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Water-Quality, Bed-Sediment, and Biological Data (October 2001 through September 2002) and Statistical Summaries of Data for Streams in the Upper Clark Fork Basin, Montana

Open-File Report 03-356

U.S. Department of the Interior
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U.S. Department of the Interior
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CONTENTS

ILLUSTRATION

TABLES

TABLES (Continued)

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:

$$°F = 9/5\ (°C) + 32$$

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
µm	micrometer
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
LRL	laboratory reporting level
LT-MDL	long-term method detection level
NWQL	USGS National Water Quality Laboratory, Denver, Colo.
RSD	relative standard deviation
SRM	standard reference material
USGS	U.S. Geological Survey

Water-Quality, Bed-Sediment, and Biological Data (October 2001 through September 2002) and Statistical Summaries of Data for Streams in the Upper Clark Fork Basin, Montana

By Kent A. Dodge, Michelle I. Hornberger[1], *and* Irene R. Lavigne[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 2001 through September 2002 (water year 2002). Data for 15 bed-sediment and 15 biological stations were obtained in August 2002. 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 elevated trace-element concentrations in water and bed sediment can pose a potential risk to aquatic biota and human health.

Concern about the potential toxicity of trace elements 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, and 1991; Lambing and others, 1994, 1995; and Dodge and others, 1996, 1997, 1998, 1999, 2000, 2001, 2002).

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

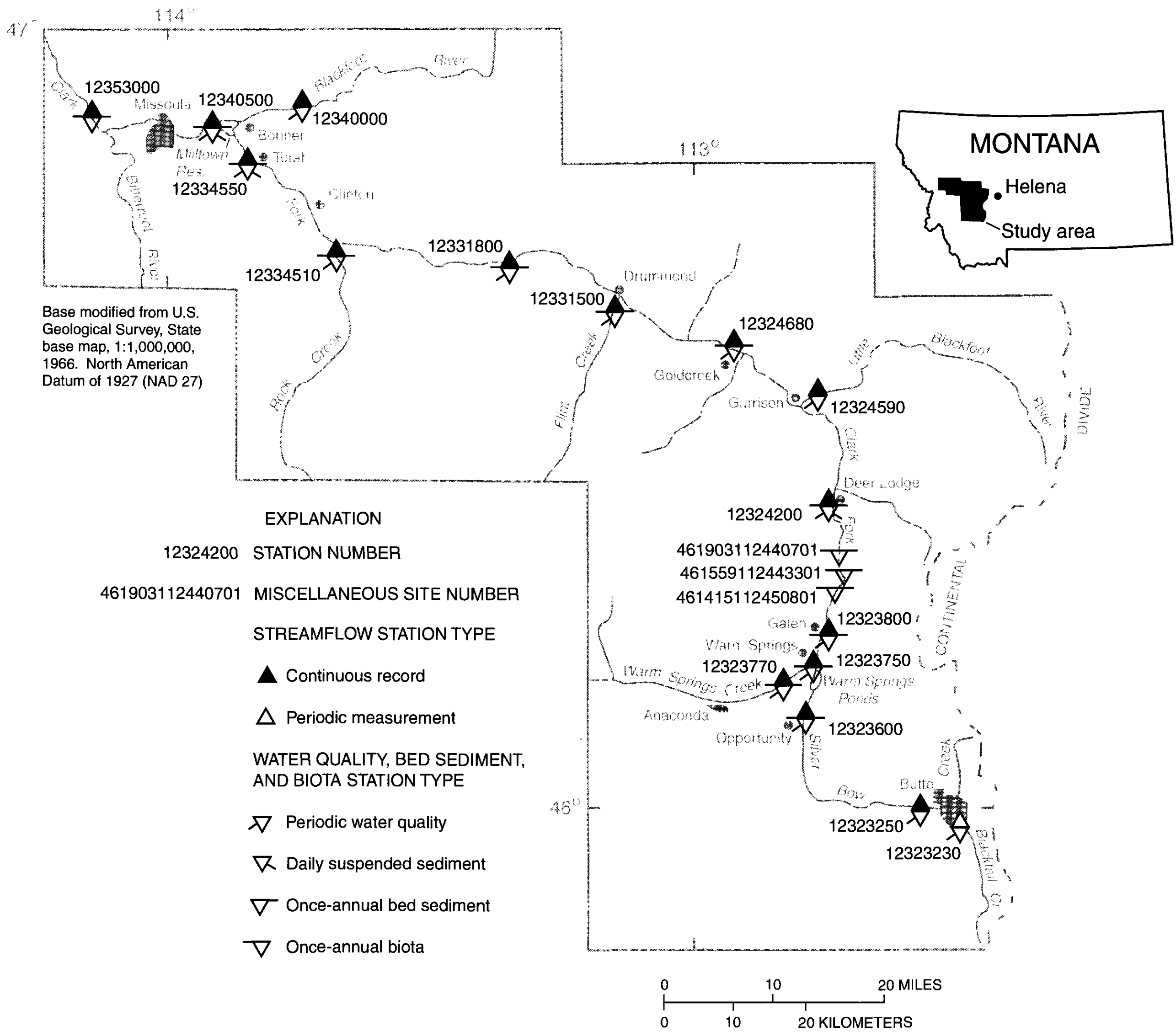

Figure 1. Location of study area.

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; Cain and others, 1992 and 1995; Axtmann and others, 1997; 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 15 bed-sediment and 15 biological stations in the upper Clark Fork basin collected from October 2001 through September 2002 (water year 2002). Quality-assurance data are presented for water-quality, bed-sediment, and biota samples. 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). Major tributaries were sampled to describe water-quality characteristics of important 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 15 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 2002 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 2002 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 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 or Teflon 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 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 from filtered (0.45-μm pore size) samples for dissolved concentrations and unfiltered samples for total-recoverable concentrations. Dissolved concentrations of calcium and magnesium also were determined to enable calculation of hardness. 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 2 to 10 times per week. These samples were collected by local contract observers using the depth-integration

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, 08/02	08/95, 08/97, 88/99, 08/02	08/95, 08/97, 08/99, 08/02
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, 08/02	08/93-99, 08/01, 08/02	08/87, 08/91-99, 08/01, 08/02
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, 08/98-01	08/93, 08/94, 08/99-01	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.

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		

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 2001 through September 2002 (water year 2002) 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 2002 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 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-con-

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 — Laboratory reporting level[1]		Precision — Maximum relative standard deviation of laboratory replicate analyses, in percent	Bias — 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	.04-.10	µg/L	20	25
Cadmium, dissolved	.04-.10	µg/L	20	25
Copper, total recoverable	.6	µg/L	20	25
Copper, dissolved	.2-1.0	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	.08-1	µg/L	20	25
Manganese, total recoverable	1-2.4	µg/L	20	25
Manganese, dissolved	.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 2002.

centration 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 (table 3). 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 and dissolved cadmium. 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:

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

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 95.1 to 105.1 percent. The mean spike recovery for spiked stream samples ranged from 92.6 to 107.1 percent. The 95-percent confidence intervals (Taylor, 1987) for the mean of spike recovery for each constituent analyzed in stream samples (table 12) did not exceed a 25-percent deviation from an expected 100-percent recovery.

High or low bias is indicated if the confidence interval does not include 100 percent recovery. All laboratory-spiked deionized-water blank samples (table 11) had confidence intervals for percent recovery that included 100 percent, except total-recoverable cadmium (96.3-98.9) percent. All laboratory-spiked stream samples (table 12) had confidence intervals for percent recovery that included 100 percent, except dissolved iron (103-111) 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. Minor exceedances were noted for dissolved calcium, dissolved magnesium, dissolved cadmium, dissolved manganese, and total-recoverable zinc. 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 2002 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). Duplicate 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 2002 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 tables 14 and 15 are the means of all analyses of duplicate 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, the mean SRM recoveries (in percent) are shown in table 16 to illustrate analytical performance. Copper for both low-concentration range (SRM 2709) and high-concentration range (SRM 2711) showed consistently low recoveries (71.3 and 74.6 percent, respectively). 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. Also, in SRM 2711, chromium and manganese showed low recoveries (36.3 and 78.6 percent, respectively). Mean recoveries for all other constituents in both low- and high-concentration SRMs ranged from about 80 to 105 percent; thus, mean recoveries 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 chromium and iron) above the analytical detection limit. However, both concentrations 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 were 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 and 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 2002 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 SRM recoveries were within 10 percent of certified values for copper, iron, and manganese. Recoveries for cadmium, chromium, nickel, and zinc were within 16 percent. Lead recoveries were low (mean SRM of 62.2 percent) due to the very low solution concentration of lead in the biota standard (less than 10 parts per billion). However, because the solution concentration in the samples were two to ten-fold higher than the reference standard, adjustments to the data were not necessary. 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.

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 1985. The summaries include the period of record, number of samples, maximum, minimum, mean, and median of concentrations.

Statistical summaries of water-quality data (table 21) are based on results of cross-sectional samples collected periodically by the USGS during the station's period of record. The summaries do not include data for 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. 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 abundance 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 2001 through September 2002

[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)
NOV 2001									
06...	1415	3.8	7.9	326	8.5	130	35.9	8.67	1.4
MAR 2002									
14...	0810	3.1	7.7	321	3.5	120	35.5	8.83	1.1
APR									
08...	0900	9.2	7.7	235	3.0	90	25.6	6.41	3.3
MAY									
06...	0935	4.8	8.0	303	7.0	120	32.7	8.58	2.2
29...	0910	4.7	7.8	300	10.5	120	34.3	8.19	2.7
JUN									
03...	1720	15	7.8	250	14.0	94	27.3	6.40	4.6
24...	1210	E4.8	7.9	315	14.0	120	34.8	8.42	2.9
AUG									
20...	1220	8.5	8.1	338	12.5	130	38.6	9.34	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)
NOV 2001								
06...	2	<0.1	<0.1	E0.8	4.6	18	580	<1
MAR 2002								
14...	<2	<.1	<.1	<1.0	3.6	44	430	<.08
APR								
08...	4	.1	<.1	4.8	9.2	231	860	.23
MAY								
06...	2	.1	<.1	2.8	4.4	72	340	E.08
29...	3	E.02	E.02	2.1	3.2	73	290	<.08
JUN								
03...	6	E.03	.06	6.0	10.0	184	780	.22
24...	3	.08	E.03	2.1	3.2	47	260	E.05
AUG								
20...	2	E.02	<.04	1.1	1.7	15	150	<.08

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 2001								
06...	1	34.5	50	2	7	81	11	0.11
MAR 2002								
14...	<1	39.8	52	3	6	80	21	.18
APR								
08...	2	144	173	4	8	80	15	.37
MAY								
06...	<1	47.9	58	4	9	77	7	.09
29...	<1	38.6	45	2	3	65	6	.08
JUN								
03...	2	30.4	58	4	9	78	15	.60
24...	<1	36.7	42	3	3	82	4	E.05
AUG								
20...	<1	26.3	29	1	2	80	2	.05

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2001 through September 2002 (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)
NOV 2001									
06...	1440	18	7.6	590	9.5	180	50.7	12.7	7.5
MAR 2002									
14...	0920	18	7.5	561	4.5	170	47.9	12.0	7.8
APR									
08...	1015	21	7.6	443	5.0	130	37.5	9.49	4.3
MAY									
06...	1040	18	7.5	500	8.5	140	40.7	10.3	4.6
29...	1015	18	7.7	516	12.5	160	46.0	11.1	5.5
JUN									
03...	1820	27	7.7	418	15.5	130	38.5	9.13	7.3
24...	1245	16	8.0	519	17.0	170	48.6	12.0	7.7
AUG									
20...	1250	16	7.8	574	17.5	170	49.4	12.4	7.4

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)
NOV 2001								
06...	11	1.2	1.5	13.8	36.0	17	390	<1
MAR 2002								
14...	9	E.1	.4	4.5	28.3	28	640	.24
APR								
08...	6	.2	.3	10.5	23.3	80	530	.32
MAY								
06...	4	.2	.3	8.9	18.8	34	290	.20
29...	6	.12	.21	5.3	16.0	27	280	.15
JUN								
03...	9	.14	.36	10.9	23.6	117	690	.46
24...	8	.20	.24	9.2	16.6	14	260	.12
AUG								
20...	9	.11	.18	8.1	13.5	14	90	.17

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 2001								
06...	4	262	298	309	374	92	14	.68
MAR 2002								
14...	7	144	179	90	128	87	19	.92
APR								
08...	4	151	171	94	106	85	12	.68
MAY								
06...	2	177	194	86	107	71	11	.53
29...	1	166	188	82	91	75	7	.34
JUN								
03...	5	113	149	60	93	92	14	1.0
24...	2	148	165	66	88	89	11	.48
AUG								
20...	<1	21.4	29	71	86	81	5	.22

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2001 through September 2002 (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)
NOV 2001									
07...	0810	27	8.1	555	1.5	190	57.0	12.6	9.1
MAR 2002									
14...	1030	E29	7.8	555	0.0	190	54.4	12.3	13.0
APR									
08...	1110	42	8.2	395	5.0	130	38.9	8.81	15.2
MAY									
06...	1140	39	8.9	433	7.5	160	46.5	9.77	11.3
29...	1125	60	8.5	364	12.0	140	43.0	7.78	10.3
JUN									
03...	1915	94	8.2	322	14.0	130	38.4	7.21	11.3
24...	1405	49	8.9	368	19.5	140	43.1	8.28	11.9
AUG									
20...	1400	14	9.5	527	20.0	190	53.4	12.8	18.7

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 2001								
07...	16	1.3	2.0	30.1	101	<10	410	<1
MAR 2002								
14...	16	1.4	1.6	43.7	102	12	530	.30
APR								
08...	63	.8	1.8	61.2	283	22	1,770	.61
MAY								
06...	16	.4	.8	29.3	85.8	17	550	.33
29...	15	.25	.69	19.5	86.2	21	620	.28
JUN								
03...	21	.38	1.34	31.5	154	45	1,140	.88
24...	16	.22	.61	19.9	76.9	14	490	.25
AUG								
20...	23	.46	.89	40.7	98.5	17	280	.40

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 2001								
07...	12	478	508	487	656	78	13	.95
MAR 2002								
14...	14	372	436	343	405	56	14	E1.1
APR								
08...	101	492	612	224	416	91	43	4.9
MAY								
06...	15	336	424	77	221	78	14	1.5
29...	15	192	285	59	162	74	17	2.8
JUN								
03...	32	234	439	95	287	74	35	8.9
24...	12	141	208	34	143	85	13	1.7
AUG								
20...	7	140	196	29	151	57	7	.26

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2001 through September 2002 (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)
NOV 2001									
06...	1620	34	9.0	637	7.0	270	75.1	19.0	17.4
MAR 2002									
14...	1130	46	8.3	675	4.0	290	83.4	19.0	11.8
APR									
08...	1225	51	8.4	581	7.5	240	69.9	16.1	8.5
MAY									
06...	1230	53	8.4	541	10.0	220	64.3	14.4	13.3
29...	1225	107	8.8	376	15.5	150	41.7	10.0	23.8
JUN									
04...	0835	186	8.5	372	10.0	140	39.7	10.4	34.1
24...	1505	140	9.0	287	18.5	110	29.1	8.00	31.3
AUG									
20...	1500	22	9.2	555	20.0	240	69.4	17.3	26.2

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 2001								
06...	22	<.1	<.1	2.5	5.2	<10	140	<1
MAR 2002								
14...	13	E.1	.1	7.4	9.9	17	160	E.05
APR								
08...	13	<.1	.5	3.3	24.8	<10	540	E.05
MAY								
06...	17	<.1	.1	3.6	10.5	12	300	E.07
29...	28	.05	.16	5.5	13.0	15	330	.10
JUN								
04...	38	.06	.17	7.3	12.7	25	250	.12
24...	34	.07	.13	6.7	10.6	23	180	.15
AUG								
20...	30	E.03	.06	3.7	5.6	E8	120	E.07

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 2001								
06...	<1	33.8	74	2	9	75	7	.64
MAR 2002								
14...	<1	301	333	21	27	87	4	.50
APR								
08...	4	135	207	7	75	97	6	.83
MAY								
06...	2	126	219	6	22	90	10	1.4
29...	2	45.5	137	4	18	86	13	3.8
JUN								
04...	2	38.0	82	6	17	87	9	4.5
24...	1	23.0	69	3	11	90	5	1.9
AUG								
20...	<1	40.5	109	2	6	83	7	.42

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2001 through September 2002 (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)
NOV 2001									
06...	1605	41	8.5	331	5.5	160	47.5	9.53	4.2
APR 2002									
08...	1210	34	8.4	358	5.5	170	51.6	10.5	4.6
MAY									
29...	1210	59	8.4	260	14.0	130	38.7	7.07	5.3
JUN									
04...	0810	101	8.0	191	7.5	89	27.7	4.92	3.9
24...	1440	95	8.3	186	15.5	40	10.5	3.29	4.8
AUG									
20...	1440	27	8.6	317	16.5	150	47.7	8.67	7.5

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 2001								
06...	5	E.1	<.1	E1.1	3.9	<10	40	<1
APR 2002								
08...	5	<.1	<.1	2.9	6.2	<10	60	<.08
MAY								
29...	5	E.03	.07	3.6	14.4	<10	200	<.08
JUN								
04...	5	E.03	.07	2.9	14.8	E9	270	E.05
24...	7	.04	.05	3.1	11.0	E8	140	E.05
AUG								
20...	9	E.03	.04	3.1	7.3	E6	70	E.05

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 2001								
06...	<1	95.2	118	1	3	57	3	.33
APR 2002								
08...	<1	173	206	2	2	80	3	.28
MAY								
29...	1	63.8	205	<1	5	66	10	1.6
JUN								
04...	1	67.8	157	2	7	61	14	3.8
24...	<1	45.3	115	1	4	62	10	2.6
AUG								
20...	<1	22.6	99	1	2	76	3	.22

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2001 through September 2002 (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)
NOV 2001									
06...	1640	87	8.8	480	5.5	210	61.4	14.0	10.4
MAR 2002									
14...	1230	96	8.3	554	3.0	240	71.7	15.8	8.3
APR									
08...	1315	91	8.4	496	7.5	210	62.2	13.5	6.9
MAY									
06...	1310	76	8.6	481	9.0	210	62.2	13.4	10.4
29...	1320	164	8.9	342	16.0	140	42.1	9.31	17.9
JUN									
04...	0715	300	8.2	308	10.5	120	35.7	8.39	24.3
24...	1605	255	8.9	252	18.0	99	28.5	6.82	22.1
AUG									
20...	1605	49	8.8	457	18.0	210	61.4	13.2	16.2

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 2001								
06...	13	<.1	<.1	2.3	5.1	<10	70	<1
MAR 2002								
14...	9	<.1	E.1	5.8	10.3	E6	130	E.04
APR								
08...	9	<.1	.2	3.4	13.3	<10	270	E.06
MAY								
06...	11	<.1	<.1	3.4	7.6	E6	140	E.05
29...	22	.04	.14	5.1	15.8	E8	310	E.06
JUN								
04...	28	.06	.23	6.2	28.8	22	510	.10
24...	24	.12	.10	6.6	13.6	14	190	.17
AUG								
20...	18	E.04	.06	3.9	6.7	E5	70	E.04

