510	553
Nickel	5	11.1	8.2	9.6	9.2
Silver	5	<3.3	<.4	[1].8	[1].8
Zinc	5	387	145	270	263
12353000--CLARK FORK BELOW MISSOULA, MONT.[2]					
Period of record for bulk bed-sediment data: 1993-2001					
Cadmium	9	2.0	<.2	[1].7	[1].6
Chromium	9	12.6	4.4	7.1	6.8
Copper	9	77	16	37	30
Iron	9	11.300	5,830	8,480	8,830
Lead	9	19	<10	[1]9	[1]8
Manganese	9	444	150	326	364
Nickel	9	7.1	3.5	5.1	4.9
Silver	9	<1.9	<.3	[1].5	[1].5
Zinc	9	172	58	110	101

[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 streamflow-gaging station to conform to previous sampling location.

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2001

[Concentrations are in micrograms per gram dry weight. Abbreviation: spp., species. Symbols: <, less than minimum reporting level; --, indicates either too few samples (less than three) 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. Insects were depurated prior to analysis during 1986-98; depuration was discontinued in 1999]

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, 1997-2001					
***Brachycentrus* spp.**					
Cadmium	4	12.5	5.8	9.6	10.0
Chromium	4	5.9	.7	2.1	.9
Copper	4	846	235	565	589
Iron	4	730	335	474	416
Lead	4	17.9	7.4	11.7	10.8
Manganese	4	666	231	439	430
Nickel	4	1.9	<.1	[1]1.2	[1]1.3
Zinc	4	888	629	755	751
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* spp.**					
Cadmium	3	10.6	5.0	8.7	10.2
Chromium	3	4.7	.8	2.3	1.5
Copper	3	884	352	693	845
Iron	3	1,750	1,270	1,480	1,430
Lead	3	50.8	34.7	40.6	36.5
Manganese	3	1,070	712	941	1,040
Nickel	3	2.5	1.6	2.1	2.2
Zinc	3	1,290	1,090	1,170	1,130
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: 1992-2001					
Hydropsyche cockerelli					
Cadmium	24	2.1	.2	.7	.6
Chromium	24	1.3	.5	.8	.8
Copper	24	97.0	22.4	43.0	40.6
Iron	24	1,240	351	683	717
Lead	24	5.7	.3	3.1	2.9
Manganese	24	2,520	491	1,080	839
Nickel	24	1.8	.3	.8	.8
Zinc	24	276	115	180	171

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2001 (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: 1992-2001					
		Hydropsyche occidentalis			
Cadmium	13	1.1	.2	.5	.4
Chromium	13	1.7	.3	.9	.9
Copper	13	46.5	11.0	30.6	30.3
Iron	13	1,050	372	806	774
Lead	13	4.3	<1.7	[1]3.1	[1]3.1
Manganese	13	3.200	1.200	2,090	1,840
Nickel	13	1.8	.7	1.2	1.1
Zinc	13	202	141	173	175
		***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, 1999					
		Arctopsyche grandis			
Cadmium	3	2.4	1.9	2.2	2.1
Chromium	3	2.9	1.4	2.0	1.8
Copper	3	102	95.6	98.9	98.8
Iron	3	1,040	684	866	872
Lead	3	5.6	<6.3	[1]4.4	<8.7
Manganese	3	2,280	1,340	1,810	1,800
Nickel	3	<7.0	1.8	[1]2.5	2.3
Zinc	3	222	180	200	197
		Hydropsyche occidentalis			
Cadmium	2	.8	.7	.8	--
Chromium	2	3.2	3.2	3.2	--
Copper	2	183	181	182	--
Iron	2	2,070	1,950	2,010	--
Lead	2	8.2	6.7	7.4	--
Manganese	2	2,480	2,400	2,440	--
Nickel	2	3.3	3.0	3.2	--
Zinc	2	172	166	169	--
		***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	--
12323800--CLARK FORK NEAR GALEN, MONT.					
Period of record for biological data: 1987, 1991-2001					
		Hydropsyche cockerelli			
Cadmium	22	2.7	.9	1.6	1.5
Chromium	22	3.3	.8	1.7	1.6
Copper	22	181	48.7	100	99
Iron	22	2,460	816	1,390	1,280
Lead	22	11.7	1.2	7.6	7.7
Manganese	22	3,620	1,070	2,190	2,180
Nickel	22	3.1	.9	1.6	1.6
Zinc	22	299	136	218	215

