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Water and Sediment Quality of the Yukon River and its Tributaries, from Eagle to St. Marys, Alaska, 2002–2003

Edited By Mark M. Dornblaser and Douglas R. Halm

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Cover photo: Yukon River, between Eagle and Circle, by Mark Dornblaser, U.S. Geological Survey

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(in pocket)

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Conversion Factors

Multiply	By	To Obtain
	Length	
mile	1.609	kilometer (km)
foot (ft)	0.305	meter (m)
inch	2.538	centimeter (cm)
inch	25.4	millimeter (mm)
inch	25,400	micrometer (µm)
inch	25,400,051	nanometer (nm)
	Area	
square mile	2.59	square kilometer (km^2)
square foot	0.09294	square meter (m^2)
	Volume	
liter (L)	0.2642	gallon
milliliter (ml)	0.03382	ounce, fluid
microliter (µl)	0.00003382	ounce, fluid
	Mass	
gram (g)	0.03527	ounce, avoirdupois
milligram (mg)	0.00003527	ounce, avoirdupois
microgram (µg)	0.00000003527	ounce, avoirdupois
	Flow	
cubic foot per second (ft^3/sec)	0.02832	cubic meters per second (m^3/sec)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:
°F= (1.8×°C) +32
Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:
°C= (°F-32)/1.8
Vertical coordinate information is referenced to the "North American Vertical Datum of 1988 (NAVD 88)"
Horizontal coordinate information is referenced to the "North American Datum of 1983 (NAD 83)"
Altitude, as used in this report, refers to distance above the vertical datum.
Water year is the 12-month period from October 1 through September 30. The water year is designated by the calendar year in which it ends.

Abbreviations

The following terms are also used in this report:

ADF&G	Alaska Department of Fish and Game
ASCWRO	Alaska Science Center Water Resources Office
BLM	Bureau of Land Management
CH_4	Methane
Cl	Chloride
CO_2	Carbon Dioxide
DIC	Dissolved Inorganic Carbon

DOC	Dissolved Organic Carbon
EDI	Equal Discharge Increment
ft^3/sec	cubic feet per second
GIS	Geographic Information System
Hg	Mercury
mg/L	milligrams per liter
NASQAN	National Stream Quality Accounting Network
NH_4^+	Ammonium ion
nm	nanometer
NO_2	Nitrite
NO_3	Nitrate
NRP	National Research Program
OM	Organic Matter
PC	Particulate Carbon
PN	Particulate Nitrogen
PO_4	Phosphate
PP	Particulate Phosphorus
ppm	parts per million by volume
QA	Quality Assurance
QC	Quality Control
RPD	Relative Percent Difference
SO_4	Sulfate
SRP	Soluble Reactive Phosphorus
SUVA	Specific Ultraviolet Absorbance
SVNRP	Stevens Village Natural Resource Program
TDN	Total Dissolved Nitrogen
TDP	Total Dissolved Phosphorus
TU	Tritium Units
µg/L	micrograms per liter
µM	micromolar, or micromoles per liter
µS/cm	microsiemens per centimeter
UAR	Uranium Activity Ratio

USGS	U.S. Geological Survey
UV	Ultraviolet
WY	Water Year
YFNWR	Yukon Flats National Wildlife Refuge

Water and Sediment Quality of the Yukon River and its Tributaries, from Eagle to St. Marys, Alaska, 2002–2003

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Abstract

The Yukon River basin is a vast and diverse ecosystem covering more than 330,000 square miles, an area larger than Texas. Approximately 126,000 people live within the basin and depend on the Yukon River and its tributaries for drinking water, commerce, and recreational and subsistence fish and game resources.

Much of the Yukon River basin is underlain by permafrost containing vast amounts of organic carbon and nutrients. Recent climatic warming of the basin has resulted in lengthening of the growing season, melting of permafrost, deepening of the soil active layer, drying of upland soils, and shrinking of wetlands. These mostly terrestrial effects also affect the hydrology of the basin, changing the timing, magnitude, and fate of water and dissolved and particulate materials delivery to the Yukon River and its tributaries.

As permafrost melts, stored carbon and nutrients are expected to become available for decomposition by soil organisms or for export downstream and to the Bering Sea. Such changes can have numerous, far-reaching effects on the ecosystem, including increased emission of greenhouse gases such as carbon dioxide and methane; changes in stream productivity, including salmon populations; changes in the productivity and chemistry of the Bering Sea; and increased fire frequency. One important question is whether organic carbon export to rivers will increase or decrease downstream from large wetland areas presently having substantial carbon storage, such as Yukon Flats.

Because very few historical water-quality data are available for the Yukon River basin, scientists are unable to quantitatively assess potential effects of climate warming on aquatic ecosystems in the basin. In order to address these concerns, the U.S.