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 2001								
06...	<1	41.2	65	2	5	71	4	.94
MAR 2002								
14...	<1	204	248	13	18	76	5	1.3
APR								
08...	2	113	170	7	31	86	5	1.2
MAY								
06...	<1	101	142	5	10	84	5	1.0
29...	2	42.6	167	2	16	78	13	5.8
JUN								
04...	4	45.0	217	5	29	66	24	19.4
24...	1	27.5	98	3	11	78	9	6.2
AUG								
20...	<1	29.8	70	2	5	80	3	.40

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2001 through September 2002 (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)
NOV 2001									
07...	0915	172	8.3	551	3.0	240	70.5	16.3	8.3
MAR 2002									
14...	1330	201	8.4	551	3.0	240	71.9	15.6	10.1
APR									
08...	1410	190	8.4	524	9.0	220	66.0	14.3	9.7
MAY									
06...	1410	132	8.6	527	10.5	230	68.6	14.8	10.6
29...	1415	141	8.8	445	17.5	190	57.3	12.1	16.6
JUN									
04...	0945	305	8.1	360	12.0	150	43.9	9.82	18.7
24...	1705	325	8.9	334	20.0	140	40.0	9.20	22.2
AUG									
22...	0735	97	8.0	541	12.0	230	68.2	14.4	12.7

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 2001								
07...	11	<.1	E.1	3.2	15.4	<10	190	<1
MAR 2002								
14...	14	<.1	.2	7.2	44.8	E10	700	.09
APR								
08...	15	E.1	E.1	6.5	37.0	<10	510	E.08
MAY								
06...	11	<.1	E.1	6.1	15.5	<10	170	E.04
29...	19	.04	.11	7.8	20.4	<10	220	<.08
JUN								
04...	32	.05	.57	9.6	92.4	21	1,450	.21
24...	26	.06	.17	9.4	33.8	E9	390	.09
AUG								
22...	13	.08	.06	10.7	15.7	E5	100	E.05

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 2001								
07...	2	29.4	79	7	22	74	14	6.5
MAR 2002								
14...	6	50.1	157	13	44	72	39	21.2
APR								
08...	5	48.9	126	8	33	79	23	11.8
MAY								
06...	2	47.7	78	5	15	80	10	3.6
29...	2	27.8	82	2	16	82	11	4.2
JUN								
04...	13	23.1	328	9	90	68	69	56.8
24...	4	18.1	95	2	25	78	23	20.2
AUG								
22...	<1	8.5	16	8	11	85	4	1.0

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2001 through September 2002 (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 2001									
08...	0835	63	8.1	284	.5	130	37.6	8.71	3.9
APR 2002									
09...	0925	197	8.1	206	3.0	88	25.5	5.92	5.3
MAY									
29...	1530	414	8.2	180	15.5	80	23.2	5.38	5.1
JUN									
04...	1125	372	8.1	194	10.5	86	24.8	5.74	5.1
24...	1830	289	8.4	222	19.5	100	29.7	6.75	6.0
AUG									
21...	1715	51	8.6	265	15.5	120	35.0	8.11	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 2001								
08...	5	<.1	<.1	<1.0	.9	<10	40	<1
APR 2002								
09...	6	<.1	<.1	2.3	2.5	79	380	.13
MAY								
29...	6	<.04	.04	1.6	2.9	36	590	E.07
JUN								
04...	6	<.04	E.03	1.3	2.0	30	280	E.06
24...	6	E.02	E.02	1.2	1.6	21	160	E.05
AUG								
21...	6	<.04	E.02	.7	1.0	<10	70	E.05

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 2001								
08...	<1	2.5	6.8	<1	1	81	2	.34
APR 2002								
09...	<1	9.5	35	2	3	84	15	8.0
MAY								
29...	1	8.2	44	1	6	58	35	39.1
JUN								
04...	<1	7.9	25	1	4	73	13	13.1
24...	<1	9.0	21	1	2	84	7	5.5
AUG								
21...	<1	5.4	16	1	1	94	3	.41

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2001 through September 2002 (Continued)

12324680--CLARK FORK AT GOLDCREEK, 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 2001									
07...	1120	299	8.5	489	4.0	210	62.0	13.7	6.9
MAR 2002									
14...	1450	326	8.6	474	4.0	210	61.4	13.3	9.4
APR									
09...	1015	454	8.3	365	5.5	150	45.5	10.0	8.1
MAY									
06...	1535	281	8.5	408	11.0	180	53.2	11.7	8.1
29...	1630	718	8.7	272	16.0	120	34.2	7.59	7.7
JUN									
04...	1220	928	8.4	270	12.0	120	35.1	7.67	10.6
25...	0730	732	8.2	307	15.0	130	38.9	8.38	12.4
AUG									
21...	1555	175	8.6	427	15.5	190	55.1	11.8	10.1

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)
NOV 2001								
07...	9	<.1	E.1	2.1	13.0	<10	190	<1
MAR 2002								
14...	12	<.1	.2	8.8	40.8	22	680	.13
APR								
09...	11	<.1	.1	5.4	28.3	35	710	.13
MAY								
06...	8	<.1	<.1	4.0	12.8	<10	230	<.08
29...	9	E.03	.12	4.2	16.3	13	560	E.04
JUN								
04...	16	E.03	.27	5.6	45.4	19	780	.14
25...	13	.04	.14	5.7	22.9	12	370	E.08
AUG								
21...	10	E.03	.04	3.5	5.7	<10	50	.10

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 2001								
07...	2	13.6	66	3	17	72	14	11.3
MAR 2002								
14...	5	33.9	130	8	44	71	38	33.4
APR								
09...	4	15.7	105	5	30	73	38	46.6
MAY								
06...	2	17.0	53	2	14	87	14	10.6
29...	2	10.0	73	1	18	84	30	58.2
JUN								
04...	7	10.5	153	4	45	84	37	92.7
25...	3	13.9	75	4	23	77	18	35.6
AUG								
21...	<1	7.6	21	2	4	79	3	1.4

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2001 through September 2002 (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 2001									
07...	1220	119	8.6	350	4.5	160	43.4	12.5	6.2
MAR 2002									
13...	1640	125	8.5	305	2.5	130	33.3	10.4	10.9
APR									
09...	1110	84	8.4	301	4.5	130	35.3	10.9	7.3
MAY									
08...	0930	31	8.5	360	4.0	170	45.7	13.1	7.5
29...	1725	19	8.8	306	20.5	140	39.7	10.8	11.9
JUN									
04...	1320	83	8.4	276	13.5	130	35.2	9.51	9.7
25...	0830	112	8.1	353	12.5	160	44.6	12.3	10.3
AUG									
20...	1740	11	8.5	483	18.0	220	59.4	17.8	11.6

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 2001								
07...	9	<.1	<.1	<1.0	1.4	<10	130	<1
MAR 2002								
13...	15	<.1	E.1	4.4	7.2	99	720	.67
APR								
09...	12	<.1	<.1	E1.0	3.6	21	470	.25
MAY								
08...	8	<.1	<.1	E.8	1.4	E6	130	.10
29...	14	E.02	.05	1.4	2.8	E8	270	.12
JUN								
04...	14	<.04	.07	1.4	3.4	19	400	.26
25...	13	E.02	.06	1.3	3.1	20	260	.20
AUG								
20...	12	<.04	<.04	1.3	1.9	E9	100	E.06

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 2001								
07...	2	21.5	53	1	7	87	8	2.6
MAR 2002								
13...	9	54.2	182	9	29	78	52	17.6
APR								
09...	7	39.7	137	2	19	88	29	6.6
MAY								
08...	2	57.6	84	2	5	88	8	.67
29...	4	39.3	147	1	11	92	17	.87
JUN								
04...	7	36.9	144	2	19	86	26	5.8
25...	5	48.6	125	2	15	87	15	4.5
AUG								
20...	<1	50.7	80	1	3	88	4	.12

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2001 through September 2002 (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)
NOV 2001									
07...	1340	498	8.4	498	6.0	220	63.2	15.1	7.5
MAR 2002									
13...	1510	698	8.2	411	3.5	180	51.1	11.9	9.7
APR									
09...	1200	650	8.3	418	8.0	180	52.2	12.3	8.9
MAY									
08...	1025	420	8.5	480	7.5	220	62.7	14.7	8.6
30...	1045	768	8.2	349	16.0	160	45.1	10.3	9.6
JUN									
04...	1430	1,120	8.3	324	15.0	140	41.5	9.42	11.9
25...	0945	963	8.3	373	17.5	160	47.5	11.1	12.3
AUG									
21...	1435	223	8.5	559	17.5	260	73.7	18.3	11.3

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)
NOV 2001								
07...	10	<.1	E.1	2.0	9.3	<10	180	<1
MAR 2002								
13...	12	E.1	.2	12.5	44.0	51	1,190	.30
APR								
09...	13	<.1	.2	5.8	32.4	12	780	.14
MAY								
08...	9	<.1	<.1	3.7	10.7	<10	190	<.08
30...	13	E.04	.25	5.5	33.8	E8	780	E.06
JUN								
04...	18	E.03	.43	6.4	60.7	12	1,220	.16
25...	14	.04	.13	6.0	21.6	E8	360	.09
AUG								
21...	10	E.03	.04	3.0	4.9	<10	40	<.08

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 2001								
07...	2	7.5	53	3	18	66	17	22.9
MAR 2002								
13...	8	27.9	160	13	70	51	96	181
APR								
09...	6	11.4	116	6	44	70	52	91.3
MAY								
08...	1	15.3	48	4	14	90	11	12.5
30...	5	10.0	118	4	44	84	47	97.5
JUN								
04...	10	10.4	190	5	76	75	71	215
25...	3	10.9	74	4	25	80	19	49.4
AUG								
21...	<1	10.9	23	3	6	67	4	2.4

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2001 through September 2002 (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 2001									
07...	1445	215	8.3	148	5.0	67	17.5	5.80	.5
APR 2002									
09...	1310	270	8.2	125	5.5	53	13.4	4.84	.6
MAY									
23...	1145	1,610	7.7	69	5.0	28	7.23	2.46	.6
JUN									
04...	1620	2,080	7.8	68	10.0	30	7.70	2.50	.6
25...	1130	1,080	8.0	92	13.0	40	10.5	3.39	.6
AUG									
21...	1320	241	8.2	136	12.5	61	15.6	5.35	.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 2001								
07...	<2	<.1	<.1	<1.0	E.3	<10	30	<1
APR 2002								
09...	<2	<.1	<.1	<1.0	E.6	17	80	<.08
MAY								
23...	<2	.04	E.02	1.0	1.5	52	260	<.08
JUN								
04...	<2	<.04	<.04	.7	1.8	29	190	<.08
25...	5	E.02	<.04	.5	.9	22	120	<.08
AUG								
21...	<2	<.04	<.04	.3	E.5	E9	40	<.08

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 2001								
07...	<1	.8	E2.5	<1	1	73	3	1.7
APR 2002								
09...	<1	.8	3.6	<1	<1	82	4	2.9
MAY								
23...	<1	1.7	13	2	2	63	17	73.9
JUN								
04...	<1	1.8	10	<1	2	57	15	84.2
25...	<1	2.2	7	<1	<1	73	7	20.4
AUG								
21...	<1	1.8	5	<1	<1	80	3	2.0

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2001 through September 2002 (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)
NOV 2001									
08...	1040	740	8.4	400	3.5	180	50.6	13.1	5.2
MAR 2002									
13...	1315	1,010	8.2	323	1.5	130	36.7	9.38	7.7
APR									
09...	1530	1,010	8.4	323	7.5	140	39.2	10.1	6.2
MAY									
08...	1150	973	8.5	277	7.0	120	34.4	9.19	4.1
23...	1345	2,520	8.1	173	7.0	73	20.4	5.38	3.4
JUN									
05...	1050	3,020	8.1	176	12.0	75	21.0	5.41	4.7
26...	0730	2,610	8.2	241	16.0	110	29.7	7.56	6.1
AUG									
*04...	1300	666	8.5	318	17.5	140	39.4	10.8	5.1
*10...	1445	856	8.7	325	18.5	150	40.8	10.9	5.9
*14...	1015	682	8.3	341	16.5	150	41.7	11.2	5.5
*18...	1230	529	8.5	337	15.5	150	40.8	11.2	5.2
21...	0720	495	8.2	350	13.5	150	42.5	11.8	4.8
*24...	1100	542	8.2	350	15.0	160	43.9	11.9	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)
NOV 2001								
08...	7	<.1	<.1	E1.1	5.7	<10	100	<1
MAR 2002								
13...	13	E.1	.4	8.4	53.6	71	1,810	.29
APR								
09...	8	<.1	.1	5.0	25.3	20	580	.14
MAY								
08...	4	<.1	<.1	2.2	5.8	E5	160	<.08
23...	4	E.04	.19	2.9	23.3	37	710	.10
JUN								
05...	7	E.02	.14	3.2	20.8	23	530	.11
26...	7	.04	.12	4.3	18.0	13	340	.08
AUG								
*04...	6	.06	<.04	2.2	3.3	<10	40	E.05
*10...	6	E.02	E.03	2.6	4.3	<10	50	<.08
*14...	5	E.02	E.03	2.3	4.1	<10	50	<.08
*18...	5	E.02	E.02	2.0	4.1	<10	30	<.08
21...	4	E.02	E.03	1.7	3.5	<10	50	<.08
*24...	5	E.02	E.03	2.5	6.4	<10	50	<.08

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 2001								
08...	<1	3.3	28	3	11	86	7	14.0
MAR 2002								
13...	11	18.0	239	12	93	87	129	352
APR								
09...	4	7.4	85	4	33	81	36	98.2
MAY								
08...	<1	5.2	24	2	9	80	10	26.3
23...	4	6.1	91	4	36	70	45	306
JUN								
05...	3	6.6	71	4	29	68	35	285
26...	2	9.2	54	4	22	71	22	155
AUG								
*04...	<1	1.2	10	3	4	65	4	7.2
*10...	<1	.6	12	2	6	70	4	9.2
*14...	<1	1.0	13	3	9	49	5	9.2
*18...	<1	.5	9	1	4	64	5	7.1
21...	<1	4.8	15	--	6	82	6	8.0
*24...	<1	.4	13	4	9	58	4	5.9

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

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2001 through September 2002 (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)
NOV 2001									
08...	1315	535	8.5	267	4.0	130	33.5	12.0	1.0
APR 2002									
09...	1730	1,310	8.4	205	5.5	97	24.7	8.68	1.5
MAY									
23...	1530	6,840	8.1	146	7.0	71	18.6	5.98	.8
JUN									
05...	0910	6,720	8.1	152	10.5	75	19.6	6.35	.8
25...	1540	5,620	8.3	156	15.0	78	20.2	6.54	.8
AUG									
21...	0845	694	8.5	257	13.5	130	33.0	12.1	1.2

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 2001								
08...	E2	<.1	<.1	<1.0	E.5	<10	20	<1
APR 2002								
09...	E1	<.1	<.1	1.5	3.8	100	500	.11
MAY								
23...	<2	<.04	.04	1.4	6.4	25	960	<.08
JUN								
05...	<2	<.04	E.02	.9	3.9	16	520	<.08
25...	<2	<.04	<.04	.7	2.2	E9	490	<.08
AUG								
21...	E1	<.04	<.04	.4	.6	<10	30	<.08

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 2001								
08...	<1	1.1	E2	<1	<1	85	1	1.4
APR 2002								
09...	<1	5.2	41	1	3	91	28	99.0
MAY								
23...	1	2.8	68	1	7	84	81	1,500
JUN								
05...	<1	1.9	35	<1	4	81	47	853
25...	<1	2.4	31	<1	3	84	44	668
AUG								
21...	<1	1.1	6	<1	<1	84	3	5.6

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2001 through September 2002 (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)
NOV 2001									
08...	1500	854	8.4	349	4.0	160	43.3	12.2	3.5
MAR 2002									
13...	1020	1,630	8.2	315	1.0	130	36.7	10.2	5.6
APR									
10...	0830	2,450	8.3	262	6.5	120	31.7	9.32	3.7
MAY									
08...	1400	3,390	8.3	200	7.0	93	24.6	7.62	1.8
24...	0815	7,890	8.0	160	7.0	75	20.2	6.10	1.8
JUN									
05...	0735	9,790	8.1	160	11.5	76	20.4	6.09	2.1
25...	1350	7,730	8.2	180	15.5	82	21.8	6.57	2.3

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)
NOV 2001								
08...	4	<.1	<.1	E1.1	4.1	<10	70	<1
MAR 2002								
13...	6	.2	E.1	5.4	17.3	35	450	.18
APR								
10...	4	<.1	<.1	3.0	9.6	58	360	.17
MAY								
08...	E2	<.1	<.1	1.3	3.7	13	140	<.08
24...	3	<.04	.09	1.5	13.9	29	800	E.04
JUN								
05...	4	<.04	.15	1.6	14.4	22	670	E.07
25...	3	E.02	.05	1.6	6.3	11	400	E.05

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 2001								
08...	<1	9.4	17	2	7	92	5	11.5
MAR 2002								
13...	3	16.5	61	8	31	97	27	119
APR								
10...	2	24.4	49	2	13	99	17	112
MAY								
08...	<1	12.6	21	1	6	92	9	82.4
24...	2	8.4	67	1	20	91	59	1,260
JUN								
05...	3	8.3	60	2	25	88	52	1,370
25...	1	8.1	40	1	9	93	35	730

Table 4. Water-quality data for the upper Clark Fork basin, Montana, October 2001 through September 2002 (Continued)

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

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)
AUG 2002									
*04...	1430	1,470	8.4	274	17.5	130	33.4	11.0	3.0
*06...	1515	1,740	8.4	273	17.0	130	34.3	10.9	2.9
*08...	1300	1,750	8.2	280	14.5	130	34.4	10.7	3.8
*10...	1600	1,800	8.3	288	17.5	130	35.7	11.0	5.0
*11...	1130	1,680	8.2	293	17.0	140	37.0	11.3	4.6
*12...	1100	1,620	8.1	292	17.0	140	36.1	11.1	4.9
*13...	1245	1,560	8.2	293	18.0	140	35.9	11.2	5.2
*14...	0915	1,490	8.2	288	17.0	130	35.1	11.3	4.6
*15...	1030	1,410	8.2	289	16.5	130	34.1	10.9	4.5
*16...	1245	1,350	8.2	290	17.0	130	35.4	11.2	4.6
*17...	1130	1,300	8.1	290	15.5	140	35.8	11.5	5.2
*18...	1130	1,250	8.2	289	16.0	140	35.5	11.5	4.7
*19...	1100	1,230	8.2	289	15.5	130	34.4	11.2	4.5
*20...	1245	1,200	8.2	291	16.0	140	35.5	11.6	4.4
21...	1040	1,200	8.3	292	14.5	140	35.8	11.6	3.4
*23...	1215	1,280	8.2	293	15.0	140	36.3	11.5	4.3
*24...	1200	1,240	8.2	294	16.0	140	36.9	11.8	4.5
*29...	1030	1,220	8.2	298	16.5	140	36.5	11.7	4.5
*31...	1900	835	8.4	300	18.0	140	37.1	11.8	3.2