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2001 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12323800--CLARK FORK NEAR GALEN, MONT.--Continued					
Period of record for biological data: 1987, 1991-2001					
		***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	31	1.7	.6	1.1	1.1
Chromium	31	6.6	.7	1.8	1.5
Copper	31	106	49.2	78.3	75.5
Iron	31	1,920	642	1,210	1,180
Lead	31	13.5	1.6	6.7	6.3
Manganese	31	6,170	1,220	2,640	2,280
Nickel	31	3.5	.8	1.6	1.6
Zinc	31	286	168	202	197
		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
461415112450801--CLARK FORK BELOW LOST CREEK, NEAR GALEN, MONT.					
Period of record for biological data: 1996-2001					
		Claassenia sabulosa			
Cadmium	1	--	--	.3	--
Chromium	1	--	--	1.9	--
Copper	1	--	--	70.1	--
Iron	1	--	--	189	--
Lead	1	--	--	1.2	--
Manganese	1	--	--	238	--
Nickel	1	--	--	.2	--
Zinc	1	--	--	245	--
		Hydropsyche cockerelli			
Cadmium	9	2.8	1.4	2.1	2.2
Chromium	9	2.6	1.0	2.0	2.1
Copper	9	147	48.8	108	98.2
Iron	9	1,900	691	1,340	1,300
Lead	9	14.8	4.5	10.8	11.3
Manganese	9	3.160	1,230	2,050	1,720
Nickel	9	1.9	1.0	1.4	1.4
Zinc	9	250	151	221	234

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2001 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
461415112450801--CLARK FORK BELOW LOST CREEK, NEAR GALEN, MONT.--Continued					
Period of record for biological data: 1996-2001					
Hydropsyche occidentalis					
Cadmium	14	1.8	.9	1.3	1.6
Chromium	14	3.3	1.3	1.9	1.9
Copper	14	157	52.1	102	120
Iron	14	1,920	963	1,400	1,520
Lead	14	12.4	6.6	9.7	11.5
Manganese	14	3,440	1,270	2,280	1,850
Nickel	14	1.7	.9	1.3	1.5
Zinc	14	283	174	230	231
***Hydropsyche* spp.**					
Cadmium	4	1.8	1.2	1.4	1.4
Chromium	4	2.4	.9	1.6	1.6
Copper	4	122	45.1	89.0	94.3
Iron	4	1,410	533	1,120	1,270
Lead	4	20.5	4.1	10.4	8.5
Manganese	4	1,980	799	1,490	1,590
Nickel	4	2.8	1.4	1.9	1.4
Zinc	4	225	143	183	183
461559112443301--CLARK FORK NEAR RACETRACK, MONT.					
Period of record for biological data: 1996-2001					
Claassenia sabulosa					
Cadmium	1	--	--	.4	--
Chromium	1	--	--	.3	--
Copper	1	--	--	40.3	--
Iron	1	--	--	113	--
Lead	1	--	--	.8	--
Manganese	1	--	--	172	--
Nickel	1	--	--	.2	--
Zinc	1	--	--	213	--
Hydropsyche cockerelli					
Cadmium	10	1.9	1.0	1.4	1.3
Chromium	10	2.7	.7	1.5	1.3
Copper	10	109	50.0	74.1	67.4
Iron	10	1,370	657	938	921
Lead	10	10.5	3.7	6.6	6.1
Manganese	10	2,010	646	1,440	1,610
Nickel	10	1.4	.7	1.0	1.1
Zinc	10	199	139	172	172
Hydropsyche occidentalis					
Cadmium	13	2.2	.7	1.3	1.2
Chromium	13	2.6	1.1	1.9	1.8
Copper	13	160	59.5	102	93.5
Iron	13	1,880	1,030	1,470	1,450
Lead	13	11.7	4.3	9.4	9.7
Manganese	13	3,770	1,090	2,160	2,100
Nickel	13	1.9	1.1	1.3	1.3
Zinc	13	255	181	226	229
***Hydropsyche* spp.**					
Cadmium	2	1.5	1.0	1.2	--
Chromium	2	1.7	.7	1.2	--
Copper	2	85.2	82.9	84.0	--
Iron	2	1,200	1,140	1,170	--
Lead	2	7.4	5.7	6.6	--
Manganese	2	1,600	910	1,260	--
Nickel	2	1.4	1.1	1.2	--
Zinc	2	208	151	180	--