Geological Survey conducted a comprehensive baseline water-quality characterization of the Yukon River and its major tributaries during 2000-05. The study included frequent water-quality sampling at a fixed-site network. In addition to the fixed-site sampling, intensive synoptic sampling of tributaries draining directly into the Yukon River was conducted along its entire length. This report contains observations of water and sediment quality made in the Yukon River basin during the synoptic sampling cruises in years 2002 and 2003. Chemical and biological data are presented for the Yukon River and its major tributaries between the towns of Eagle and St. Marys, Alaska.

Chapter 1. Introduction

The Yukon River basin covers more than 330,000 square miles in northwestern Canada and central Alaska, an area larger than Texas (fig. 1). It is one of the largest and most diverse river basins in North America, and is of prime importance to the ecology of the Bering Sea, contributing most of its freshwater runoff, sediment load, and dissolved solutes (Lisitsysn, 1969).

Figure 1. Location of the Yukon River basin in Canada and Alaska.

The hydrology of the Yukon River basin is changing. Air temperature records between 1961–1990 show a warming trend of about 0.75°C per decade at latitudes where the Yukon River is located (Chapman and Walsh, 1993). Continued warming will affect permafrost distribution, glacial runoff, and biogeochemical fluxes within and from the basin. The exact effects are unclear. However, early results suggest that warming has altered the delivery of terrestrial carbon to the Yukon River, as the organic carbon released from permafrost is mineralized prior to entering the streams (Striegl and others, 2005).

The U.S. Geological Survey (USGS) National Stream Quality Accounting Network (NASQAN) Program began a 5-year study of the Yukon River basin in 2000 (Brabets and others, 2000; Nelson et al. 2001). One of the objectives of this study was to develop a baseline characterization of water-quality conditions in the Yukon River basin that will serve as a benchmark for future studies of the river. Water quality is important to study for several reasons. The thousands of people who live along the Yukon and its tributaries depend on river water for drinking. Salmon and other fish species, important for both subsistence and recreation, require good water quality for their continued existence. This is also true for the countless birds, mammals, and other fauna that live in the basin.

Intensive Sampling

Intensive synoptic boat-based sampling of the Yukon River and its major tributaries was conducted during 2002–2004. The study was conducted by the USGS National Research Program (NRP), with the assistance of the USGS Water Resources Office of the Alaska Science Center, the USGS Wisconsin Water Science Center, and university collaborators. Due to the length of the river, the Yukon was divided into segments; in 2002, the river was sampled along the 500 mile reach between Eagle, Alaska, and the Dalton Highway Bridge crossing near Stevens Village, and in 2003 the river was sampled along the 870 mile reach between the Dalton Highway Bridge and St Marys.

The 2002 reach of the Yukon River was sampled twice, once in June to capture peak flow conditions, and once in late August/early September to capture late summer flow conditions. The 2003 reach of the Yukon River was also sampled twice, once in June and once in late August, and completed the coverage of nearly the entire length of the Yukon River within Alaska. Plate 1 shows the sampling sites along the main stem of the Yukon River and its tributaries. Tables 1 and 2 reference the locations of the sampling sites on fig. 1, and provide location identification (ID), latitude/longitude, drainage area, and elevation. Sampling locations were chosen on the basis of the following criteria: logistics, drainage-basin size, the existence of historical data at that site, land use (that is, mining), the geochemistry of the basin (that is, bedrock type), the extent of permafrost, and the extent of land-cover types such as wetlands (which are organic carbon rich and suspended sediment poor), and glacial terrain (which is organic carbon poor and has high suspended sediment load).

Table 1. Summary of site characteristics, year 2002

[Site ID, USGS site identification number; ID on Plate 1, refer to Plate 1 for site ID locations; sq. mi., square miles; ft, feet; NAD 83, North American Datum of 1983; NAVD88, North American Vertical Datum of 1988]