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)
AUG 2002								
*04...	3	E.04	E.03	1.4	3.6	<10	70	E.05
*06...	3	<.04	E.02	1.6	6.4	E6	110	E.06
*08...	4	E.03	.23	1.8	25.9	11	570	.11
*10...	8	E.02	.33	2.1	34.4	E7	830	.09
*11...	8	<.04	.42	1.9	50.6	E8	1,300	.12
*12...	13	<.04	.77	1.5	84.8	17	2,130	.19
*13...	10	E.02	.63	1.7	71.1	14	1,880	.15
*14...	9	<.04	.47	1.4	54.4	15	1,460	.14
*15...	7	E.03	.33	1.6	39.6	E6	1,050	E.07
*16...	8	<.04	.48	1.5	52.6	11	1,350	.13
*17...	10	.04	.60	1.8	62.4	E9	1,570	.11
*18...	9	E.03	.48	1.7	57.0	E9	1,370	.12
*19...	8	E.03	.42	1.4	45.8	E10	1,190	.40
*20...	9	<.04	.43	1.4	51.5	13	1,210	.19
21...	8	<.04	.40	1.1	46.8	15	1,170	.12
*23...	6	E.03	.28	1.9	32.4	<10	890	.13
*24...	6	E.03	.29	1.9	34.0	E5	880	.10
*29...	7	E.03	.31	1.9	35.3	E9	950	E.08
*31...	3	E.02	.09	1.7	4.7	<10	110	<.08

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)
AUG 2002								
*04...	<1	1.1	20	1	4	93	4	15.9
*06...	<1	5.7	29	1	7	93	7	32.9
*08...	4	.7	81	4	50	91	33	156
*10...	6	.9	80	5	69	85	61	296
*11...	9	1.0	102	6	95	81	89	404
*12...	15	2.9	162	5	172	81	162	709
*13...	13	.9	144	7	151	73	155	653
*14...	9	1.2	113	4	116	70	120	483
*15...	7	.5	87	6	84	71	87	331
*16...	9	.9	103	5	109	75	106	386
*17...	11	.5	121	10	134	73	123	432
*18...	10	.6	108	7	116	76	114	385
*19...	8	.9	93	5	101	75	92	306
*20...	9	5.0	97	5	106	73	106	343
21...	8	29.8	92	2	99	76	93	301
*23...	6	.4	67	7	66	68	68	235
*24...	6	.6	69	7	67	68	71	238
*29...	6	.6	83	7	70	71	71	234
*31...	<1	.4	21	4	12	74	7	15.8

*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 2001 through September 2002

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

Day	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
					2001				
		October			**November**			**December**	
1	96	7	1.8	177	10	4.8	157	6	2.5
2	95	6	1.5	177	10	4.8	189	6	3.1
3	93	6	1.5	176	10	4.8	188	7	3.6
4	87	7	1.6	175	11	5.2	179	8	3.9
5	110	10	3.0	175	14	6.6	154	10	4.1
6	127	18	6.2	174	15	7.0	188	12	6.1
7	124	27	9.1	175	15	7.1	180	13	6.3
8	145	34	13	175	12	5.7	177	10	4.8
9	153	38	16	177	10	4.8	177	8	3.8
10	155	40	17	175	10	4.7	e150	7	2.8
11	157	34	14	174	10	4.7	160	7	3.0
12	160	28	12	175	11	5.2	164	7	3.1
13	162	23	10	176	12	5.7	160	10	4.3
14	168	21	9.5	177	12	5.7	e150	14	5.7
15	178	21	10	175	13	6.1	e145	16	6.3
16	176	20	9.5	172	14	6.5	150	15	6.1
17	176	20	9.5	172	14	6.5	182	12	5.9
18	177	20	9.5	180	15	7.3	162	9	3.9
19	176	20	9.5	177	15	7.2	168	7	3.2
20	185	19	9.5	180	16	7.8	175	7	3.3
21	182	18	8.8	180	16	7.8	174	7	3.3
22	178	17	8.2	181	15	7.3	e150	7	2.8
23	177	16	7.6	180	14	6.8	e135	7	2.6
24	174	17	8.0	177	13	6.2	e120	7	2.3
25	175	19	9.0	179	12	5.8	e110	8	2.4
26	175	21	9.9	184	11	5.5	e95	11	2.8
27	174	19	8.9	185	9	4.5	e95	13	3.3
28	172	15	7.0	160	7	3.0	e110	13	3.9
29	172	11	5.1	164	6	2.7	e125	11	3.7
30	173	10	4.7	192	6	3.1	e140	10	3.8
31	176	10	4.8	--	--	--	e150	11	4.5
TOTAL	4,828	--	255.7	5,296	--	170.9	4,759	--	121.2
MEAN	156	19	8.2	176	12	5.7	154	10	3.9
MAX	185	40	17	192	16	7.8	189	16	6.3
MIN	87	6	1.5	160	6	2.7	95	6	2.3

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 2001 through September 2002 (Continued)

Day	Mean stream-flow (ft^3/s)	Suspended sediment: Mean concen-tration (mg/L)	Suspended sediment: Dis-charge (ton/d)	Mean stream-flow (ft^3/s)	Suspended sediment: Mean concen-tration (mg/L)	Suspended sediment: Dis-charge (ton/d)	Mean stream-flow (ft^3/s)	Suspended sediment: Mean concen-tration (mg/L)	Suspended sediment: Dis-charge (ton/d)
					2002				
		January			**February**			**March**	
1	e150	13	5.3	148	25	10	e150	27	11
2	e140	15	5.7	164	33	15	e150	25	10
3	e140	16	6.0	e150	31	13	162	22	9.6
4	e150	17	6.9	164	28	12	176	22	10
5	e160	17	7.3	e160	26	11	182	26	13
6	170	17	7.8	181	24	12	181	39	19
7	191	29	15	177	24	11	170	30	14
8	201	37	20	177	23	11	e150	22	8.9
9	186	34	17	172	22	10	e160	24	10
10	e165	31	14	171	21	9.7	169	44	20
11	e160	28	12	176	20	9.5	195	53	28
12	e170	26	12	166	20	9.0	220	81	48
13	178	25	12	165	21	9.4	210	47	27
14	173	27	13	175	25	12	203	39	21
15	176	27	13	161	26	11	192	30	16
16	176	26	12	169	24	11	193	30	16
17	171	23	11	174	22	10	182	34	17
18	167	19	8.6	170	21	9.6	180	39	19
19	157	16	6.8	168	21	9.5	186	28	14
20	162	13	5.7	173	23	11	183	25	12
21	e160	12	5.2	169	26	12	160	27	12
22	e155	12	5.0	183	27	13	189	36	18
23	e150	12	4.9	186	28	14	191	39	20
24	160	12	5.2	e135	25	9.1	204	44	24
25	174	12	5.6	e100	22	5.9	208	43	24
26	176	12	5.7	e110	20	5.9	199	34	18
27	e160	12	5.2	e130	18	6.3	212	42	24
28	e140	12	4.5	153	19	7.8	202	36	20
29	e120	12	3.9	--	--	--	200	36	19
30	e130	13	4.6	--	--	--	199	29	16
31	e140	17	6.4	--	--	--	199	26	14
TOTAL	5,008	--	267.3	4,527	--	290.7	5,757	--	552.5
MEAN	162	19	8.6	162	24	10	186	35	18
MAX	201	37	20	186	33	15	220	81	48
MIN	120	12	3.9	100	18	5.9	150	22	8.9

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 2001 through September 2002 (Continued)

Day	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
					2002				
		April			**May**			**Jnne**	
1	201	28	15	156	15	6.3	287	52	40
2	187	42	21	155	14	5.8	363	59	58
3	188	40	20	147	10	4.0	389	128	134
4	191	37	19	147	9	3.6	311	68	57
5	190	38	19	127	16	5.5	273	50	37
6	197	39	21	131	12	4.2	252	39	27
7	198	35	19	136	15	5.5	251	29	20
8	191	26	13	140	12	4.5	263	25	18
9	190	27	14	125	11	3.7	296	26	21
10	201	30	16	127	12	4.1	429	54	62
11	200	30	16	131	7	2.5	388	52	54
12	196	28	15	126	6	2.0	308	29	24
13	192	32	17	118	7	2.2	278	22	17
14	201	36	20	109	8	2.4	243	21	14
15	235	32	20	100	9	2.4	236	21	13
16	218	27	16	85	11	2.5	248	21	14
17	211	23	13	83	8	1.8	284	24	18
18	214	26	15	74	5	1.0	325	27	24
19	208	24	13	76	5	1.0	344	16	15
20	200	23	12	83	5	1.1	293	12	9.5
21	193	21	11	120	12	3.9	258	14	9.8
22	181	18	8.8	191	42	22	286	19	15
23	165	20	8.9	197	28	15	339	26	24
24	175	18	8.5	185	19	9.5	322	20	17
25	183	20	9.9	163	16	7.0	286	13	10
26	186	16	8.0	144	12	4.7	260	10	7.0
27	178	13	6.2	139	10	3.7	251	9	6.1
28	182	13	6.4	147	10	4.0	232	9	5.6
29	168	14	6.4	145	10	3.9	239	10	6.5
30	160	12	5.2	175	20	9.4	246	10	6.6
31	--	--	--	278	94	71	--	--	--
TOTAL	5,780	--	413.3	4,260	--	220.2	8,780	--	784.1
MEAN	193	26	14	137	15	7.1	293	30	26
MAX	235	42	21	278	94	71	429	128	134
MIN	160	12	5.2	74	5	1.0	232	9	5.6

Table 5. Daily streamflow and suspended-sediment data for Clark Fork at Deer Lodge, Montana, October 2001 through September 2002 (Continued)

Day	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
					2002				
		July			August			September	
1	219	9	5.3	63	15	2.5	99	3	.80
2	195	7	3.7	60	15	2.4	99	3	.81
3	181	6	2.9	59	12	1.9	100	3	.81
4	182	7	3.4	66	7	1.2	97	3	.78
5	171	7	3.2	77	4	.83	89	3	.72
6	160	7	3.0	81	3	.66	90	3	.73
7	157	7	3.0	82	3	.67	132	7	2.5
8	158	6	2.6	135	3	1.1	142	8	3.1
9	147	5	2.0	168	2	.91	129	7	2.4
10	134	5	1.8	140	2	.76	119	6	1.9
11	116	4	1.3	116	2	.62	117	6	1.9
12	104	4	1.1	106	2	.57	115	6	1.9
13	97	3	.79	92	2	.50	115	5	1.6
14	87	3	.70	82	2	.44	115	4	1.2
15	81	3	.65	73	2	.39	111	4	1.2
16	78	3	.63	74	3	.60	111	4	1.2
17	77	3	.62	72	4	.78	112	5	1.5
18	74	4	.80	70	3	.57	126	7	2.4
19	69	4	.75	66	1	.18	129	7	2.4
20	78	5	1.1	65	2	.35	123	7	2.3
21	76	5	1.0	77	4	.84	113	7	2.1
22	66	6	1.1	103	4	1.1	115	5	1.5
23	62	6	1.0	113	2	.61	118	4	1.3
24	69	6	1.1	110	2	.60	106	5	1.4
25	71	6	1.1	100	2	.54	103	8	2.2
26	73	6	1.2	102	2	.55	112	10	3.0
27	83	7	1.6	99	2	.54	124	10	3.4
28	90	8	1.9	103	2	.56	132	10	3.6
29	83	9	2.0	106	2	.57	130	10	3.5
30	72	9	1.8	104	2	.56	132	10	3.6
31	69	11	2.1	99	2	.53	--	--	--
TOTAL	3,379	--	55.24	2,863	--	24.93	3,455	--	57.75
MEAN	109	6	1.8	92	4	.80	115	6	1.9
MAX	219	11	5.3	168	15	2.5	142	10	3.6
MIN	62	3	.62	59	1	.18	89	3	.72

TOTAL FOR WATER YEAR 2002:

STREAMFLOW--58,692 ft^3/s
SEDIMENT DISCHARGE--3,213.82 tons

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 2001 through September 2002

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

Day	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
	2001								
	October			**November**			**December**		
1	474	5	6.4	854	14	32	697	7	13
2	478	6	7.8	847	13	30	655	7	12
3	485	7	9.2	822	12	27	699	8	15
4	486	7	9.2	800	10	22	697	8	15
5	491	8	11	789	9	19	631	7	12
6	518	9	13	776	9	19	615	7	12
7	547	11	16	770	8	17	671	7	13
8	555	13	19	761	7	14	656	6	11
9	567	14	21	736	7	14	635	6	10
10	591	15	24	725	7	14	643	6	10
11	619	15	25	718	7	14	590	6	9.6
12	644	16	28	706	6	11	577	5	7.8
13	681	18	33	720	6	12	588	6	9.5
14	730	20	39	728	6	12	683	7	13
15	788	22	47	724	6	12	637	7	12
16	782	22	46	722	6	12	574	8	12
17	764	21	43	717	6	12	654	7	12
18	748	20	40	722	7	14	611	6	9.9
19	771	19	40	728	7	14	589	5	7.9
20	814	18	40	721	7	14	615	5	8.3
21	820	16	35	720	8	16	631	5	8.5
22	806	13	28	728	7	14	656	4	7.1
23	814	11	24	728	7	14	596	4	6.4
24	811	10	22	713	6	12	489	4	5.3
25	788	11	23	708	6	11	e350	3	2.8
26	773	11	23	697	6	11	e250	3	2.0
27	772	11	23	686	6	11	e200	4	2.2
28	788	11	23	660	6	11	e220	6	3.6
29	805	11	24	618	6	10	e250	8	5.4
30	818	12	26	676	6	11	e350	10	9.5
31	822	14	31	--	--	--	e500	10	14
TOTAL	21,350	--	799.6	22,020	--	456	17,209	--	291.8
MEAN	689	13	26	734	7	15	555	6	9.4
MAX	822	22	47	854	14	32	699	10	15
MIN	474	5	6.4	618	6	10	200	3	2.0

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 2001 through September 2002 (Continued)

Day	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft³/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
	2002								
	January			**February**			**March**		
1	e480	9	12	542	8	12	e600	14	23
2	e450	7	8.5	587	8	13	e550	11	16
3	495	7	9.4	554	9	13	e480	7	9.1
4	559	7	11	557	9	14	507	7	9.6
5	616	7	12	573	9	14	562	11	17
6	612	6	9.9	554	9	13	651	13	23
7	631	7	12	604	9	15	596	14	23
8	743	15	30	648	10	18	512	13	18
9	830	21	47	619	10	17	494	11	15
10	774	15	31	592	9	14	548	14	21
11	699	8	15	614	9	15	617	16	27
12	713	8	15	595	9	14	874	80	189
13	713	9	17	560	9	14	1,040	130	364
14	686	8	15	572	8	12	900	46	112
15	640	8	14	572	8	12	807	26	57
16	597	7	11	558	7	11	750	18	36
17	598	7	11	582	8	13	e700	19	36
18	600	7	11	613	9	15	603	15	24
19	561	8	12	596	10	16	661	16	29
20	586	7	11	598	10	16	e650	20	35
21	596	6	9.7	597	11	18	e500	24	32
22	594	6	9.6	652	13	23	e520	19	27
23	556	7	11	774	21	44	642	22	38
24	541	7	10	732	20	40	782	36	76
25	613	7	12	e500	16	22	899	86	209
26	655	7	12	e300	16	13	939	76	193
27	615	6	10	e400	16	17	1,080	112	326
28	549	5	7.4	e550	15	22	1,030	99	275
29	475	5	6.4	--	--	--	928	46	115
30	494	4	5.3	--	--	--	889	34	82
31	511	7	9.7	--	--	--	916	31	77
TOTAL	18,782	--	417.9	16,195	--	480	22,227	--	2,533.7
MEAN	606	8	13	578	11	17	717	35	82
MAX	830	21	47	774	21	44	1,080	130	364
MIN	450	4	5.3	300	7	11	480	7	9.1

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 2001 through September 2002 (Continued)

Day	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
					2002				
		April			May			June	
1	e1,000	53	143	986	15	40	3,490	71	668
2	e950	80	205	999	15	40	3,590	63	610
3	846	29	66	1,050	18	51	3,790	84	858
4	813	28	61	1,090	18	53	3,400	56	514
5	841	31	70	1,070	16	46	3,010	35	284
6	1,020	63	173	1,080	14	41	2,900	29	227
7	1,260	135	459	1,060	12	34	2,770	26	194
8	1,160	94	293	994	10	27	2,580	25	174
9	1,060	44	126	937	9	23	2,600	26	183
10	1,070	38	110	894	8	19	3,000	38	308
11	1,110	40	120	874	8	19	3,250	51	448
12	1,130	46	140	841	8	18	2,940	38	301
13	1,150	42	131	822	10	22	2,740	29	214
14	1,290	58	202	873	11	26	2,650	26	186
15	1,690	126	576	953	12	31	2,700	26	189
16	1,630	66	291	984	10	27	2,810	32	242
17	1,430	42	162	966	10	26	3,210	33	286
18	1,300	26	92	994	10	27	3,720	39	391
19	1,210	22	72	1,130	17	52	3,800	37	379
20	1,130	20	61	1,450	42	164	3,490	28	264
21	1,100	22	65	1,980	74	395	3,070	23	191
22	1,080	17	49	2,610	81	572	2,930	25	198
23	1,050	15	43	2,570	44	305	3,150	31	264
24	1,050	11	31	2,250	28	170	3,040	28	230
25	1,000	11	30	2,000	23	124	2,780	22	165
26	994	15	40	1,940	21	110	2,580	21	147
27	1,000	18	49	2,110	21	119	2,400	21	136
28	1,000	15	41	2,320	27	169	2,400	18	117
29	974	15	39	2,620	39	275	2,390	18	116
30	968	15	39	3,060	65	537	2,440	17	112
31	--	--	--	3,500	91	860	--	--	--
TOTAL	33,306	--	3,979	47,007	--	4,422	89,620	--	8,596
MEAN	1,110	41	133	1,516	25	143	2,987	34	287
MAX	1,690	135	576	3,500	91	860	3,800	84	858
MIN	813	11	30	822	8	18	2,390	17	112

Table 6. Daily streamflow and suspended-sediment data for Clark Fork at Turah Bridge, near Bonner, Montana, October 2001 through September 2002 (Continued)

Day	Mean streamflow (ft³/s)	Suspended sediment Mean concentration (mg/L)	Suspended sediment Discharge (ton/d)	Mean streamflow (ft³/s)	Suspended sediment Mean concentration (mg/L)	Suspended sediment Discharge (ton/d)	Mean streamflow (ft³/s)	Suspended sediment Mean concentration (mg/L)	Suspended sediment Discharge (ton/d)
				2002					
	July			August			September		
1	2,310	14	87	705	4	7.6	572	5	7.7
2	2,140	12	69	686	4	7.4	558	5	7.5
3	2,010	9	49	653	4	7.1	544	5	7.3
4	1,910	8	41	652	4	7.0	541	5	7.3
5	1,840	6	30	727	6	12	541	5	7.3
6	1,620	7	31	728	5	9.8	549	5	7.4
7	1,270	7	24	718	4	7.8	611	5	8.2
8	1,280	8	28	782	4	8.4	661	5	8.9
9	1,260	7	24	865	6	14	689	5	9.3
10	1,190	5	16	862	4	9.3	677	5	9.1
11	1,120	5	15	809	4	8.7	653	4	7.1
12	1,070	4	12	745	4	8.0	627	4	6.8
13	1,020	4	11	700	4	7.6	605	4	6.5
14	975	4	11	668	5	9.0	582	4	6.3
15	972	4	11	638	5	8.6	572	4	6.2
16	1,070	4	12	597	5	8.1	562	4	6.1
17	1,030	4	11	557	5	7.5	560	4	6.1
18	976	4	11	524	5	7.1	573	4	6.2
19	990	4	11	508	4	5.5	585	4	6.3
20	1,040	5	14	495	5	6.7	586	4	6.3
21	1,000	6	16	513	6	8.3	554	3	4.5
22	949	7	18	548	5	7.4	545	3	4.4
23	917	6	15	557	4	6.0	546	3	4.4
24	903	6	15	545	4	5.9	551	3	4.5
25	878	5	12	559	3	4.5	553	2	3.0
26	885	5	12	556	4	6.0	548	2	3.0
27	919	5	12	546	4	5.9	566	2	3.1
28	868	4	9.4	552	4	6.0	587	2	3.2
29	830	4	9.0	556	4	6.0	601	2	3.2
30	799	4	8.6	573	4	6.2	625	2	3.4
31	751	4	8.1	582	4	6.3	--	--	--
TOTAL	36,792	--	653.1	19,706	--	235.7	17,524	--	180.6
MEAN	1,187	6	21	636	4	7.6	584	4	6.0
MAX	2,310	14	87	865	6	14	689	5	9.3
MIN	751	4	8.1	495	3	4.5	541	2	3.0