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2001 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
461903112440701--CLARK FORK AT DEMPSEY CREEK DIVERSION, NEAR RACETRACK, MONT.					
Period of record for biological data: 1996-2001					
		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	7	1.6	.7	1.2	1.4
Chromium	7	1.7	.8	1.1	1.0
Copper	7	143	62.7	84.6	77.5
Iron	7	1,290	665	888	851
Lead	7	8.9	3.5	6.2	6.8
Manganese	7	1,230	487	1,010	1,140
Nickel	7	1.9	.6	1.1	.9
Zinc	7	192	162	177	178
		Hydropsyche occidentalis			
Cadmium	16	1.7	.7	1.1	1.1
Chromium	16	2.8	1.2	1.9	1.8
Copper	16	163	74.9	95.8	88.3
Iron	16	1,660	940	1,440	1,500
Lead	16	13.8	6.1	11.1	11.4
Manganese	16	3,990	826	2,490	2,310
Nickel	16	2.4	1.2	1.5	1.4
Zinc	16	292	222	247	236
		***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, 1990-2001					
		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	22	2.3	.6	1.4	1.3
Chromium	22	3.2	.4	1.7	1.8
Copper	22	136	54.7	93.4	92.5
Iron	22	3,340	490	1,160	1,050
Lead	22	18.2	4.3	9.6	8.9
Manganese	22	1,490	396	811	710
Nickel	22	2.4	.3	1.2	1.0
Zinc	22	391	132	186	184

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2001 (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, 1990-2001					
		Hydropsyche occidentalis			
Cadmium	36	2.7	.8	1.3	1.3
Chromium	36	3.6	.6	1.9	1.9
Copper	36	162	49.4	112	110
Iron	36	2,060	557	1,410	1,420
Lead	36	18.6	3.5	11.0	10.8
Manganese	36	2,840	649	1,710	1,730
Nickel	36	12.9	1.0	1.8	1.4
Zinc	36	329	166	238	233
		***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, 1998, 2001					
		Arctopsyche grandis			
Cadmium	15	.7	.2	.4	.4
Chromium	15	1.6	.6	.9	.8
Copper	15	14.2	9.0	12.2	13.0
Iron	15	677	177	384	313
Lead	15	1.3	.5	.8	.8
Manganese	15	1,140	318	678	551
Nickel	15	1.4	.4	.7	.6
Zinc	15	214	113	165	162
		Claassenia sabulosa			
Cadmium	7	.5	.1	.2	.2
Chromium	7	.9	.3	.6	.7
Copper	7	36.1	20.0	29.4	30.3
Iron	7	319	98	175	156
Lead	7	<.8	<.1	[1].4	[1].3
Manganese	7	90.5	46.7	63.8	61.6
Nickel	7	.7	.4	.5	.5
Zinc	7	233	172	203	202
		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	2	<.7	.3	[1].3	--
Chromium	2	2.3	1.3	1.8	--
Copper	2	15.2	15.1	15.2	--
Iron	2	1,340	426	883	--
Lead	2	2.3	<3.7	[1]2.1	--
Manganese	2	554	434	494	--
Nickel	2	1.1	.8	1.0	--
Zinc	2	137	110	124	--

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2001 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12324680--CLARK FORK AT GOLDCREEK, MONT.					
Period of record for biological data: 1992-2001					
		Arctopsyche grandis			
Cadmium	25	6.6	1.1	2.6	2.3
Chromium	25	3.3	.6	1.4	1.1
Copper	25	129	26.4	53.2	51.3
Iron	25	2,360	339	817	610
Lead	25	10.9	2.3	4.4	3.7
Manganese	25	1.580	592	876	842
Nickel	25	1.8	.2	.8	.7
Zinc	25	326	165	220	200
		Claassenia sabulosa			
Cadmium	18	3.5	.3	1.4	1.0
Chromium	18	1.6	.3	.6	.6
Copper	18	81.7	33.0	56.0	55.9
Iron	18	567	63.0	190	174
Lead	18	1.8	.5	1.1	1.1
Manganese	18	279	50.6	117	94.7
Nickel	18	.7	.2	.3	.3
Zinc	18	351	166	255	258
		Hydropsyche cockerelli			
Cadmium	17	2.6	.6	1.6	1.6
Chromium	17	4.7	.5	2.3	2.0
Copper	17	188	17.1	83.0	66.6
Iron	17	3,250	522	1,320	1,080
Lead	17	16.2	2.4	8.0	6.0
Manganese	17	1,670	538	792	687
Nickel	17	2.3	.3	1.3	1.3
Zinc	17	249	106	192	201
		***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	15	1.7	.7	1.3	1.3
Chromium	15	3.9	.4	1.6	1.6
Copper	15	156	26.4	64.4	58.3
Iron	15	2.720	466	1,140	1,040
Lead	15	15.7	2.9	7.3	6.0
Manganese	15	2,210	530	1,170	1,030
Nickel	15	2.5	.8	1.3	1.1
Zinc	15	277	97	195	192
12331500--FLINT CREEK NEAR DRUMMOND, MONT.					
Period of record for biological data: 1986, 1992-2001					
		Arctopsyche grandis			
Cadmium	38	.8	.1	.3	.3
Chromium	38	4.7	.3	1.9	1.7
Copper	38	21.7	8.9	14.9	15.1
Iron	38	2,460	412	1.350	1.320
Lead	38	17.5	3.7	9.0	8.1
Manganese	38	2,480	424	1,480	1,340
Nickel	38	2.7	.6	1.4	1.3
Zinc	38	275	93	196	190