TOTAL FOR WATER YEAR 2002:

STREAMFLOW--361,738 ft³/s
SEDIMENT DISCHARGE--23,045.4 tons

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 2001 through September 2002

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

Day	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)	Mean streamflow (ft^3/s)	Suspended sediment: Mean concentration (mg/L)	Suspended sediment: Discharge (ton/d)
	2001								
	October			**November**			**December**		
1	856	4	9.2	1,400	6	23	1,130	4	12
2	860	4	9.3	1,340	6	22	1,100	4	12
3	861	7	16	1,310	6	21	1,120	4	12
4	856	7	16	1,300	6	21	1,130	4	12
5	874	7	17	1,290	6	21	1,070	4	12
6	899	6	15	1,280	5	17	1,050	4	11
7	930	6	15	1,260	5	17	1,100	5	15
8	949	5	13	1,220	5	17	1,110	5	15
9	963	6	16	1,230	6	20	1,050	4	11
10	980	6	16	1,210	6	20	1,010	4	11
11	1,030	6	17	1,190	6	19	1,020	4	11
12	1,060	7	20	1,190	5	16	991	3	8.0
13	1,110	7	21	1,190	5	16	1,010	3	8.2
14	1,160	7	22	1,190	5	16	1,150	3	9.3
15	1,210	7	23	1,190	5	16	1,060	3	8.6
16	1,200	7	23	1,170	5	16	967	3	7.8
17	1,180	7	22	1,190	5	16	1,070	3	8.6
18	1,120	7	21	1,180	6	19	988	3	8.0
19	1,190	7	23	1,170	6	19	936	2	5.1
20	1,230	7	23	1,170	6	19	e950	2	5.1
21	1,230	7	23	1,190	6	19	e1,050	2	5.7
22	1,230	7	23	1,220	5	16	1,090	2	5.9
23	1,240	6	20	1,210	4	13	1,010	2	5.4
24	1,250	6	20	1,220	3	9.9	e850	2	4.6
25	1,250	6	20	1,180	3	9.6	e750	2	4.0
26	1,230	6	20	1,170	4	13	e650	3	5.3
27	1,220	6	20	1,150	4	12	e600	3	4.9
28	1,240	6	20	1,120	4	12	e550	3	4.5
29	1,270	7	24	1,030	4	11	e700	4	7.6
30	1,310	6	21	1,110	4	12	e850	3	6.9
31	1,310	6	21	--	--	--	e1,000	2	5.4
TOTAL	34,298	--	589.5	36,270	--	498.5	30,112	--	262.9
MEAN	1,106	6	19	1,209	5	17	971	3	8.5
MAX	1,310	7	24	1,400	6	23	1,150	5	15
MIN	856	4	9.2	1,030	3	9.6	550	2	4.0

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 2001 through September 2002 (Continued)

Day	Mean stream-flow (ft^3/s)	Suspended sediment: Mean concen-tration (mg/L)	Suspended sediment: Dis-charge (ton/d)	Mean stream-flow (ft^3/s)	Suspended sediment: Mean concen-tration (mg/L)	Suspended sediment: Dis-charge (ton/d)	Mean stream-flow (ft^3/s)	Suspended sediment: Mean concen-tration (mg/L)	Suspended sediment: Dis-charge (ton/d)
					2002				
		January			February			March	
1	e1,000	2	5.4	1,020	2	5.5	1,030	3	8.3
2	e900	5	12	1,030	2	5.5	1,000	3	8.1
3	e900	6	15	953	3	7.7	948	3	7.7
4	e1,000	5	14	953	3	7.7	1,030	3	8.3
5	e1,100	4	12	982	3	8.0	1,060	5	14
6	e1,100	4	12	965	4	10	1,060	4	11
7	1,100	5	15	1,060	5	14	923	3	7.5
8	1,210	5	16	1,100	7	21	885	4	9.6
9	1,300	5	18	1,130	8	24	976	4	11
10	1,250	5	17	965	7	18	996	5	13
11	1,160	4	13	1,070	6	17	1,120	7	21
12	1,160	4	13	985	5	13	1,280	11	38
13	1,160	3	9.4	953	5	13	1,620	24	105
14	1,120	3	9.1	978	4	11	1,420	16	62
15	1,060	3	8.6	887	3	7.2	1,340	10	36
16	1,020	3	8.3	937	3	7.6	1,240	8	27
17	1,020	3	8.3	964	4	10	1,170	7	22
18	1,010	3	8.2	1,060	4	11	1,020	7	19
19	978	3	7.9	1,030	5	14	1,110	8	24
20	1,010	3	8.2	1,010	5	14	1,110	8	24
21	1,040	3	8.4	980	5	13	886	4	9.6
22	1,030	4	11	1,050	6	17	962	4	10
23	986	4	11	1,220	7	23	1,150	7	22
24	962	4	10	1,110	8	24	1,280	9	31
25	1,050	4	11	859	8	19	1,400	12	45
26	1,100	5	15	e650	8	14	1,460	17	67
27	1,060	4	11	882	8	19	1,600	21	91
28	935	4	10	1,010	6	16	1,730	29	135
29	903	4	9.8	--	--	--	1,640	16	71
30	896	3	7.3	--	--	--	1,580	13	56
31	981	2	5.3	--	--	--	1,640	12	53
TOTAL	32,501	--	340.2	27,793	--	384.2	37,666	--	1,067.1
MEAN	1,048	4	11	993	5	14	1,215	9	34
MAX	1,300	6	18	1,220	8	24	1,730	29	135
MIN	896	2	5.3	650	2	5.5	885	3	7.5

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 2001 through September 2002 (Continued)

Day	Mean stream-flow (ft^3/s)	Suspended sediment		Mean stream-flow (ft^3/s)	Suspended sediment		Mean stream-flow (ft^3/s)	Suspended sediment	
		Mean concen-tration (mg/L)	Dis-charge (ton/d)		Mean concen-tration (mg/L)	Dis-charge (ton/d)		Mean concen-tration (mg/L)	Dis-charge (ton/d)
					2002				
		April			May			June	
1	1,900	15	77	3,060	8	66	11,500	96	2,970
2	2,000	21	113	3,240	9	79	11,400	79	2,420
3	1,640	17	75	3,610	9	88	11,200	68	2,050
4	1,560	14	59	3,910	10	106	10,400	57	1,610
5	1,570	12	51	3,870	10	104	9,650	47	1,230
6	1,910	14	72	3,800	9	92	9,520	41	1,050
7	2,650	29	207	3,640	9	88	9,400	37	939
8	2,590	38	266	3,410	8	74	8,890	37	888
9	2,410	25	163	3,190	7	60	8,420	31	705
10	2,350	18	114	2,940	7	56	8,490	30	688
11	2,530	16	109	2,840	6	46	8,360	35	790
12	2,710	16	117	2,670	7	51	7,580	34	696
13	3,000	19	154	2,730	5	37	7,060	27	515
14	3,910	22	232	3,160	7	60	6,920	24	449
15	5,220	38	535	3,770	10	102	7,410	25	500
16	5,200	30	421	3,960	10	107	8,210	35	776
17	4,710	24	305	3,930	10	106	9,090	48	1,180
18	4,340	22	258	4,100	11	122	9,640	58	1,510
19	3,920	13	138	4,670	15	189	9,430	55	1,400
20	3,600	11	107	6,480	40	700	8,470	43	983
21	3,460	11	103	9,060	102	2,490	7,480	30	606
22	3,340	9	81	10,400	97	2,720	7,190	25	485
23	3,310	10	89	9,650	73	1,900	7,870	28	595
24	3,360	7	64	8,300	49	1,100	8,210	53	1,180
25	3,220	6	52	7,260	36	705	7,740	37	773
26	3,150	6	51	6,730	29	527	7,280	27	531
27	3,120	7	59	6,960	26	488	6,900	25	466
28	3,070	8	66	7,690	31	643	6,880	27	501
29	2,990	8	64	8,810	46	1,090	6,770	21	384
30	2,980	7	56	10,400	84	2,360	6,620	19	340
31	--	--	--	11,400	94	2,880	--	--	--
TOTAL	91,720	--	4,258	169,640	--	19,236	253,980	--	29,210
MEAN	3,057	16	142	5,472	28	621	8,466	40	974
MAX	5,220	38	535	11,400	102	2,880	11,500	96	2,970
MIN	1,560	6	51	2,670	5	37	6,620	19	340

Table 7. Daily streamflow and suspended-sediment data for Clark Fork above Missoula, Montana, October 2001 through September 2002 (Continued)

Day	Mean stream-flow (ft^3/s)	Suspended sediment: Mean concen-tration (mg/L)	Suspended sediment: Dis-charge (ton/d)	Mean stream-flow (ft^3/s)	Suspended sediment: Mean concen-tration (mg/L)	Suspended sediment: Dis-charge (ton/d)	Mean stream-flow (ft^3/s)	Suspended sediment: Mean concen-tration (mg/L)	Suspended sediment: Dis-charge (ton/d)
					2002				
		July			**August**			**September**	
1	6,030	16	260	1,680	5	23	1,090	7	21
2	5,430	15	220	1,610	5	22	1,160	7	22
3	4,850	13	170	1,560	4	17	1,160	7	22
4	4,580	10	124	1,500	4	16	1,080	6	18
5	4,220	10	114	1,750	10	47	1,080	6	17
6	3,970	8	86	1,780	8	38	1,140	8	25
7	3,730	8	81	1,730	15	70	1,230	10	33
8	3,700	6	60	1,750	32	151	1,270	11	38
9	3,690	5	50	1,800	49	239	1,320	9	32
10	3,450	5	47	1,780	59	283	1,300	8	28
11	3,240	5	44	1,680	92	418	1,260	7	24
12	2,970	5	40	1,600	155	672	1,210	5	16
13	2,840	6	46	1,530	154	635	1,170	5	16
14	2,680	6	43	1,460	114	449	1,150	6	19
15	2,570	6	42	1,400	90	340	1,110	6	18
16	2,630	6	43	1,350	106	386	1,120	6	18
17	2,580	6	42	1,300	121	425	1,110	6	18
18	2,380	5	32	1,250	111	376	1,110	8	24
19	2,360	12	76	1,230	94	311	1,150	9	28
20	2,380	17	109	1,200	103	334	1,150	9	28
21	2,240	15	91	1,210	92	299	1,120	9	27
22	2,180	13	77	1,260	80	272	1,100	8	24
23	2,120	12	69	1,270	70	239	1,060	8	23
24	2,090	10	57	1,230	70	232	1,060	7	20
25	2,020	9	49	1,230	66	220	1,060	7	20
26	2,030	7	38	1,230	56	186	1,060	9	26
27	2,050	7	39	1,200	52	169	1,060	10	29
28	1,980	6	32	1,210	59	192	1,090	10	29
29	1,890	6	31	1,210	71	233	1,090	10	29
30	1,860	5	25	1,120	34	103	1,160	10	31
31	1,740	5	23	1,010	8	22	--	--	--
TOTAL	92,480	--	2,260	44,120	--	7,419	34,230	--	723
MEAN	2,983	9	73	1,423	64	239	1,141	8	24
MAX	6,030	17	260	1,800	155	672	1,320	11	38
MIN	1,740	5	23	1,010	4	16	1,060	5	16

TOTAL FOR WATER YEAR 2002:

STREAMFLOW--884,810 ft^3/s
SEDIMENT DISCHARGE--66,248.4 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. Symbol: <, less than minimum reporting level]

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)
12323800	Clark Fork near Galen	11-06-01	1640	210	61.4	14.0	10.4	13
	Clark Fork near Galen	11-06-01	1645	210	61.8	13.8	10.6	13
12324200	Clark Fork at Deer Lodge	03-14-02	1330	240	71.9	15.6	10.1	14
	Clark Fork at Deer Lodge	03-14-02	1335	250	73.1	15.8	9.9	14
12323230	Blacktail Creek at Harrison Avenue, at Butte	04-08-02	0900	90	25.6	6.41	3.3	4
	Blacktail Creek at Harrison Avenue, at Butte	04-08-02	0905	88	24.8	6.23	3.4	5
12334550	Clark Fork at Turah Bridge, near Bonner	05-08-02	1150	120	34.4	9.19	4.1	4
	Clark Fork at Turah Bridge, near Bonner	05-08-02	1155	120	34.7	9.23	4.2	4
12340500	Clark Fork above Missoula	05-24-02	0815	75	20.2	6.10	1.8	3
	Clark Fork above Missoula	05-24-02	0820	76	20.3	6.10	1.8	2
12323600	Silver Bow Creek at Opportunity	06-03-02	1915	130	38.4	7.21	11.3	21
	Silver Bow Creek at Opportunity	06-03-02	1920	130	39.1	7.36	11.7	22
12331800	Clark Fork near Drummond	08-21-02	1435	260	73.7	18.3	11.3	10
	Clark Fork near Drummond	08-21-02	1440	270	75.1	18.9	11.3	10

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)
12323800	11-06-01	<0.1	<0.1	2.3	5.1	<10	70	<1
	11-06-01	<.1	<.1	2.4	5.0	<10	70	<1
12324200	03-14-02	<.1	.2	7.2	44.8	E10	700	.09
	03-14-02	<.1	.2	7.5	42.9	E9	700	.09
12323230	04-08-02	.1	<.1	4.8	9.2	231	860	.23
	04-08-02	E.1	<.1	4.9	9.0	231	870	.25
12334550	05-08-02	<.1	<.1	2.2	5.8	E5	160	<.08
	05-08-02	<.1	<.1	2.0	5.8	E6	150	<.08
12340500	05-24-02	<.04	.09	1.5	13.9	29	800	E.04
	05-24-02	<.04	.10	1.6	12.1	30	790	E.06
12323600	06-03-02	.38	1.34	31.5	154	45	1,140	.88
	06-03-02	.38	1.32	31.9	154	46	1,180	.86
12331800	08-21-02	E.03	.04	3.0	4.9	<10	40	<.08
	08-21-02	E.03	.04	3.0	4.9	<10	40	E.05

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)
12323800	11-06-01	<1	41.2	65	2	5	71	4
	11-06-01	<1	42.2	65	2	5	70	3
12324200	03-14-02	6	50.1	157	13	44	72	39
	03-14-02	6	50.9	159	14	43	72	38
12323230	04-08-02	2	144	173	4	8	80	15
	04-08-02	1	149	172	4	8	81	15
12334550	05-08-02	<1	5.2	24	2	9	80	10
	05-08-02	<1	5.3	23	3	9	77	11
12340500	05-24-02	2	8.4	67	1	20	91	59
	05-24-02	2	8.3	67	1	20	90	60
12323600	06-03-02	32	234	439	95	287	74	35
	06-03-02	32	234	443	97	296	73	37
12331800	08-21-02	<1	10.9	23	3	6	67	4
	08-21-02	<1	10.9	22	3	6	69	4

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

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

Constituent and reporting unit	Number of replicate pairs	Standard deviation, in units (+/-)	Relative standard deviation, in percent (+/-)
Calcium, dissolved, mg/L	7	0.58	1.2
Magnesium, dissolved, mg/L	7	.19	1.7
Arsenic, total recoverable, µg/L	7	.46	4.7
Arsenic, dissolved, µg/L	7	.14	1.8
Cadmium, total recoverable, µg/L	7	.01	2.3
Cadmium, dissolved, µg/L	7	.0	.0
Copper, total recoverable, µg/L	7	.70	2.1
Copper, dissolved, µg/L	7	.15	2.0
Iron, total recoverable, µg/L	7	12	2.2
Iron, dissolved, µg/L	7	.54	1.1
Lead, total recoverable, µg/L	7	.27	4.4
Lead, dissolved, µg/L	7	.01	3.7
Manganese, total recoverable, µg/L	7	1.3	.94
Manganese, dissolved, µg/L	7	1.4	1.9
Zinc, total recoverable, µg/L	7	2.4	4.4
Zinc, dissolved, µg/L	7	.66	3.8
Sediment, suspended, mg/L	7	.76	3.2
Sediment, suspended, percent finer than 0.062 mm	7	1.1	1.4

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

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

Constituent and reporting unit	Number of replicate pairs	Standard deviation,[1] in units (+/-)	Relative standard deviation, in percent (+/-)	Within limits of data-quality objective
Calcium, dissolved, mg/L	7	0.42	1.2	Yes
Magnesium, dissolved, mg/L	7	.08	.91	Yes
Arsenic, total recoverable, µg/L	7	.60	6.6	Yes
Arsenic, dissolved, µg/L	7	.12	1.5	Yes
Cadmium, total recoverable, µg/L	7	.02	25	Yes[2]
Cadmium, dissolved, µg/L	7	.02	33	Yes[2]
Copper, total recoverable, µg/L	7	.32	2.5	Yes
Copper, dissolved, µg/L	7	.10	3.2	Yes
Iron, total recoverable, µg/L	7	2.8	.60	Yes
Iron, dissolved, µg/L	7	1.7	2.9	Yes
Lead, total recoverable, µg/L	7	.04	1.6	Yes
Lead, dissolved, µg/L	7	.01	11	Yes
Manganese, total recoverable, µg/L	7	.45	.43	Yes
Manganese, dissolved, µg/L	7	.59	1.2	Yes
Zinc, total recoverable, µg/L	7	.15	1.2	Yes
Zinc, dissolved, µg/L	7	.05	1.5	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 (maximum relative standard deviation of 20 percent) results 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	93.0-103	97.9	Yes
Arsenic, dissolved, µg/L	4	95.8-114	105.1	Yes
Cadmium, total recoverable, µg/L	4	96.3-98.9	97.6	Yes
Cadmium, dissolved, µg/L	4	98.8-103	101.1	Yes
Copper, total recoverable, µg/L	4	96.7-101	98.8	Yes
Copper, dissolved, µg/L	4	95.0-104	99.4	Yes
Iron, total recoverable, µg/L	4	89.3-101	95.1	Yes
Iron, dissolved, µg/L	4	93.0-112	102.3	Yes
Lead, total recoverable, µg/L	4	90.5-103	96.9	Yes
Lead, dissolved, µg/L	4	89.9-107	98.5	Yes
Manganese, total recoverable, µg/L	4	95.4-102	98.5	Yes
Manganese, dissolved, µg/L	4	88.8-104	96.5	Yes
Zinc, total recoverable, µg/L	4	91.8-105	98.3	Yes
Zinc, dissolved, µg/L	4	94.4-113	103.9	Yes

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

[Abbreviation: µg/L, micrograms per liter]

Constituent and reporting unit	Number of samples	95-percent confidence interval for spike recovery, in percent	Mean spike recovery, in percent	Within limits of data-quality objective
Arsenic, total recoverable, µg/L	5	86.0-114	99.9	Yes
Arsenic, dissolved, µg/L	5	97.1-114	105.8	Yes
Cadmium, total recoverable, µg/L	5	98.6-105	102.0	Yes
Cadmium, dissolved, µg/L	5	97.5-114	106.0	Yes
Copper, total recoverable, µg/L	5	92.9-101	96.9	Yes
Copper, dissolved, µg/L	5	91.2-103	97.3	Yes
Iron, total recoverable, µg/L	5	83.3-102	92.6	Yes
Iron, dissolved, µg/L	5	103-111	107.1	Yes
Lead, total recoverable, µg/L	5	92.2-106	98.9	Yes
Lead, dissolved, µg/L	5	91.9-111	101.4	Yes
Manganese, total recoverable, µg/L	5	92.5-104	98.3	Yes
Manganese, dissolved, µg/L	5	88.4-100	94.3	Yes
Zinc, total recoverable, µg/L	5	89.9-102	95.8	Yes
Zinc, dissolved, µg/L	5	92.6-110	101.3	Yes

Table 13. Chemical analyses of field blanks for water samples

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

Date	Time	pH, onsite (standard units)	Specific conduct-ance, onsite (µS/cm)	Calcium, dissolved (mg/L)	Magne-sium, dissolved (mg/L)	Arsenic, dissolved (µg/L)	Arsenic, total recov-erable (µg/L)	Cadmium, dissolved (µg/L)	Cadmium, total recoverable (µg/L)	Copper, dissolved (µg/L)
NOV 2001										
07...	0630	5.6	2	<0.01	<0.008	<0.2	<2	<0.1	<0.1	<1.0
MAR 2002										
13...	1100	5.6	2	<.01	<.008	<.2	<2	E.1	<.1	<1.0
APR										
09...	1500	5.6	2	<.01	<.008	<.2	<2	<.1	<.1	<1.0
MAY										
08...	1330	5.6	2	<.01	<.008	<.2	<2	<.1	<.1	<1.0
30...	1030	5.7	2	<.01	<.008	<.2	<2	<.04	<.04	<.2
JUN										
04...	0930	5.6	2	E.01	<.008	<.2	<2	<.04	<.04	<.2
24...	1700	5.7	2	<.01	<.008	<.2	<2	<.04	<.04	<.2
AUG										
20...	2100	5.6	2	.03	.009	<.2	<2	<.04	<.04	<.2

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)	Manga-nese, total recoverable (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)
NOV 2001									
07...	<0.6	<10	<10	<1	<1	<0.1	<2.4	<1	1
MAR 2002									
13...	<.6	<10	<10	<.08	<1	<.1	<2.4	<1	<1
APR									
09...	<.6	<10	<10	<.08	<1	<.1	<2.4	<1	<1
MAY									
08...	<.6	<10	<10	<.08	<1	<.1	<2.4	<1	<1
30...	<.6	<10	<10	<.08	<1	<.1	<1	<1	<1
JUN									
04...	<.6	<10	<10	<.08	<1	<.1	<1	<1	<1
24...	<.6	<10	<10	<.08	<1	<.1	<1	<1	<1
AUG									
20...	<.6	<10	<10	<.08	<1	E.1	<1	<1	<1

Table 14. Trace-element analyses of fine-grained bed sediment, upper Clark Fork basin, Montana, August 2002

[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]

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	30.2	18.9	3,700	29,800	381	2,770	14.1	8.3	5,620
12323750	Silver Bow Creek at Warm Springs	3	8.4	19.5	286	22,100	68	10,600	14.6	3.5	1,000
12323770	Warm Springs Creek at Warm Springs	3	5.8	31.5	881	16,800	67	11,000	17.7	5.1	373
12323800	Clark Fork near Galen	3	9.3	25.8	1,110	23,600	113	5,960	16.6	4.9	1,170
461415112450801	Clark Fork below Lost Creek, near Galen	3	8.1	31.8	1,350	28,500	167	5,890	15.2	6.6	1,120
461559112443301	Clark Fork near Racetrack	3	8.1	29.2	1,240	23,100	143	2,100	10.5	5.3	1,130
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	3	8.4	25.6	1,020	25,300	139	2,560	10.6	4.8	1,070
12324200	Clark Fork at Deer Lodge	3	4.9	36.7	880	25,300	122	2,410	12.9	4.1	961
12324680	Clark Fork at Goldcreek	3	4.0	33.3	475	20,000	67	1,390	10.9	2.3	670
12331500	Flint Creek near Drummond	3	5.9	28.0	53	20,600	126	4,230	10.4	5.8	503
12331800	Clark Fork near Drummond	3	6.3	35.3	414	20,300	78	1,650	12.8	3.0	863
12334510	Rock Creek near Clinton	3	2.4	20.5	9	14,800	12	170	9.5	.7	32
12334550	Clark Fork at Turah Bridge, near Bonner	3	4.5	29.3	214	16,300	47	866	9.4	1.7	586
12340500	Clark Fork above Missoula	3	4.7	30.5	543	20,900	78	822	13.3	2.8	1,090
12353000	Clark Fork below Missoula[1]	3	5.0	23.7	166	18,600	36	1,150	11.0	1.5	363

[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 2002

[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]

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	30.2	18.1	3,800	28,700	398	2,660	12.7	8.1	5,930
12323750	Silver Bow Creek at Warm Springs	1	.9	5.2	10	6,100	6	1,020	4.9	.4	100
12323770	Warm Springs Creek at Warm Springs	2	1.5	7.4	130	8,000	24	4,240	6.9	1.3	160
12323800	Clark Fork near Galen	2	6.0	20.0	730	19,000	89	4,540	11.2	3.3	760
461415112450801	Clark Fork below Lost Creek, near Galen	2	2.3	6.8	240	12,300	49	1,290	4.5	1.1	340
461559112443301	Clark Fork near Racetrack	2	5.9	19.7	760	20,400	101	1,350	9.0	3.3	730
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	2	6.9	17.6	610	24,400	97	1,630	9.0	2.8	740
12324200	Clark Fork at Deer Lodge	2	7.0	29.2	710	23,000	102	1,390	11.6	3.1	860
12324680	Clark Fork at Goldcreek	2	3.5	21.9	270	18,000	46	380	10.2	1.3	460
12331500	Flint Creek near Drummond	2	3.4	13.3	20	13,500	84	2,770	6.2	4.6	270
12331800	Clark Fork near Drummond	2	3.1	12.7	130	14,400	31	410	7.7	.9	380
12334510	Rock Creek near Clinton	2	3.2	17.5	160	13,300	38	700	8.4	1.3	420
12334550	Clark Fork at Turah Bridge, near Bonner	2	2.9	21.8	10	14,200	12	140	9.8	.5	40
12340500	Clark Fork above Missoula	2	5.2	31.5	630	21,500	84	890	14.4	3.4	1,210
12353000	Clark Fork below Missoula[1]	2	3.0	12.7	80	13,300	23	560	8.1	.7	180

[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)
			<u>SRM sample 2709</u>		
Cadmium	10	1:5	0.4	--	--
Chromium	10	1:5	130	80.9	79.8-82.0
Copper	10	1:5	35	71.3	70.8-71.9
Iron	10	1:5	35,000	89.3	89.0-89.6
Lead	10	1:5	19	90.2	88.3-92.1
Manganese	10	1:5	538	80.6	76.2-85.0
Nickel	10	1:5	88	88.4	87.4-88.4
Silver	10	1:5	.4	--	--
Zinc	10	1:5	106	82.5	81.4-83.5
			<u>SRM sample 2711</u>		
Cadmium	10	1:10	41.7	104.7	104-106
Chromium	10	1:10	47.0	36.3	32.2-40.4
Copper	10	1:10	114	74.6	72.7-76.5
Iron	10	1:10	28,900	88.3	87.5-89.1
Lead	10	1:10	1,160	103.7	102-105
Manganese	10	1:10	638	78.6	76.7-80.5
Nickel	10	1:10	20.6	89.2	87.5-90.9
Silver	10	1:10	4.6	83.5	81.2-85.8
Zinc	10	1:10	350	89.2	88.0-90.3

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 (normal) hydrochloric acid used for reconstituting dried residue. Symbol: <, less than]

Station number	Station name	Dilution ratio	Trace-element concentration, in µg/mL								
			Cad-mium	Chro-mium	Cop-per	Iron	Lead	Manga-nese	Nickel	Silver	Zinc
12323600	Silver Bow Creek at Opportunity	1:1	<0.003	<0.09	<0.003	<0.04	<0.005	<0.001	<0.002	<0.001	<0.001
12323770	Warm Springs Creek at Warm Springs	1:1	<.003	<.09	<.003	<.04	<.005	<.001	<.002	<.001	<.001
12323800	Clark Fork near Galen	1:1	<.003	.10	<.003	<.04	<.005	<.001	<.002	<.001	<.001
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	1:1	<.003	<.09	<.003	<.04	<.005	<.001	<.002	<.001	<.001
12324200	Clark Fork at Deer Lodge	1:1	<.003	<.09	<.003	<.04	<.005	<.001	<.002	<.001	<.001
12324680	Clark Fork at Goldcreek	1:1	<.003	<.09	<.003	<.04	<.005	<.001	<.002	<.001	<.001
12331500	Flint Creek near Drummond	1:1	<.003	<.09	<.003	<.04	<.005	<.001	<.002	<.001	<.001
12334510	Rock Creek near Clinton	1:1	<.003	<.09	<.003	<.04	<.005	<.001	<.002	<.001	<.001
12334550	Clark Fork at Turah Bridge, near Bonner	1:1	<.003	<.09	<.003	<.04	<.005	<.001	<.002	<.001	<.001
12340500	Clark Fork above Missoula	1:1	<.003	<.09	<.003	.05	<.005	<.001	<.002	<.001	<.001
12353000	Clark Fork below Missoula	1:1	<.003	<.09	<.003	<.04	<.005	<.001	<.002	<.001	<.001
12353000	Clark Fork below Missoula	1:1	<.003	<.09	<.003	<.04	<.005	<.001	<.002	<.001	<.001

Table 18. Trace-element analyses of biota, upper Clark Fork basin, Montana, August 2002

[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									
Brachycentrus spp.	1	12.2	<0.6	674	1,190	21.5	817	2.1	995
Hydropsyche cockerelli	1	9.7	1.8	1,090	2,660	47.2	1,160	3.6	1,380
Hydropsyche spp.	2	8.6	.7	881	2,110	40.2	920	2.4	1,090
12323750 Silver Bow Creek at Warm Springs									
Hydropsyche cockerelli	2	.7	.4	30.2	998	2.3	1,540	1.2	168
Hydropsyche occidentalis	2	1.6	1.1	45.7	2,810	7.9	3,350	2.6	207
12323770 Warm Springs Creek at Warm Springs									
Arctopsyche grandis	1	3.0	.8	78.3	757	3.0	3,560	2.2	183
Hydropsyche spp.	1	1.1	1.4	95.9	1,220	5.2	3,390	1.8	125
12323800 Clark Fork near Galen									
Hydropsyche cockerelli	3	1.5	1.3	88.9	1,340	7.3	2,650	1.4	171
Hydropsyche occidentalis	1	1.6	.4	83.3	1,450	8.6	2,800	1.8	170
461415112450801 Clark Fork below Lost Creek, near Galen									
Hydropsyche cockerelli	2	1.9	.8	89.7	1,730	11.1	1,920	1.1	247
461559112443301 Clark Fork near Racetrack									
Hydropsyche cockerelli	1	1.5	.6	74.1	731	4.8	1,570	.8	167
461903112440701 Clark Fork at Dempsey Creek diversion, near Racetrack									
Hydropsyche cockerelli	2	1.3	.5	65.3	601	7.4	754	.5	178
Hydropsyche occidentalis	1	1.5	.8	79.8	995	9.5	1,510	1.3	231
12324200 Clark Fork at Deer Lodge									
Hydropsyche cockerelli	1	1.7	.5	109	738	7.9	693	.7	194
Hydropsyche occidentalis	1	1.3	1.2	101	1,190	10.1	1,490	1.2	256
12324680 Clark Fork at Goldcreek									
Arctopsyche grandis	4	1.7	.5	22.1	432	2.1	875	.5	181
Claassenia sabulosa	2	.6	.3	53.4	307	1.2	203	.6	316
Hydropsyche cockerelli	2	1.1	.7	34.0	870	4.4	1,250	.9	181
12331500 Flint Creek near Drummond									
Arctopsyche grandis	1	.4	.9	15.5	1,050	6.5	1,590	1.2	192
Hydropsyche cockerelli	1	.9	1.3	12.4	3,720	22.4	2,690	2.7	196
12331800 Clark Fork near Drummond									
Arctopsyche grandis	3	1.2	.3	18.3	306	2.9	566	.4	173
Claassenia sabulosa	2	.6	.2	58.1	132	.6	124	.2	278
Hydropsyche cockerelli	3	.7	.6	32.2	818	6.1	992	.8	170

Table 18. Trace-element analyses of biota, upper Clark Fork basin, Montana, August 2002 (Continued)

Taxon	Number of com-posite samples	Concentration, in µg/g							
		Cad-mium	Chro-mium	Cop-per	Iron	Lead	Manga-nese	Nickel	Zinc
12334510 Rock Creek near Clinton									
Arctopsyche grandis	2	.4	1.1	7.8	1,080	.5	307	1.6	141
Claassenia sabulosa	1	.2	.2	23.9	102	<.5	32	.4	180
12334550 Clark Fork at Turah Bridge, near Bonner									
Arctopsyche grandis	2	.7	.7	22.6	570	2.3	511	.8	172
Claassenia sabulosa	1	.3	.5	78.7	112	.3	91	.2	244
Hydropsyche cockerelli	2	.6	1.2	37.1	1,090	3.9	506	1.2	171
Hydropsyche occidentalis	1	.7	1.2	35.2	1,160	4.9	728	1.2	200
12340500 Clark Fork above Missoula									
Arctopsyche grandis	3	.5	.7	23.1	731	4.4	758	.7	225
Claassenia sabulosa	2	.3	.4	50.1	306	1.4	177	.4	280
12353000 Clark Fork below Missoula[1]									
Arctopsyche grandis	2	.8	1.4	28.8	1,480	3.7	556	1.2	169
Claassenia sabulosa	3	.4	.3	49.9	143	.4	91	.2	234
Hydropsyche cockerelli	4	.9	2.1	52.8	2,160	5.7	640	1.8	181

[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	87.7	85.9-89.5
Chromium	12	.77	116	83.7-148
Copper	12	106	94.3	93.2-95.4
Iron	12	105	96.1	90.8-101
Lead	[1]11	.35	62.2	55.6-68.8
Manganese	12	13.6	91.4	89.6-93.2
Nickel	12	2.5	84.6	79.7-89.5
Zinc	12	180	87.9	86.8-89.0

[1]Lead concentration in one sample 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	<0.01	<0.01	<0.06	<0.10	<0.01	<0.01	<0.06	<0.01
12323750	Silver Bow Creek at Warm Springs	1:1	<.01	<.01	<.06	<.10	<.01	<.01	<.06	<.01
12323770	Warm Springs Creek at Warm Springs	1:1	<.01	<.01	<.06	<.10	<.01	<.01	<.06	<.01
12323800	Clark Fork near Galen	1:1	<.01	<.01	<.06	<.10	<.01	<.01	<.06	<.01
461415112450801	Clark Fork below Lost Creek, near Galen	1:1	<.01	<.01	<.06	<.10	<.01	<.01	<.06	<.01
461559112443301	Clark Fork near Racetrack	1:1	<.01	<.01	<.06	<.10	<.01	<.01	<.06	<.01
461903112440701	Clark Fork at Dempsey Creek diversion, near Racetrack	1:1	<.01	<.01	<.06	<.10	<.01	<.01	<.06	<.01
12324200	Clark Fork at Deer Lodge	1:1	<.01	<.01	<.06	<.10	<.01	<.01	<.06	<.01
12324680	Clark Fork at Goldcreek	1:1	<.01	<.01	<.06	<.10	<.01	<.01	<.06	<.01
12331500	Flint Creek near Drummond	1:1	<.01	<.01	<.06	<.10	<.01	<.01	<.06	<.01
12331800	Clark Fork near Drummond	1:1	<.01	<.01	<.06	<.10	<.01	<.01	<.06	<.01
12334510	Rock Creek near Clinton	1:1	<.01	<.01	<.06	<.10	<.01	<.01	<.06	<.01
12334550	Clark Fork at Turah Bridge, near Bonner	1:1	<.01	<.01	<.06	<.10	<.01	<.01	<.06	<.01
12340500	Clark Fork above Missoula	1:1	<.01	<.01	<.06	<.10	<.01	<.01	<.06	<.01
12353000	Clark Fork below Missoula	1:1	<.01	<.01	<.06	<.10	<.01	<.01	<.06	<.01

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2002

[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 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 2002					
Streamflow, instantaneous (ft^3/s)	75	156	1.9	15	8.2
Specific conductance, onsite (µS/cm)	75	412	116	265	271
Temperature, water (°C)	75	17.5	2.0	8.2	7.5
pH, onsite (standard units)	75	8.2	7.3	7.8	7.8
Hardness, total (mg/L as $CaCO_3$)	75	150	38	105	110
Calcium, dissolved (mg/L)	75	41.8	10.6	30	31
Magnesium, dissolved (mg/L)	75	11.0	2.71	7.3	7.4
Arsenic, total recoverable (µg/L)	75	18	<2	[2]5	4
Arsenic, dissolved (µg/L)	75	13	1	4	3
Cadmium, total recoverable (µg/L)	75	.06	<.04	--	<1
Cadmium, dissolved (µg/L)	75	.5	<.1	[2]<.1	<.1
Copper, total recoverable (µg/L)	75	52	1.5	7	6
Copper, dissolved (µg/L)	75	10	<E.8	[2]4	3
Iron, total recoverable (µg/L)	75	4,220	140	713	560
Iron, dissolved (µg/L)	75	478	15	161	150
Lead, total recoverable (µg/L)	75	47	<1	[2]2	1
Lead, dissolved (µg/L)	75	1	<.08	[2].1	<.5
Manganese, total recoverable (µg/L)	75	240	24	62	53
Manganese, dissolved (µg/L)	75	144	17	43	39
Zinc, total recoverable (µg/L)	75	130	<10	[2]11	3
Zinc, dissolved (µg/L)	75	11	<3	[2]4	2
Sediment, suspended concentration (mg/L)	75	139	2	15	8
Sediment, suspended discharge (ton/d)	75	58.5	.02	1.5	.16
Sediment, suspended (percent finer than 0.062 mm)	75	97	50	82	84