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2001 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12331500--FLINT CREEK NEAR DRUMMOND, MONT.--Continued					
Period of record for biological data: 1986, 1992-2001					
		Hydropsyche cockerelli			
Cadmium	10	.7	.1	.4	.3
Chromium	10	4.0	.9	2.0	1.9
Copper	10	28.3	9.5	18.2	18.1
Iron	10	3,390	996	1,990	1,950
Lead	10	28.4	3.1	13.9	14.6
Manganese	10	2,460	401	1,210	1,210
Nickel	10	2.3	.9	1.9	2.2
Zinc	10	208	85	167	181
		Hydropsyche occidentalis			
Cadmium	7	1.1	.2	.6	.6
Chromium	7	17.6	.7	4.5	2.1
Copper	7	27.3	15.1	20.6	18.6
Iron	7	2,990	912	1,900	1,870
Lead	7	29.8	5.8	19.4	24.0
Manganese	7	4,790	1,400	2,270	1,780
Nickel	7	6.9	.8	3.0	2.4
Zinc	7	243	128	185	188
		***Hydropsyche* spp.**			
Cadmium	1	--	--	<.3	--
Chromium	1	--	--	1.4	--
Copper	1	--	--	12.5	--
Iron	1	--	--	1,440	--
Lead	1	--	--	4.5	--
Manganese	1	--	--	1,320	--
Nickel	1	--	--	1.3	--
Zinc	1	--	--	130	--
		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, 1991-2001					
		Arctopsyche grandis			
Cadmium	29	3.8	.5	1.6	1.4
Chromium	29	2.5	.2	1.0	1.0
Copper	29	89.2	17.3	36.1	29.6
Iron	29	1,660	240	642	576
Lead	29	11.8	2.1	4.9	4.3
Manganese	29	2,010	462	892	754
Nickel	29	1.9	.2	.7	.7
Zinc	29	308	142	197	190
		Claassenia sabulosa			
Cadmium	34	2.8	.2	1.2	1.2
Chromium	34	3.3	.3	.8	.6
Copper	34	165	18.0	65.7	53.8
Iron	34	387	45.4	162	135
Lead	34	2.9	.2	1.0	.8
Manganese	34	410	33.1	161	135
Nickel	34	1.1	.1	.3	.2
Zinc	34	567	103	273	251

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2001 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12331800--CLARK FORK NEAR DRUMMOND, MONT.--Continued					
Period of record for biological data: 1986, 1991-2001					
		Hydropsyche cockerelli			
Cadmium	26	2.3	.6	1.3	1.2
Chromium	26	3.5	.4	1.7	1.6
Copper	26	156	30.0	64.3	52.6
Iron	26	2,500	506	1,240	1,030
Lead	26	15.0	5.1	9.1	8.6
Manganese	26	1.680	549	947	849
Nickel	26	2.0	.5	1.2	1.2
Zinc	26	248	134	197	191
		***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	16	2.0	.7	1.2	1.2
Chromium	16	8.1	.4	2.4	2.1
Copper	16	118	13.3	55.8	55.7
Iron	16	2,060	424	1,280	1,310
Lead	16	14.0	2.9	9.4	9.5
Manganese	16	2,920	619	1,560	1,220
Nickel	16	2.4	.5	1.5	1.6
Zinc	16	293	157	226	225
		***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	--
12334510--ROCK CREEK NEAR CLINTON, MONT.					
Period of record for biological data: 1987, 1991-99, 2001					
		Arctopsyche grandis			
Cadmium	36	.4	.06	.2	.2
Chromium	36	2.9	.5	1.2	1.0
Copper	36	15.7	4.7	8.7	8.5
Iron	36	1,040	191	568	524
Lead	36	1.1	.1	[1].4	[1].4
Manganese	36	454	113	256	239
Nickel	36	1.7	.2	.9	1.0
Zinc	36	189	84	129	134
		Claassenia sabulosa			
Cadmium	18	.3	.05	.2	.2
Chromium	18	1.8	.1	.7	.6
Copper	18	40.7	18.1	29.0	28.9
Iron	18	129	49.8	92.2	98.7
Lead	18	1.0	.1	.4	.3
Manganese	18	76.3	15.7	34.7	33.6
Nickel	18	.9	.1	.3	.3
Zinc	18	264	144	199	198