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2002 (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 2002**					
Streamflow, instantaneous (ft^3/s)	75	134	13	30	24
Specific conductance, onsite (μS/cm)	75	691	226	469	478
Temperature, water (°C)	75	20.0	1.0	10.2	9.0
pH, onsite (standard units)	75	8.1	7.2	7.6	7.6
Hardness, total (mg/L as $CaCO_3$)	75	180	66	148	150
Calcium, dissolved (mg/L)	75	51.6	19.0	42	43
Magnesium, dissolved (mg/L)	75	13.0	4.51	10	11
Arsenic, total recoverable (μg/L)	75	45	4	14	11
Arsenic, dissolved (μg/L)	75	13	4	7	7
Cadmium, total recoverable (μg/L)	75	6	.18	2.2	2
Cadmium, dissolved (μg/L)	75	6.2	E.1	1.6	1.3
Copper, total recoverable (μg/L)	75	550	13.5	125	91
Copper, dissolved (μg/L)	75	303	4.5	54	39
Iron, total recoverable (μg/L)	75	7,400	90	1,160	700
Iron, dissolved (μg/L)	75	270	E10	[2]86	74
Lead, total recoverable (μg/L)	75	250	<1	20	8
Lead, dissolved (μg/L)	75	2.4	<.5	[2].6	<1
Manganese, total recoverable (μg/L)	75	1,600	29	552	510
Manganese, dissolved (μg/L)	75	1,700	21.4	497	471
Zinc, total recoverable (μg/L)	75	2,200	86	655	530
Zinc, dissolved (μg/L)	75	2,200	60	541	424
Sediment, suspended concentration (mg/L)	74	405	3	31	13
Sediment, suspended discharge (ton/d)	74	70.2	.14	3.8	.98
Sediment, suspended (percent finer than 0.062 mm)	74	98	42	83	86

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2002 (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 2002					
Streamflow, instantaneous (ft^3/s)	78	361	13	77	54
Specific conductance, onsite (µS/cm)	77	616	202	399	388
Temperature, water (°C)	77	22.5	0.0	9.1	9.0
pH, onsite (standard units)	77	9.5	7.2	8.4	8.3
Hardness, total (mg/L as $CaCO_3$)	77	220	60	142	140
Calcium, dissolved (mg/L)	77	62.7	18.5	42	41
Magnesium, dissolved (mg/L)	77	15.0	3.42	9.1	8.7
Arsenic, total recoverable (µg/L)	77	235	11	30	18
Arsenic, dissolved (µg/L)	77	34	1	10	9
Cadmium, total recoverable (µg/L)	77	49	.61	[2]2.7	1.9
Cadmium, dissolved (µg/L)	77	41	.1	1.6	1.0
Copper, total recoverable (µg/L)	77	3,900	59.6	265	140
Copper, dissolved (µg/L)	77	450	19.4	56	44
Iron, total recoverable (µg/L)	77	24,100	260	1,780	860
Iron, dissolved (µg/L)	77	307	<3	[2]47	25
Lead, total recoverable (µg/L)	77	650	7	46	17
Lead, dissolved (µg/L)	77	5.1	<.5	[2].8	<1
Manganese, total recoverable (µg/L)	77	10,000	174	698	508
Manganese, dissolved (µg/L)	77	9,300	68	568	440
Zinc, total recoverable (µg/L)	77	15,000	143	705	470
Zinc, dissolved (µg/L)	77	13,000	27	421	250
Sediment, suspended concentration (mg/L)	78	801	6	59	18
Sediment, suspended discharge (ton/d)	78	781	.25	26	2.8
Sediment, suspended (percent finer than 0.062 mm)	78	95	37	77	80

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2002 (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 2002**					
Streamflow, instantaneous (ft^3/s)	84	662	16	148	94
Specific conductance, onsite (µS/cm)	82	783	249	464	466
Temperature, water (°C)	83	22.0	.5	11.0	11.0
pH, onsite (standard units)	82	9.3	8.0	8.8	8.8
Hardness, total (mg/L as $CaCO_3$)	82	310	97	191	190
Calcium, dissolved (mg/L)	82	90.4	27.9	56	56
Magnesium, dissolved (mg/L)	82	21.4	5.94	13	13
Arsenic, total recoverable (µg/L)	82	94	10	26	24
Arsenic, dissolved (µg/L)	82	60	6.8	21	21
Cadmium, total recoverable (µg/L)	82	.5	<.1	[2]<.1	<1
Cadmium, dissolved (µg/L)	82	.3	<.1	[2].1	<.1
Copper, total recoverable (µg/L)	82	80	3.4	20	14
Copper, dissolved (µg/L)	82	40	1.9	10	8
Iron, total recoverable (µg/L)	82	3,000	70	370	300
Iron, dissolved (µg/L)	82	93	<5	[2]17	14
Lead, total recoverable (µg/L)	82	15	<1	[2]2	2
Lead, dissolved (µg/L)	82	1.0	<.5	[2].1	<.5
Manganese, total recoverable (µg/L)	82	899	55	197	160
Manganese, dissolved (µg/L)	82	875	11.8	128	94
Zinc, total recoverable (µg/L)	82	180	<10	[2]43	30
Zinc, dissolved (µg/L)	82	73	<3	[2]11	6
Sediment, suspended concentration (mg/L)	84	229	1	13	7
Sediment, suspended discharge (ton/d)	84	279	.11	8.9	1.8
Sediment, suspended (percent finer than 0.062 mm)	83	97	43	82	85

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2002 (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 2002**					
Streamflow, instantaneous (ft^3/s)	58	420	2.8	99	57
Specific conductance, onsite (μS/cm)	57	795	139	301	269
Temperature, water (°C)	58	18	.5	9.1	9.0
pH, onsite (standard units)	57	8.7	7.4	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	57	420	40	145	130
Calcium, dissolved (mg/L)	57	130	10.5	44	40
Magnesium, dissolved (mg/L)	57	22.0	3.29	8.4	7.4
Arsenic, total recoverable (μg/L)	57	27	3	8	6
Arsenic, dissolved (μg/L)	57	14	2	5	4
Cadmium, total recoverable (μg/L)	57	.2	<.1	[2].07	<1
Cadmium, dissolved (μg/L)	57	E.1	<.1	[2].04	<.1
Copper, total recoverable (μg/L)	57	96.7	2.3	20	10
Copper, dissolved (μg/L)	57	16	1	4	3
Iron, total recoverable (μg/L)	57	1,660	40	314	130
Iron, dissolved (μg/L)	57	30	<5	[2]10	9
Lead, total recoverable (μg/L)	57	14	<1	[2]2	<1
Lead, dissolved (μg/L)	57	1.8	<.08	--	<.5
Manganese, total recoverable (μg/L)	57	1,400	57	231	200
Manganese, dissolved (μg/L)	57	570	22.6	140	110
Zinc, total recoverable (μg/L)	57	60	<10	[2]11	3
Zinc, dissolved (μg/L)	57	10	<1	[2]2	<20
Sediment, suspended concentration (mg/L)	58	100	2	19	10
Sediment, suspended discharge (ton/d)	57	87.3	.05	10	1.2
Sediment, suspended (percent finer than 0.062 mm)	58	88	55	74	75

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2002 (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 2002**					
Streamflow, instantaneous (ft^3/s)	125	1,050	14	211	126
Specific conductance, onsite (µS/cm)	113	720	197	430	442
Temperature, water (°C)	124	22.5	0.0	9.8	9.8
pH, onsite (standard units)	112	9.0	7.5	8.5	8.5
Hardness, total (mg/L as $CaCO_3$)	111	370	81	187	190
Calcium, dissolved (mg/L)	111	110	24.2	55	57
Magnesium, dissolved (mg/L)	111	22.0	5.08	12	12
Arsenic, total recoverable (µg/L)	111	78	3	20	16
Arsenic, dissolved (µg/L)	111	53	4	15	12
Cadmium, total recoverable (µg/L)	111	3	<.1	[2].2	<1
Cadmium, dissolved (µg/L)	111	1	<.1	[2].07	<.1
Copper, total recoverable (µg/L)	110	240	4.8	32	19
Copper, dissolved (µg/L)	111	50	2.3	10	8
Iron, total recoverable (µg/L)	111	9,200	60	548	290
Iron, dissolved (µg/L)	111	110	<3	[2]16	10
Lead, total recoverable (µg/L)	111	28	<1	[2]4	2
Lead, dissolved (µg/L)	111	3	<.5	[2].2	<.6
Manganese, total recoverable (µg/L)	111	1,400	47	257	200
Manganese, dissolved (µg/L)	111	460	25.2	118	89
Zinc, total recoverable (µg/L)	111	360	<10	[2]49	30
Zinc, dissolved (µg/L)	111	110	<3	[2]13	7
Sediment, suspended concentration (mg/L)	125	338	2	20	8
Sediment, suspended discharge (ton/d)	125	459	.12	23	2.3
Sediment, suspended (percent finer than 0.062 mm)	124	97	41	78	78

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2002 (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 2002**					
Streamflow, instantaneous (ft^3/s)	177	1,920	23	293	219
Specific conductance, onsite (μS/cm)	160	642	234	488	508
Temperature, water (°C)	176	23.0	0.0	9.7	10.0
pH, onsite (standard units)	125	8.9	7.4	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	117	270	95	205	220
Calcium, dissolved (mg/L)	117	81.0	28.2	60	63
Magnesium, dissolved (mg/L)	117	18	5.9	13	14
Arsenic, total recoverable (μg/L)	127	215	8	25	17
Arsenic, dissolved (μg/L)	127	39	6	14	13
Cadmium, total recoverable (μg/L)	127	5	<.1	[2].5	<1
Cadmium, dissolved (μg/L)	127	2	<.1	[2].08	<.1
Copper, total recoverable (μg/L)	126	1,500	8.2	95	41
Copper, dissolved (μg/L)	127	120	3.2	12	9
Iron, total recoverable (μg/L)	127	29,000	30	1,820	660
Iron, dissolved (μg/L)	127	190	<3	[2]15	9
Lead, total recoverable (μg/L)	127	200	<1	[2]12	5
Lead, dissolved (μg/L)	127	6	<.08	[2].4	<1
Manganese, total recoverable (μg/L)	127	4,600	12	282	160
Manganese, dissolved (μg/L)	127	400	1	44	33
Zinc, total recoverable (μg/L)	127	1,700	4	107	53
Zinc, dissolved (μg/L)	127	230	<10	[2]14	10
Sediment, suspended concentration (mg/L)	177	2,250	2	80	23
Sediment, suspended discharge (ton/d)	177	8,690	.29	179	12
Sediment, suspended (percent finer than 0.062 mm)	168	99	40	71	72

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2002 (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 2002					
Streamflow, instantaneous (ft^3/s)	102	2,080	15	288	184
Specific conductance, onsite (µS/cm)	90	338	120	228	221
Temperature, water (°C)	101	22	0.0	8.4	9.0
pH, onsite (standard units)	89	8.6	7.0	8.1	8.1
Hardness, total (mg/L as $CaCO_3$)	84	160	51	104	100
Calcium, dissolved (mg/L)	84	46.9	14.0	30	30
Magnesium, dissolved (mg/L)	84	10.2	3.30	7.0	7.0
Arsenic, total recoverable (µg/L)	89	17	4	7	6
Arsenic, dissolved (µg/L)	89	7	3	5	5
Cadmium, total recoverable (µg/L)	89	2	<.1	[2].1	<1
Cadmium, dissolved (µg/L)	89	.2	<.04	--	<.1
Copper, total recoverable (µg/L)	88	45	<1	[2]4	2
Copper, dissolved (µg/L)	89	7	<1	[2]2	2
Iron, total recoverable (µg/L)	89	25,000	20	1,110	260
Iron, dissolved (µg/L)	89	120	<3	[2]35	26
Lead, total recoverable (µg/L)	89	25	<1	[2]3	<5
Lead, dissolved (µg/L)	88	6	<.5	[2].4	<1
Manganese, total recoverable (µg/L)	89	1,100	<10	[2]68	30
Manganese, dissolved (µg/L)	89	45.2	1.0	9	8
Zinc, total recoverable (µg/L)	89	140	<1	[2]12	<40
Zinc, dissolved (µg/L)	89	24	<1	[2]3	<20
Sediment, suspended concentration (mg/L)	102	1,410	1	50	10
Sediment, suspended discharge (ton/d)	102	7,920	.08	136	5.2
Sediment, suspended (percent finer than 0.062 mm)	102	97	32	75	79

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2002 (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 2002**					
Streamflow, instantaneous (ft^3/s)	83	3,920	87	757	513
Specific conductance, onsite (µS/cm)	82	510	207	373	392
Temperature, water (°C)	83	21.5	0.0	9.6	9.5
pH, onsite (standard units)	82	8.8	7.9	8.4	8.3
Hardness, total (mg/L as $CaCO_3$)	82	230	86	163	170
Calcium, dissolved (mg/L)	82	68.0	25.9	48	51
Magnesium, dissolved (mg/L)	82	15.0	5.15	10	11
Arsenic, total recoverable (µg/L)	82	75	7	16	13
Arsenic, dissolved (µg/L)	82	20	5.8	10	10
Cadmium, total recoverable (µg/L)	82	2	<.1	[2].2	<1
Cadmium, dissolved (µg/L)	82	.2	<.1	[2].04	<.1
Copper, total recoverable (µg/L)	81	440	5.2	46	29
Copper, dissolved (µg/L)	81	36	2.1	7	6
Iron, total recoverable (µg/L)	82	12,000	30	990	510
Iron, dissolved (µg/L)	82	100	<3	[2]19	12
Lead, total recoverable (µg/L)	81	73	<1	[2]6	4
Lead, dissolved (µg/L)	81	.8	<.08	[2].1	<.5
Manganese, total recoverable (µg/L)	82	1,100	10	138	100
Manganese, dissolved (µg/L)	82	57.3	4.0	20	19
Zinc, total recoverable (µg/L)	82	510	2	54	35
Zinc, dissolved (µg/L)	82	26	<1	[2]7	4
Sediment, suspended concentration (mg/L)	83	752	2	58	23
Sediment, suspended discharge (ton/d)	83	7,960	.94	266	36
Sediment, suspended (percent finer than 0.062 mm)	83	93	43	75	78

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2002 (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 2002**					
Streamflow, instantaneous (ft^3/s)	131	892	2.8	182	119
Specific conductance, onsite (µS/cm)	120	529	134	304	302
Temperature, water (°C)	129	21.0	0.0	9.0	9.5
pH, onsite (standard units)	117	8.8	7.5	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	110	260	59	142	140
Calcium, dissolved (mg/L)	110	73.0	16.4	39	38
Magnesium, dissolved (mg/L)	110	20	4.3	11	11
Arsenic, total recoverable (µg/L)	117	57	7	17	13
Arsenic, dissolved (µg/L)	117	20	5	9	9
Cadmium, total recoverable (µg/L)	117	3	<.04	[2].2	<1
Cadmium, dissolved (µg/L)	117	.1	<.04	--	<.1
Copper, total recoverable (µg/L)	116	32	1	7	4
Copper, dissolved (µg/L)	117	7	<1	[2]2	2
Iron, total recoverable (µg/L)	117	7,200	60	886	470
Iron, dissolved (µg/L)	117	240	<3	[2]39	21
Lead, total recoverable (µg/L)	117	87	<1	[2]11	7
Lead, dissolved (µg/L)	117	7	<.5	[2].7	<1
Manganese, total recoverable (µg/L)	117	1,600	50	209	132
Manganese, dissolved (µg/L)	117	139	14	42	37
Zinc, total recoverable (µg/L)	117	290	<10	[2]38	20
Zinc, dissolved (µg/L)	117	27	<1	[2]5	3
Sediment, suspended concentration (mg/L)	131	556	3	51	26
Sediment, suspended discharge (ton/d)	131	904	.02	44	8.0
Sediment, suspended (percent finer than 0.062 mm)	131	98	28	80	84

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2002 (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 2002**					
Streamflow, instantaneous (ft^3/s)	83	3,860	149	1,060	768
Specific conductance, onsite (μS/cm)	82	630	189	408	426
Temperature, water (°C)	83	22.5	.5	10.5	11.0
pH, onsite (standard units)	82	8.5	7.8	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	82	300	74	183	190
Calcium, dissolved (mg/L)	82	83	21	52	55
Magnesium, dissolved (mg/L)	82	22	5.2	13	13
Arsenic, total recoverable (μg/L)	82	62	8	17	13
Arsenic, dissolved (μg/L)	82	20	6.6	11	10
Cadmium, total recoverable (μg/L)	82	2	<.1	[2].2	<1
Cadmium, dissolved (μg/L)	82	.2	<.1	[2]<.1	<.1
Copper, total recoverable (μg/L)	80	360	4.6	47	24
Copper, dissolved (μg/L)	80	21	1	7	5
Iron, total recoverable (μg/L)	82	8,800	20	1,120	540
Iron, dissolved (μg/L)	82	150	<3	[2]20	9
Lead, total recoverable (μg/L)	78	56	<1	[2]9	4
Lead, dissolved (μg/L)	78	1.2	<.08	[2].2	<.5
Manganese, total recoverable (μg/L)	82	880	8	161	105
Manganese, dissolved (μg/L)	82	60.7	4.5	17	15
Zinc, total recoverable (μg/L)	82	490	3	71	40
Zinc, dissolved (μg/L)	82	21	<3	[2]7	5
Sediment, suspended concentration (mg/L)	83	530	2	71	29
Sediment, suspended discharge (ton/d)	83	4,720	1.7	363	64
Sediment, suspended (percent finer than 0.062 mm)	83	92	38	74	75

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2002 (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 2002**					
Streamflow, instantaneous (ft^3/s)	101	5,060	113	985	558
Specific conductance, onsite (µS/cm)	92	158	53	106	99
Temperature, water (°C)	101	18	0.0	8.2	8.5
pH, onsite (standard units)	91	8.8	6.9	8.0	8.0
Hardness, total (mg/L as $CaCO_3$)	83	90	22	49	49
Calcium, dissolved (mg/L)	83	23.0	5.92	13	13
Magnesium, dissolved (mg/L)	83	8.00	1.86	4.2	4.0
Arsenic, total recoverable (µg/L)	89	5	<1	[2].9	<1
Arsenic, dissolved (µg/L)	89	1	<1	[2].6	<1
Cadmium, total recoverable (µg/L)	89	3	<.04	[2].2	<1
Cadmium, dissolved (µg/L)	89	1	<.04	--	<.1
Copper, total recoverable (µg/L)	87	41	<.6	[2]4	2
Copper, dissolved (µg/L)	88	6	<1	[2]1	<1
Iron, total recoverable (µg/L)	89	2,100	20	304	140
Iron, dissolved (µg/L)	89	163	<5	[2]35	29
Lead, total recoverable (µg/L)	87	19	<1	[2]2	<1
Lead, dissolved (µg/L)	87	5	<.08	[2].5	<1
Manganese, total recoverable (µg/L)	89	90	<10	[2]16	8
Manganese, dissolved (µg/L)	89	8	<1	[2]2	2
Zinc, total recoverable (µg/L)	89	60	<1	[2]6	<10
Zinc, dissolved (µg/L)	89	15	<1	[2]2	<3
Sediment, suspended concentration (mg/L)	101	223	1	21	6
Sediment, suspended discharge (ton/d)	101	3,050	.31	145	12
Sediment, suspended (percent finer than 0.062 mm)	101	95	35	69	71

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2002 (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 2002**					
Streamflow, instantaneous (ft^3/s)	180	9,560	296	1,860	1,120
Specific conductance, onsite (μS/cm)	155	483	140	306	323
Temperature, water (°C)	179	22.0	0.0	9.2	9.5
pH, onsite (standard units)	126	8.8	7.4	8.2	8.3
Hardness, total (mg/L as $CaCO_3$)	116	210	58	133	135
Calcium, dissolved (mg/L)	116	59.0	16.4	37	38
Magnesium, dissolved (mg/L)	116	14.0	3.94	9.5	9.5
Arsenic, total recoverable (μg/L)	125	110	3	11	7
Arsenic, dissolved (μg/L)	125	17	2.7	6	5
Cadmium, total recoverable (μg/L)	125	4	<.1	[2].3	<1
Cadmium, dissolved (μg/L)	125	.11	<.1	--	<.1
Copper, total recoverable (μg/L)	123	500	3	41	19
Copper, dissolved (μg/L)	124	25	E1.1	5	4
Iron, total recoverable (μg/L)	125	19,000	50	1,220	450
Iron, dissolved (μg/L)	125	190	<3	[2]25	14
Lead, total recoverable (μg/L)	121	100	<1	[2]9	4
Lead, dissolved (μg/L)	121	7	<.08	[2].4	<1
Manganese, total recoverable (μg/L)	125	2,000	10	145	80
Manganese, dissolved (μg/L)	125	37.4	1.0	8	7
Zinc, total recoverable (μg/L)	125	1,100	<10	[2]73	36
Zinc, dissolved (μg/L)	124	39	<3	[2]7	5
Sediment, suspended concentration (mg/L)	180	1,370	2	63	20
Sediment, suspended discharge (ton/d)	180	34,700	3.5	697	62
Sediment, suspended (percent finer than 0.062 mm)	169	98	27	73	74

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2002 (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 2002					
Streamflow, instantaneous (ft^3/s)	132	13,400	344	2,750	1,320
Specific conductance, onsite (µS/cm)	109	294	131	206	205
Temperature, water (°C)	132	21.0	0.0	9.1	9.2
pH, onsite (standard units)	92	8.7	7.5	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	85	140	55	101	97
Calcium, dissolved (mg/L)	85	37	14	26	25
Magnesium, dissolved (mg/L)	85	13	4.9	8.9	8.5
Arsenic, total recoverable (µg/L)	92	4	<1	[2]1	1
Arsenic, dissolved (µg/L)	92	2	<1	[2].9	.9
Cadmium, total recoverable (µg/L)	92	2	<.04	[2].2	<1
Cadmium, dissolved (µg/L)	92	1	<.04	--	<.1
Copper, total recoverable (µg/L)	89	34	<1	[2]6	3
Copper, dissolved (µg/L)	90	7	<1	[2]2	1
Iron, total recoverable (µg/L)	92	3,600	20	514	235
Iron, dissolved (µg/L)	92	100	<3	[2]19	12
Lead, total recoverable (µg/L)	88	25	<1	[2]3	<1
Lead, dissolved (µg/L)	88	8	<.08	[2].5	<1
Manganese, total recoverable (µg/L)	92	180	<10	[2]34	20
Manganese, dissolved (µg/L)	92	11	<1	[2]3	2
Zinc, total recoverable (µg/L)	92	60	<1	[2]7	<10
Zinc, dissolved (µg/L)	92	15	<1	[2]3	<3
Sediment, suspended concentration (mg/L)	132	271	1	32	10
Sediment, suspended discharge (ton/d)	132	7,670	1.1	583	32
Sediment, suspended (percent finer than 0.062 mm)	130	98	42	80	82

Table 21. Statistical summary of water-quality data for the upper Clark Fork basin, Montana, March 1985 through September 2002 (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 2002					
Streamflow, instantaneous (ft^3/s)	146	21,600	720	4,430	2,360
Specific conductance, onsite (µS/cm)	123	399	142	255	262
Temperature, water (°C)	143	20.0	0.0	9.1	8.5
pH, onsite (standard units)	103	8.7	7.9	8.3	8.3
Hardness, total (mg/L as $CaCO_3$)	103	170	61	117	120
Calcium, dissolved (mg/L)	103	46	14	32	32
Magnesium, dissolved (mg/L)	103	13.0	5.28	9.3	9.3
Arsenic, total recoverable (µg/L)	103	69	1	5	4
Arsenic, dissolved (µg/L)	103	9	1	3	3
Cadmium, total recoverable (µg/L)	103	5	<.1	[2].1	<1
Cadmium, dissolved (µg/L)	103	.2	<.04	--	<.1
Copper, total recoverable (µg/L)	101	400	2	16	8
Copper, dissolved (µg/L)	102	11	.7	3	2
Iron, total recoverable (µg/L)	103	13,000	40	621	230
Iron, dissolved (µg/L)	103	200	<3	[2]22	15
Lead, total recoverable (µg/L)	98	78	<1	[2]3	2
Lead, dissolved (µg/L)	98	1.2	<.08	[2].2	<.6
Manganese, total recoverable (µg/L)	103	1,100	10	65	40
Manganese, dissolved (µg/L)	103	230	6.2	18	14
Zinc, total recoverable (µg/L)	103	1,100	<10	[2]32	13
Zinc, dissolved (µg/L)	103	16	<1	[2]4	2
Sediment, suspended concentration (mg/L)	146	824	2	38	11
Sediment, suspended discharge (ton/d)	146	21,900	5.8	984	69
Sediment, suspended (percent finer than 0.062 mm)	141	99	44	87	91

[1]Differing 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 August 2002

[Fine-grained bed sediment is material less than 0.064 millimeter in diameter. Reported concentrations are in micrograms per gram dry weight. Symbol: <, less than minimum reporting level. 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: 1992-2002					
Cadmium	11	42.0	23.7	32.3	30.1
Chromium	10	32.4	16.8	25.7	26.2
Copper	11	9,020	3,700	5,240	4,810
Iron	11	41,200	28,200	36,600	37,500
Lead	11	1,030	381	778	833
Manganese	11	9,220	1,690	3,260	2,590
Nickel	10	21.4	12.7	15.7	15.8
Silver	11	20.0	8.3	15.9	16.4
Zinc	11	13,400	5,620	8,530	8,010
12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT.					
Period of record for fine-grained bed-sediment data: 1992-2002					
Cadmium	11	12.2	4.2	7.5	6.7
Chromium	10	34.1	12.3	20.8	21.2
Copper	11	769	169	382	286
Iron	11	27,200	15,400	21,100	20,800
Lead	11	100	49	72	68
Manganese	11	17,700	1,470	7,300	7,230
Nickel	10	19.1	9.2	14.8	15.0
Silver	11	3.5	.3	[1]1.6	[1]1.6
Zinc	11	2,220	620	1,090	840
12323770--WARM SPRINGS CREEK AT WARM SPRINGS, MONT.					
Period of record for fine-grained bed-sediment data: 1995, 1997, 1999, 2002					
Cadmium	4	5.8	1.3	3.4	3.2
Chromium	4	33.4	27.5	30.8	31.1
Copper	4	892	779	850	864
Iron	4	22,400	16,800	20,400	21,200
Lead	4	86	67	81	85
Manganese	4	11,000	2,020	6,950	7,410
Nickel	4	21.9	17.6	19.2	18.6
Silver	4	5.1	3.1	3.8	3.5
Zinc	4	421	372	391	385
12323800--CLARK FORK NEAR GALEN, MONT.					
Period of record for fine-grained bed-sediment data: 1987, 1991-2002					
Cadmium	13	20.1	4.0	10.0	9.3
Chromium	10	33.9	19.1	27.0	26.7
Copper	13	2,300	991	1,300	1,220
Iron	13	39,800	22,600	28,400	27,700
Lead	13	235	113	146	136
Manganese	13	15,600	2,780	8,550	8,470
Nickel	10	23.2	15.4	18.8	18.6
Silver	13	7.3	<3.2	[1]4.3	[1]4.2
Zinc	13	3,560	1,090	1,740	1,370

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through August 2002 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
461415112450801--CLARK FORK BELOW LOST CREEK, NEAR GALEN, MONT.					
Period of record for fine-grained bed-sediment data: 1996-2002					
Cadmium	7	10.5	6.5	8.1	8.1
Chromium	7	34.5	22.3	29.5	31.8
Copper	7	2,050	1,350	1,570	1,440
Iron	7	32,800	26,300	30,600	31,400
Lead	7	200	167	183	182
Manganese	7	5,900	3,540	4,960	5,000
Nickel	7	19.9	13.4	17.2	17.8
Silver	7	7.8	4.2	6.4	6.6
Zinc	7	1,680	1,120	1,400	1,450
461559112443301--CLARK FORK NEAR RACETRACK, MONT.					
Period of record for fine-grained bed-sediment data: 1996-2002					
Cadmium	7	8.6	5.0	7.1	7.5
Chromium	7	33.3	19.1	26.7	29.2
Copper	7	1,610	933	1,230	1,240
Iron	7	31,700	23,100	27,200	28,600
Lead	7	186	128	147	143
Manganese	7	4,120	2,100	3,050	2,920
Nickel	7	18.4	10.5	14.6	16.5
Silver	7	6.1	<3.3	[1]4.9	[1]5.3
Zinc	7	1,550	1,030	1,230	1,170
461903112440701--CLARK FORK AT DEMPSEY CREEK DIVERSION, NEAR RACETRACK, MONT.					
Period of record for fine-grained bed-sediment data: 1996-2002					
Cadmium	7	10.3	4.3	7.0	6.9
Chromium	7	34.1	16.0	26.3	26.4
Copper	7	1,550	766	1,060	1,030
Iron	7	33,700	22,000	27,400	28,200
Lead	7	152	115	132	130
Manganese	7	6,410	1,810	3,230	2,630
Nickel	7	16.9	9.5	13.6	15.1
Silver	7	6.2	2.7	4.8	4.8
Zinc	7	1,570	900	1,160	1,070
12324200--CLARK FORK AT DEER LODGE, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1990-2002					
Cadmium	15	10.0	4.4	6.7	6.3
Chromium	10	43.9	19.5	32.0	33.9
Copper	15	4,180	837	1,400	1,070
Iron	15	35,300	22,600	28,100	28,400
Lead	15	242	121	155	150
Manganese	15	6,020	1,460	2,770	2,410
Nickel	10	21.1	12.2	16.3	16.1
Silver	15	7.9	2.4	4.7	4.5
Zinc	15	1,730	940	1,290	1,320

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through August 2002 (Continued)

Constituent	Number of samples	Maxi- mum	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	3	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: 1992-2002					
Cadmium	11	8.1	3.5	5.3	5.5
Chromium	10	48.9	24.9	33.7	32.6
Copper	11	1,080	393	753	766
Iron	11	30,600	19,900	24,700	24,400
Lead	11	152	61	104	107
Manganese	11	2,610	1,160	1,810	1,770
Nickel	10	18.6	10.9	15.5	16.2
Silver	11	4.8	2.3	3.4	3.2
Zinc	11	1,320	590	1,050	1,110
12331500--FLINT CREEK NEAR DRUMMOND, MONT.					
Period of record for fine-grained bed-sediment data: 1986, 1989, 1992-2002					
Cadmium	13	7.0	<.2	[1]3.3	[1]3.1
Chromium	10	29.2	20.4	25.0	25.2
Copper	13	73	53	61	63
Iron	13	28,100	19,800	23,400	23,400
Lead	13	240	126	172	168
Manganese	13	5,510	2,370	3,790	3,910
Nickel	10	14.9	10.4	12.5	12.1
Silver	12	7.8	5.0	6.4	6.5
Zinc	13	777	503	636	648
12331800--CLARK FORK NEAR DRUMMOND, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1991-2002					
Cadmium	14	7.7	2.6	4.9	4.8
Chromium	10	35.4	17.0	30.1	32.1
Copper	14	747	387	525	524
Iron	14	27,000	16,500	22,100	23,200
Lead	14	135	72	96	95
Manganese	14	2,790	1,150	1,770	1,700
Nickel	10	16.8	11.6	14.5	15.4
Silver	14	4.7	<3.2	[1]3.0	[1]2.9
Zinc	14	1,230	785	1,040	1,030

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through August 2002 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12334510--ROCK CREEK NEAR CLINTON, MONT.					
Period of record for fine-grained bed-sediment data: 1986-87, 1989, 1991-99, 2001-02					
Cadmium	14	3.7	<.2	[1].8	[1]<.4
Chromium	9	27.9	16.5	22.2	21.3
Copper	14	16	3	12	13
Iron	14	21,400	13,100	17,600	17,800
Lead	14	16	<3	[1]9	[1]9
Manganese	14	724	126	374	330
Nickel	9	14.8	9.5	12.1	12.7
Silver	13	1.9	<.3	[1].5	[1]<.3
Zinc	14	58	32	46	48
12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.					
Period of record for fine-grained bed-sediment data: 1986, 1991-2002					
Cadmium	13	7.3	3.1	4.2	3.9
Chromium	10	34.7	15.3	26.0	28.4
Copper	13	635	214	388	352
Iron	13	24,400	15,100	19,400	17,500
Lead	13	115	47	75	70
Manganese	13	2,270	671	1,180	1,080
Nickel	10	19.1	9.3	13.8	14.0
Silver	13	3.9	<1.9	[1]2.2	[1]2.1
Zinc	13	1,160	586	890	880
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: 1997-2002					
Cadmium	6	4.7	1.5	3.2	3.1
Chromium	6	30.6	19.0	26.6	29.3
Copper	6	543	166	327	258
Iron	6	24,300	18,100	20,800	20,600
Lead	6	78	37	55	53
Manganese	6	1,370	480	980	990
Nickel	6	15.8	11.8	13.7	13.9
Silver	6	2.9	.8	[1]2.0	[1]2.2
Zinc	6	1,090	438	700	622

Table 22. Statistical summary of fine-grained bed-sediment data for the upper Clark Fork basin, Montana, August 1986 through August 2002 (Continued)

Constituent	Number of samples	Maxi-mum	Minimum	Mean	Median
12353000--CLARK FORK BELOW MISSOULA, MONT.[2]					
Period of record for fine-grained bed-sediment data: 1986, 1990-2002					
Cadmium	14	6.0	1.1	2.3	1.9
Chromium	10	27.6	12.3	21.9	22.6
Copper	14	293	87	153	140
Iron	14	21,100	13,400	18,400	19,000
Lead	14	58	12	37	36
Manganese	14	2,530	446	1,320	1,210
Nickel	10	14.1	8.9	12.4	12.7
Silver	14	3.0	.4	[1]1.3	[1]1.3
Zinc	14	675	252	402	395

[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 August 2002

[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	Maxi-mum	Minimum	Mean	Median
12323600--SILVER BOW CREEK AT OPPORTUNITY, MONT.					
Period of record for bulk bed-sediment data: 1993-95, 1997-2002					
Cadmium	9	30.2	4.2	12.8	8.5
Chromium	9	18.1	9.6	13.5	12.7
Copper	9	3,800	670	1,550	976
Iron	9	29,300	18,300	23,200	20,800
Lead	9	398	198	278	263
Manganese	9	5,480	504	1,760	748
Nickel	9	12.7	6.0	7.9	6.8
Silver	9	8.0	3.2	5.0	4.1
Zinc	9	5,930	1,720	3,300	2,270
12323750--SILVER BOW CREEK AT WARM SPRINGS, MONT.					
Period of record for bulk bed-sediment data: 1993, 1995-2002					
Cadmium	9	1.7	<.9	[1]1.0	[1]1.2
Chromium	9	11.8	5.2	8.7	9.2
Copper	9	111	9	46	32
Iron	9	12,300	6,100	10,100	9,600
Lead	9	33	<10	[1]13	[1]11
Manganese	9	2,100	209	890	830
Nickel	9	9.2	4.8	6.0	5.4
Silver	9	1.3	<.3	[1].7	[1].7
Zinc	9	303	93	154	131
12323770--WARM SPRINGS CREEK AT WARM SPRINGS, MONT.					
Period of record for bulk bed-sediment data: 1995, 1997, 1999, 2002					
Cadmium	4	1.5	<.8	[1].6	[1]<.9
Chromium	4	12.0	7.4	10.2	10.7
Copper	4	238	127	193	204
Iron	4	12,700	8,010	10,200	10,000
Lead	4	38	18	29	29
Manganese	4	4,240	1,220	2,640	2,540
Nickel	4	8.5	5.7	7.2	7.4
Silver	4	1.3	<.8	[1].9	[1]1.0
Zinc	4	275	146	183	155
12323800--CLARK FORK NEAR GALEN, MONT.					
Period of record for bulk bed-sediment data: 1993-2002					
Cadmium	10	8.2	<.9	[1]3.9	[1]3.8
Chromium	10	23.7	4.2	15.5	15.4
Copper	10	902	223	496	475
Iron	10	31,300	9,930	20,400	20,000
Lead	10	158	41	81	79
Manganese	10	9,490	900	3,490	1,890
Nickel	10	15.2	4.9	9.0	9.1
Silver	10	5.2	.7	[1]2.1	[1]1.6
Zinc	10	1,280	417	725	665

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through August 2002 (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: 1996-2002					
Cadmium	7	3.3	<.9	[1]2.4	[1]2.5
Chromium	7	17.5	6.8	11.7	12.0
Copper	7	763	238	428	398
Iron	7	21,000	12,300	16,400	16,000
Lead	7	104	41	70	72
Manganese	7	1,840	1,260	1,470	1,390
Nickel	7	8.2	4.2	6.2	6.7
Silver	7	2.8	.8	[1]1.6	[1]1.6
Zinc	7	787	339	523	522
461559112443301--CLARK FORK NEAR RACETRACK, MONT.					
Period of record for bulk bed-sediment data: 1996-2002					
Cadmium	7	6.6	<.9	[1]3.3	[1]2.7
Chromium	7	19.7	10.1	15.0	14.7
Copper	7	757	361	515	475
Iron	7	25,900	16,200	19,500	18,200
Lead	7	101	59	79	78
Manganese	7	1,710	759	1,320	1,350
Nickel	7	9.9	5.5	7.5	7.3
Silver	7	3.3	1.4	[1]2.4	[1]2.6
Zinc	7	781	472	633	626
461903112440701--CLARK FORK AT DEMPSEY CREEK DIVERSION, NEAR RACETRACK, MONT.					
Period of record for bulk bed-sediment data: 1996-2002					
Cadmium	7	9.2	1.5	4.2	3.0
Chromium	7	21.1	13.0	17.2	17.3
Copper	7	1,000	244	541	577
Iron	7	25,400	16,400	22,200	23,500
Lead	7	115	47	79	88
Manganese	7	4,930	825	1,880	1,630
Nickel	7	12.8	5.5	8.6	9.0
Silver	7	4.4	<.8	[1]2.4	[1]2.8
Zinc	7	1,240	368	664	604
12324200--CLARK FORK AT DEER LODGE, MONT.					
Period of record for bulk bed-sediment data: 1993-2002					
Cadmium	10	7.8	1.0	[1]3.2	[1]2.2
Chromium	10	29.2	12.1	19.1	19.6
Copper	10	906	281	495	412
Iron	10	25,000	13,200	19,600	19,700
Lead	10	112	45	77	78
Manganese	10	2,530	607	1,220	1,040
Nickel	10	12.3	7.7	10.0	10.1
Silver	10	3.9	<.7	[1]1.9	[1]1.6
Zinc	10	1,060	456	637	564
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 August 2002 (Continued)