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2001 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12334510--ROCK CREEK NEAR CLINTON, MONT.--Continued					
Period of record for biological data: 1987, 1991-99, 2001					
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
***Hydropsyche* spp.**					
Cadmium	3	.3	<.5	[1].2	.2
Chromium	3	2.1	1.1	1.6	1.7
Copper	3	16.2	11.6	14.3	15.0
Iron	3	1,140	837	1,000	1,030
Lead	3	<3.1	<1.8	[1]--	<2.9
Manganese	3	462	299	399	437
Nickel	3	1.3	.8	1.1	1.1
Zinc	3	135	117	126	126
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.					
Period of record for biological data: 1986, 1991-2001					
Arctopsyche grandis					
Cadmium	40	2.7	.6	1.3	1.1
Chromium	40	4.1	.6	1.7	1.6
Copper	40	125	20.1	41.0	34.1
Iron	40	2,870	420	1,050	908
Lead	40	13.2	2.1	4.8	4.4
Manganese	40	893	351	643	652
Nickel	40	2.7	.4	1.2	1.0
Zinc	40	276	152	204	199
Claassenia sabulosa					
Cadmium	25	2.5	.3	1.1	.9
Chromium	25	2.0	.2	.7	.6
Copper	25	79.2	38.3	56.1	53.4
Iron	25	181	58.6	105	102
Lead	25	1.6	.2	.6	.6
Manganese	25	139	37.2	75.6	67.4
Nickel	25	.6	.1	.2	.2
Zinc	25	283	144	220	222
Hydropsyche cockerelli					
Cadmium	26	1.7	.5	.9	.7
Chromium	26	8.0	1.0	2.1	1.7
Copper	26	118	26.4	50.7	44.1
Iron	26	2,530	688	1,290	1,160
Lead	26	12.1	2.2	5.6	5.4
Manganese	26	788	426	606	580
Nickel	26	2.6	.6	1.3	1.2
Zinc	26	228	148	189	184

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2001 (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, 1991-2001					
***Hydropsyche morosa* group**					
Cadmium	2	1.3	1.1	1.2	--
Chromium	2	4.6	2.4	3.5	--
Copper	2	84.1	26.8	55.4	--
Iron	2	1,800	986	1,390	--
Lead	2	6.6	<7.8	5.2	--
Manganese	2	1,320	537	928	--
Nickel	2	1.7	1.3	1.5	--
Zinc	2	231	171	201	--
Hydropsyche occidentalis					
Cadmium	19	1.8	.3	.9	.9
Chromium	19	3.2	.6	1.9	1.7
Copper	19	102	34.1	50.9	44.9
Iron	19	2,310	472	1,220	1,120
Lead	19	14.2	3.0	6.8	5.7
Manganese	19	1.600	454	822	697
Nickel	19	3.2	.6	1.3	1.0
Zinc	19	416	145	208	189
***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, 1998, 2000					
Arctopsyche grandis					
Cadmium	10	.4	<.1	[1].2	[1].2
Chromium	4	1.8	.8	1.3	1.2
Copper	10	13.4	9.9	11.9	12.0
Iron	10	1,230	108	588	609
Lead	10	2.1	.5	1.1	.8
Manganese	4	517	286	398	393
Nickel	4	1.2	.8	1.0	.9
Zinc	10	143	123	135	136
Claassenia sabulosa					
Cadmium	11	.2	.1	.1	.1
Chromium	5	.9	.3	.5	.5
Copper	11	88.5	19.0	45.2	44.0
Iron	11	199	46.2	100	99.0
Lead	11	.6	.4	.3	.4
Manganese	5	127	26.3	57.1	44.7
Nickel	5	.3	.1	.2	.2
Zinc	11	329	117	209	194
Hydropsyche occidentalis					
Cadmium	12	.5	.1	.2	.2
Chromium	12	2.7	.8	1.8	1.7
Copper	12	20.6	12.0	14.6	14.4
Iron	12	1.930	1,060	1,410	1,380
Lead	12	1.9	.8	1.3	1.2
Manganese	12	527	414	472	460
Nickel	12	1.8	.9	1.3	1.2
Zinc	12	150	117	134	130