Constituent	Number of samples	Maximum	Minimum	Mean	Median
	12324680--CLARK FORK AT GOLDCREEK, MONT.				
	Period of record for bulk bed-sediment data: 1993-2002				
Cadmium	10	7.6	1.1	[1]3.3	[1]2.9
Chromium	10	33.2	15.0	22.1	21.3
Copper	10	858	197	443	326
Iron	10	24,900	15,400	19,100	18,500
Lead	10	92	37	63	63
Manganese	10	2,930	377	1,260	970
Nickel	10	15.9	9.0	11.6	11.3
Silver	10	3.7	<.7	[1]1.9	[1]1.5
Zinc	10	1,020	368	683	650
	12331500--FLINT CREEK NEAR DRUMMOND, MONT.				
	Period of record for bulk bed-sediment data: 1993-2002				
Cadmium	10	3.8	<.2	[1]1.8	[1]1.6
Chromium	10	13.9	4.9	9.8	10.9
Copper	10	40	16	24	22
Iron	10	15,700	8,630	12,900	13,400
Lead	10	120	51	77	80
Manganese	10	3,200	1,150	2,170	2,220
Nickel	10	8.0	4.5	5.9	5.9
Silver	10	5.8	2.5	4.3	4.4
Zinc	10	429	178	277	279
	12331800--CLARK FORK NEAR DRUMMOND, MONT.				
	Period of record for bulk bed-sediment data: 1993-2002				
Cadmium	10	4.7	<1.6	[1]2.4	[1]2.1
Chromium	10	29.5	6.9	18.4	17.2
Copper	10	605	114	260	210
Iron	10	21,800	12,100	16,000	15,500
Lead	10	78	31	47	46
Manganese	10	1,510	409	980	960
Nickel	10	14.2	7.7	10.3	9.8
Silver	10	3.5	.5	[1]1.6	[1]1.4
Zinc	10	939	381	577	506
	12334510--ROCK CREEK NEAR CLINTON, MONT.				
	Period of record for bulk bed-sediment data: 1993-99, 2001-02				
Cadmium	9	<1.5	<.2	[1]--	[1]<.8
Chromium	9	22.6	6.4	10.5	8.8
Copper	9	10	3	5	5
Iron	9	14,800	5,290	8,690	7,410
Lead	9	<13	<3	[1]6	[1]5
Manganese	9	270	72	160	145
Nickel	9	10.2	3.6	5.9	5.1
Silver	9	<1.6	.1	[1].4	[1].4
Zinc	9	37	7	19	17
	12334550--CLARK FORK AT TURAH BRIDGE, NEAR BONNER, MONT.				
	Period of record for bulk bed-sediment data: 1993-2002				
Cadmium	10	4.9	.4	[1]2.1	[1]2.1
Chromium	10	23.8	6.9	15.3	16.0
Copper	10	336	75	186	184
Iron	10	19,100	9,270	13,300	13,000
Lead	10	67	21	38	37
Manganese	10	1,470	234	680	565
Nickel	10	14.0	6.4	9.1	8.6
Silver	10	2.9	<.3	[1]1.2	[1]1.0
Zinc	10	769	271	471	493

Table 23. Statistical summary of bulk bed-sediment data for the upper Clark Fork basin, Montana, August 1993 through August 2002 (Continued)

Constituent	Number of samples	Maxi-mum	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: 1997-2002				
Cadmium	6	3.4	<.8	[1]1.8	[1].8
Chromium	6	31.5	9.7	17.0	16.1
Copper	6	630	43	178	100
Iron	6	21,500	11,500	16,000	16,100
Lead	6	84	7	31	24
Manganese	6	888	228	573	562
Nickel	6	14.4	8.2	10.4	9.8
Silver	6	<3.3	<.4	[1]1.2	[1].8
Zinc	6	1,210	145	427	300
	12353000--CLARK FORK BELOW MISSOULA, MONT.[2]				
	Period of record for bulk bed-sediment data: 1993-2002				
Cadmium	10	3.0	<.2	[1].9	[1].6
Chromium	10	12.7	4.4	7.7	7.1
Copper	10	77	16	40	31
Iron	10	13,300	5,830	8,960	8,840
Lead	10	23	<10	[1]10	[1]8
Manganese	10	560	150	349	366
Nickel	10	8.1	3.5	5.4	5.2
Silver	10	<1.9	<.3	[1].5	[1].5
Zinc	10	183	58	117	111

[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 August 2002

[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, 1997-2002					
Brachycentrus spp.					
Cadmium	5	12.5	5.8	10.1	11.6
Chromium	5	5.9	.7	2.1	.9
Copper	5	846	235	587	592
Iron	5	1,190	335	617	469
Lead	5	21.5	7.4	13.7	13.8
Manganese	5	817	231	515	503
Nickel	5	2.1	<.1	[1]1.3	[1]1.6
Zinc	5	995	629	803	815
Hydropsyche cockerelli					
Cadmium	6	9.7	4.1	5.7	4.9
Chromium	6	8.0	1.0	3.4	2.5
Copper	6	1,090	269	486	386
Iron	6	2,660	689	1,220	978
Lead	6	47.2	19.0	24.8	20.5
Manganese	6	1,160	180	576	513
Nickel	6	3.6	.7	2.0	1.8
Zinc	6	1,380	749	911	838
Hydropsyche spp.					
Cadmium	5	10.6	5.0	8.7	8.8
Chromium	5	4.7	.6	1.7	.8
Copper	5	930	352	768	845
Iron	5	2,110	1,270	1,730	1,750
Lead	5	50.8	34.7	40.4	39.9
Manganese	5	1,070	712	933	939
Nickel	5	2.5	1.6	2.2	2.4
Zinc	5	1,290	1,070	1,140	1,110
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: 1992-2002					
Hydropsyche cockerelli					
Cadmium	26	2.1	.2	.7	.6
Chromium	26	1.3	.4	.8	.8
Copper	26	97.0	22.4	42.0	39.3
Iron	26	1,240	351	708	733
Lead	26	5.7	.3	3.0	2.9
Manganese	26	2,520	491	1,120	873
Nickel	26	1.8	.3	.8	.8
Zinc	26	276	115	179	171

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 2002 (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: 1992-2002					
Hydropsyche occidentalis					
Cadmium	15	1.6	.2	.6	.4
Chromium	15	1.7	.3	.9	1.0
Copper	15	48.9	11.0	32.6	30.3
Iron	15	2,960	372	1,070	837
Lead	15	8.2	<1.7	[1]3.9	[1]3.3
Manganese	15	3,410	1,200	2,260	2,140
Nickel	15	2.7	.7	1.4	1.3
Zinc	15	211	141	178	178
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, 2002					
Arctopsyche grandis					
Cadmium	4	3.0	1.9	2.4	2.2
Chromium	4	2.9	.8	1.7	1.6
Copper	4	102	78.3	93.7	97.2
Iron	4	1,040	684	839	815
Lead	4	5.6	3.0	[1]4.3	4.3
Manganese	4	3,560	1,340	2,250	2,040
Nickel	4	2.3	1.8	[1]2.1	2.2
Zinc	4	222	181	196	190
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	2	1.1	.6	.9	--
Chromium	2	1.6	1.4	1.5	--
Copper	2	95.9	94.8	95.3	--
Iron	2	1,220	1,150	1,190	--
Lead	2	5.9	5.2	5.6	--
Manganese	2	3,390	956	2,170	--
Nickel	2	2.0	1.8	1.9	--
Zinc	2	129	125	127	--
12323800--CLARK FORK NEAR GALEN, MONT.					
Period of record for biological data: 1987, 1991-2002					
Hydropsyche cockerelli					
Cadmium	25	2.7	.9	1.6	1.5
Chromium	25	3.3	.8	1.7	1.6
Copper	25	181	48.7	98	97
Iron	25	2,460	816	1,380	1,340
Lead	25	11.7	1.2	7.5	7.6
Manganese	25	3,620	1,070	2,240	2,290
Nickel	25	3.1	.9	1.6	1.4
Zinc	25	299	136	212	211

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 2002 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
	12323800--CLARK FORK NEAR GALEN, MONT.--Continued				
	Period of record for biological data: 1987, 1991-2002				
	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	32	1.7	.6	1.1	1.1
Chromium	32	6.6	.4	1.8	1.4
Copper	32	106	49.2	78.5	75.5
Iron	32	1,920	642	1,220	1,180
Lead	32	13.5	1.6	6.7	6.3
Manganese	32	6,170	1,220	2,650	2,290
Nickel	32	3.5	.8	1.6	1.6
Zinc	32	286	168	201	196
	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: 1996-2002				
	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	11	2.8	1.4	2.0	2.2
Chromium	11	2.6	.8	1.8	2.0
Copper	11	147	48.8	105	97.0
Iron	11	2,570	691	1,410	1,300
Lead	11	15.2	4.5	10.8	11.3
Manganese	11	3,160	1,230	2,030	1,810
Nickel	11	1.9	1.0	1.4	1.4
Zinc	11	321	151	226	234

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 2002 (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: 1996-2002					
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: 1996-2002					
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	11	1.9	1.0	1.4	1.4
Chromium	11	2.7	.6	1.4	1.1
Copper	11	109	50.0	74.1	70.6
Iron	11	1,370	657	919	862
Lead	11	10.5	3.7	6.4	6.1
Manganese	11	2,010	646	1,450	1,570
Nickel	11	1.4	.7	1.0	1.0
Zinc	11	199	139	172	171
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 August 2002 (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: 1996-2002					
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	9	1.6	.7	1.2	1.3
Chromium	9	1.7	.4	1.0	.9
Copper	9	143	60.7	80.3	75.9
Iron	9	1,290	552	824	831
Lead	9	8.9	3.5	5.9	5.0
Manganese	9	1,230	487	956	1,140
Nickel	9	1.9	.5	.9	.7
Zinc	9	192	162	177	178
Hydropsyche occidentalis					
Cadmium	17	1.7	.7	1.1	1.1
Chromium	17	2.8	.8	1.8	1.8
Copper	17	163	74.9	94.9	87.5
Iron	17	1,660	940	1,410	1,500
Lead	17	13.8	6.1	11.0	11.4
Manganese	17	3,990	826	2,430	2,290
Nickel	17	2.4	1.2	1.5	1.4
Zinc	17	292	222	246	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, 1990-2002					
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	23	2.3	.6	1.4	1.3
Chromium	23	3.2	.4	1.6	1.7
Copper	23	136	54.7	94.1	97.7
Iron	23	3,340	490	1,140	1,040
Lead	23	18.2	4.3	9.5	8.9
Manganese	23	1,490	396	805	701
Nickel	23	2.4	.3	1.2	1.0
Zinc	23	391	132	186	185

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 2002 (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, 1990-2002				
	Hydropsyche occidentalis				
Cadmium	37	2.7	.8	1.3	1.3
Chromium	37	3.6	.6	1.9	1.9
Copper	37	162	49.4	112	109
Iron	37	2,060	557	1,410	1,420
Lead	37	18.6	3.5	10.9	10.7
Manganese	37	2,840	649	1,700	1,730
Nickel	37	12.9	1.0	1.8	1.4
Zinc	37	329	166	238	236
	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 August 2002 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
	12324680--CLARK FORK AT GOLDCREEK, MONT.				
	Period of record for biological data: 1992-2002				
	Arctopsyche grandis				
Cadmium	29	6.6	1.1	2.5	2.0
Chromium	29	3.3	.4	1.3	1.0
Copper	29	129	21.4	48.9	39.1
Iron	29	2,360	339	764	518
Lead	29	10.9	2.0	4.1	3.6
Manganese	29	1,580	592	876	861
Nickel	29	1.8	.2	.8	.6
Zinc	29	326	163	214	195
	Claassenia sabulosa				
Cadmium	20	3.5	.3	1.3	.9
Chromium	20	1.6	.3	.6	.5
Copper	20	81.7	33.0	55.8	54.9
Iron	20	567	63.0	202	192
Lead	20	1.8	.5	1.1	1.1
Manganese	20	279	50.6	125	102
Nickel	20	.7	.2	.3	.3
Zinc	20	351	166	261	260
	Hydropsyche cockerelli				
Cadmium	19	2.6	.6	1.6	1.4
Chromium	19	4.7	.5	2.1	1.9
Copper	19	188	17.1	77.8	65.1
Iron	19	3,250	522	1,270	930
Lead	19	16.2	2.4	7.6	5.8
Manganese	19	1,670	538	841	713
Nickel	19	2.3	.3	1.3	1.2
Zinc	19	249	106	191	200
	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, 1992-2002				
	Arctopsyche grandis				
Cadmium	39	.8	.1	.3	.3
Chromium	39	4.7	.3	1.8	1.7
Copper	39	21.7	8.9	14.9	15.2
Iron	39	2,460	412	1,340	1,300
Lead	39	17.5	3.7	8.9	7.8
Manganese	39	2,480	424	1,480	1,360
Nickel	39	2.7	.6	1.4	1.3
Zinc	39	275	93	196	192

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 2002 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12331500--FLINT CREEK NEAR DRUMMOND, MONT.--Continued					
Period of record for biological data: 1986, 1992-2002					
Hydropsyche cockerelli					
Cadmium	11	.9	.1	.4	.4
Chromium	11	4.0	.9	1.9	1.8
Copper	11	28.3	9.5	17.7	18.0
Iron	11	3,720	996	2,150	2,020
Lead	11	28.4	3.1	14.7	16.2
Manganese	11	2,690	401	1,340	1,220
Nickel	11	2.7	.9	2.0	2.2
Zinc	11	208	85	169	182
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, 1991-2002					
Arctopsyche grandis					
Cadmium	32	3.8	.5	1.5	1.3
Chromium	32	2.5	.2	.9	1.0
Copper	32	89.2	16.9	34.4	28.7
Iron	32	1,660	240	610	552
Lead	32	11.8	2.1	4.7	4.3
Manganese	32	2,010	462	859	737
Nickel	32	1.9	.2	.7	.6
Zinc	32	308	142	194	190
Claassenia sabulosa					
Cadmium	36	2.8	.2	1.2	1.1
Chromium	36	3.3	.1	.7	.6
Copper	36	165	18.0	65.2	53.8
Iron	36	387	45.4	161	135
Lead	36	2.9	.2	1.0	.8
Manganese	36	410	33.1	158	135
Nickel	36	1.1	.1	.3	.2
Zinc	36	567	103	274	252

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 2002 (Continued)

Constituent	Number of composite samples	Maximum	Minimum	Mean	Median
12331800--CLARK FORK NEAR DRUMMOND, MONT.--Continued					
Period of record for biological data: 1986, 1991-2002					
Hydropsyche cockerelli					
Cadmium	29	2.3	.6	1.2	1.0
Chromium	29	3.5	.4	1.6	1.5
Copper	29	156	30.0	61.0	51.1
Iron	29	2,500	506	1,190	984
Lead	29	15.0	5.1	8.8	8.2
Manganese	29	1,680	549	952	901
Nickel	29	2.0	.5	1.2	1.1
Zinc	29	248	134	194	186
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, 2001-02					
Arctopsyche grandis					
Cadmium	38	.4	.06	.2	.2
Chromium	38	2.9	.5	1.2	1.0
Copper	38	15.7	4.7	8.6	8.5
Iron	38	1,090	191	594	547
Lead	38	1.1	.05	[1].4	[1].4
Manganese	38	454	113	259	260
Nickel	38	1.8	.2	.9	1.0
Zinc	38	189	84	129	134
Claassenia sabulosa					
Cadmium	19	.3	.05	.2	.2
Chromium	19	1.8	.1	.7	.6
Copper	19	40.7	18.1	28.8	28.5
Iron	19	129	49.8	92.7	102
Lead	19	1.0	.1	.4	.3
Manganese	19	76.3	15.7	34.6	32.9
Nickel	19	.9	.1	.4	.3
Zinc	19	264	144	198	192

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 2002 (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, 2001-02					
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, 1991-2002					
Arctopsyche grandis					
Cadmium	42	2.7	.6	1.3	.9
Chromium	42	4.1	.6	1.7	1.5
Copper	42	125	20.1	40.1	33.9
Iron	42	2,870	420	1,030	879
Lead	42	13.2	2.1	4.7	4.2
Manganese	42	893	351	637	637
Nickel	42	2.7	.4	1.2	.9
Zinc	42	276	152	203	198
Claassenia sabulosa					
Cadmium	26	2.5	.3	1.1	.9
Chromium	26	2.0	.2	.7	.6
Copper	26	79.2	38.3	57.0	53.9
Iron	26	181	58.6	105	103
Lead	26	1.6	.2	.6	.6
Manganese	26	139	37.2	76.2	68.5
Nickel	26	.6	.1	.2	.2
Zinc	26	283	144	221	226
Hydropsyche cockerelli					
Cadmium	28	1.7	.5	.9	.7
Chromium	28	8.0	.9	2.0	1.6
Copper	28	118	26.4	49.7	43.9
Iron	28	2,530	688	1,270	1,160
Lead	28	12.1	2.2	5.5	5.2
Manganese	28	788	426	599	570
Nickel	28	2.6	.6	1.3	1.2
Zinc	28	228	148	188	184

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 2002 (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, 1991-2002					
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	[1]5.2	--
Manganese	2	1,320	537	928	--
Nickel	2	1.7	1.3	1.5	--
Zinc	2	231	171	201	--
Hydropsyche occidentalis					
Cadmium	20	1.8	.3	.9	.9
Chromium	20	3.2	.6	1.9	1.7
Copper	20	102	34.1	50.1	44.9
Iron	20	2,310	472	1,220	1,130
Lead	20	14.2	3.0	6.7	5.7
Manganese	20	1,600	454	817	728
Nickel	20	3.2	.6	1.2	1.1
Zinc	20	416	145	208	200
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 August 2002 (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: 1997-2002					
Arctopsyche grandis					
Cadmium	19	1.8	.4	.7	.6
Chromium	19	3.0	.6	1.4	1.4
Copper	19	77.6	19.5	32.2	27.5
Iron	19	2,340	476	984	895
Lead	19	6.8	1.2	3.4	3.1
Manganese	19	1,210	476	831	835
Nickel	19	2.0	.5	1.1	.9
Zinc	19	260	133	186	177
Claassenia sabulosa					
Cadmium	9	2.0	.2	.7	.4
Chromium	9	1.1	.3	.7	.7
Copper	9	71.7	33.0	50.4	46.8
Iron	9	402	95.3	243	246
Lead	9	3.1	.5	[1]1.3	[1]1.1
Manganese	9	683	75.2	237	136
Nickel	9	<.5	<.3	[1].4	[1].4
Zinc	9	363	191	275	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, 1990-2002					
Arctopsyche grandis					
Cadmium	25	1.5	.2	.7	.7
Chromium	25	2.7	.5	1.3	1.4
Copper	25	38.0	9.4	21.8	22.0
Iron	25	1,590	343	836	813
Lead	25	3.9	.9	1.9	1.9
Manganese	25	1,090	511	714	711
Nickel	25	1.6	.4	1.0	1.0
Zinc	25	217	106	155	152

Table 24. Statistical summary of biological data for the upper Clark Fork basin, Montana, August 1986 through August 2002 (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, 1990-2002					
Claassenia sabulosa					
Cadmium	39	1.3	.1	.5	.4
Chromium	39	1.2	.05	.5	.5
Copper	39	74.8	31.1	48.2	46.9
Iron	39	239	66.6	113	108
Lead	39	1.3	.1	.4	.3
Manganese	39	168	48.9	102	99
Nickel	39	.3	.1	.2	.2
Zinc	39	286	146	215	210
Hydropsyche cockerelli					
Cadmium	38	1.1	.2	.5	.6
Chromium	38	3.4	.8	1.9	1.9
Copper	38	54.1	12.4	31.4	32.0
Iron	38	2,220	584	1,380	1,390
Lead	38	6.6	1.2	2.6	2.4
Manganese	38	1,210	353	746	673
Nickel	38	1.9	.5	1.3	1.3
Zinc	38	187	77.4	148	154
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.