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2001 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12340000--BLACKFOOT RIVER NEAR BONNER, MONT.--Continued					
Period of record for biological data: 1986-87, 1991, 1993, 1996, 1998, 2000					
		***Hydropsyche* spp.**			
Cadmium	1	--	--	.6	--
Chromium	1	--	--	1.6	--
Copper	1	--	--	13.9	--
Iron	1	--	--	1,140	--
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: 1997-2001					
		Arctopsyche grandis			
Cadmium	16	1.8	.5	.8	.7
Chromium	16	3.0	.8	1.5	1.5
Copper	16	77.6	22.3	33.9	28.2
Iron	16	2,340	476	1,030	947
Lead	16	6.8	1.2	3.2	2.9
Manganese	16	1,210	476	845	887
Nickel	16	2.0	.7	1.1	1.0
Zinc	16	235	133	178	175
		Claassenia sabulosa			
Cadmium	7	2.0	.2	.9	.6
Chromium	7	1.1	.4	.8	.7
Copper	7	71.7	37.8	50.5	46.8
Iron	7	402	95.0	225	229
Lead	7	3.1	.5	[1]1.2	[1]1.0
Manganese	7	683	75.2	254	136
Nickel	7	<1.3	<.3	[1].4	[1].4
Zinc	7	363	191	273	273
		Hydropsyche cockerelli			
Cadmium	9	1.3	.4	.8	1.0
Chromium	9	4.1	1.8	2.8	3.1
Copper	9	96.1	29.9	56.3	45.7
Iron	9	3,590	1,400	2,120	2,040
Lead	9	6.3	4.2	5.4	5.5
Manganese	9	1.470	781	1,050	1,000
Nickel	9	2.4	1.4	1.8	1.6
Zinc	9	226	156	189	191
		Hydropsyche occidentalis			
Cadmium	6	1.1	.4	.7	.7
Chromium	6	3.2	2.1	2.7	2.9
Copper	6	76.5	30.3	48.5	48.2
Iron	6	2,400	1,450	1,970	2,110
Lead	6	7.7	4.0	5.7	5.5
Manganese	6	2,460	939	1,810	1,810
Nickel	6	2.3	1.6	2.0	2.0
Zinc	6	232	192	218	221
12353000--CLARK FORK BELOW MISSOULA, MONT.[2]					
Period of record for biological data: 1986, 1990-2001					
		Arctopsyche grandis			
Cadmium	23	1.5	.2	.7	.6
Chromium	23	2.7	.5	1.3	1.4
Copper	23	38.0	9.4	21.2	20.3
Iron	23	1,500	343	781	754
Lead	23	3.2	.9	1.8	1.8
Manganese	23	1,090	511	729	715
Nickel	23	1.6	.4	.9	.9
Zinc	23	217	106	154	148

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through September 2001 (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, 1990-2001					
		Claassenia sabulosa			
Cadmium	36	1.3	.1	.5	.4
Chromium	36	1.2	.05	.5	.5
Copper	36	74.8	31.1	48.1	46.7
Iron	36	240	66.6	110	98
Lead	36	1.3	.1	.4	.3
Manganese	36	168	48.9	104	101
Nickel	36	.3	.1	.2	.2
Zinc	36	286	146	214	204
		Hydropsyche cockerelli			
Cadmium	34	1.1	.2	.5	.6
Chromium	34	3.4	.8	1.9	1.9
Copper	34	45.7	12.4	28.9	28.3
Iron	34	2,000	584	1,280	1,320
Lead	34	3.6	1.2	2.3	2.4
Manganese	34	1,210	353	760	673
Nickel	34	1.7	.5	1.2	1.3
Zinc	34	172	77.4	144	147
		Hydropsyche occidentalis			
Cadmium	16	1.1	.2	.5	.4
Chromium	16	3.5	.1	1.4	1.5
Copper	16	38.2	16.0	24.4	21.6
Iron	16	1,420	482	956	985
Lead	16	4.2	.7	2.1	1.9
Manganese	16	1,460	491	849	825
Nickel	16	2.2	.5	1.0	.9
Zinc	16	193	112	144	147
		***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 and 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 streamflow-gaging station to conform to previous sampling location.

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