Site ID	ID on Plate 1	Site Name	Latitude (NAD 83)	Longitude (NAD 83)	Drainage Area (sq. mi.)	Elevation (ft above NAVD88)
		Main Stem Sites				
15356000	1	Yukon River at Eagle	64° 47' 22"	141° 11' 52"	113,500	850
654335144032800	2	Yukon River above Circle	65° 43' 35"	144° 03' 28"	--	590
662437147060400	3	Yukon River at Joe Devlin Island	66° 24' 37"	147° 06' 04"	--	348
661340147541000	4	Yukon River at Timber Point	66° 13' 40"	147° 54' 10"	--	300
15453500	5	Yukon River near Stevens Village	65° 52' 32"	149° 43' 04"	196,300	240
		Tributaries				
651237141410700	6	Nation River Mouth	65° 12' 37"	141° 41' 07"	931	750
652223142294100	7	Kandik River Mouth	65° 22' 23"	142° 29' 41"	1,084	725
651705142440400	8	Charley River Mouth	65° 18' 46"	142° 45' 55"	1,690	700
652113143071500	9	Coal Creek Mouth	65° 21' 03"	143° 06' 53"	81	650
652108143193800	10	Woodchopper Creek Mouth	65° 21' 08"	143° 19' 38"	82	653
664424144321200	11	Sheenjek River Mouth	66° 44' 24"	144° 32' 12"	5,162	449
664036144352800	12	Black River Mouth	66° 40' 36"	144° 35' 28"	6,099	435
663821145060500	13	Porcupine River 9.5 miles Upstream From Mouth	66° 38' 21"	145° 06' 05"	44,954	400
663941145521600	14	Christian River Mouth	66° 39' 41"	145° 52' 16"	3,408	410
664151146003000	15	Chandalar River Mouth	66° 41' 51"	146° 00' 30"	9,861	400
663050146065600	16	Upper Mouth Birch Creek	66° 30' 50"	146° 06' 56"	4,200	375
662642146375200	17	Lower Mouth Birch Creek	66° 26' 42"	146° 37' 52"	844	357
661236147462200	18	Beaver Creek Mouth	66° 12' 36"	147° 32' 22"	2,095	328
663032146500000	19	Hadweenzic River Mouth	66° 29' 05"	146° 52' 02"	935	390
661744147464000	20	Hodzana River Mouth	66° 17' 44"	147° 46' 40"	1,669	340
660051149153200	21	Dall River Mouth	66° 00' 51"	149° 15' 32"	1,434	290
		Main Stem Grab Sites				
650037141211300	22	Yukon River below Tatonduk River	65° 00' 36"	141° 21' 22"	--	850
651204141440700	23	Yukon River below Nation River	65° 12' 03"	141° 44' 16"	--	770
652251142314900	24	Yukon River below Kandik River	65° 22' 50"	142° 31' 57"	--	705
651915142515800	25	Yukon River below Charley River	65° 19' 14"	142° 52' 07"	--	680
652128143110000	26	Yukon River below Coal Creek	65° 21' 27"	143° 11' 09"	--	670
652122143205000	27	Yukon River below Woodchopper Creek	65° 21' 20"	143° 20' 58"	--	650
660123144120500	28	Yukon River above Twentytwo Mile Village	66° 01' 22"	144° 12' 14"	--	510
661130144353900	29	Yukon River near Halfway Whirlpool	66° 11' 28"	144° 35' 48"	--	450
662247144525400	30	Yukon River above Twelvemile Island	66° 22' 45"	144° 53' 03"	--	449
663401145300800	31	Yukon River below Lower Mouth Porcupine River	66° 33' 60"	145° 30' 17"	--	400
661501147513300	32	Yukon River at Oscar Island	66° 14' 59"	147° 51' 43"	--	300
660316148515400	33	Yukon River at Adams Island	66° 03' 15"	148° 52' 04"	--	350

Table 2. Summary of site characteristics, year 2003

[Site ID, USGS site identification number; ID on Plate 1, refer to Plate 1 for site ID locations; sq. mi., square miles; ft, feet; NAD 83, North American Datum of 1983; NAVD88, North American Vertical Datum of 1988]

Site ID	ID on Plate 1	Site Name	Latitude (NAD 83)	Longitude (NAD 83)	Drainage Area (sq. mi.)	Elevation (ft above NAVD88)
		Main Stem Sites				
15564800	34	Yukon River at Ruby	64° 44' 41"	155° 29' 49"	259,000	139
15565200	35	Yukon River at Kaltag	64° 15' 54"	158° 40' 21"	296,000	99
		Tributaries				
655252149480800	36	Ray River Mouth	65° 52' 52"	149° 48' 08"	676	290
653954149473500	37	Hess Creek Mouth	65° 39' 54"	149° 47' 35"	1,190	280
650813152250200	38	Tozitna River Mouth	65° 08' 13"	152° 25' 02"	1,630	190
645408154143400	39	Nowitna River Mouth	64° 54' 08"	154° 14' 34"	7,180	150
15564600	40	Melozitna River Mouth	64° 45' 58"	155° 27' 31"	2,720	140
643816156030100	41	Yuki River near Mouth	64° 38' 16"	156° 03' 01"	1,070	135
645725157334800	42	Koyukuk River near Koyukuk, AK	64° 57' 25"	157° 33' 48"	31,400	117
644226158080900	43	Nulato River Mouth	64° 42' 26"	158° 08' 09"	883	109
623945160182800	44	Anvik River Mouth	62° 39' 45"	160° 18' 28"	1,780	74
623125160135800	45	Bonasila River Mouth	62° 31' 25"	160° 13' 58"	1,160	55
621418159341000	46	Innoko River near Mouth	62° 14' 18"	159° 34' 10"	14,100	48
620239162343500	47	Atchuelinguk River Mouth	62° 01' 11"	162° 43' 07"	2,100	20
620313163091100	48	Andreafsky River Mouth	62° 03' 13"	163° 09' 11"	2,100	20
		Main Stem Grab Sites				
655111149470600	49	Yukon River below Ray River	65° 51' 11"	149° 47' 06"	--	290
653743149512600	50	Yukon River below Hess Creek	65° 37' 43"	149° 51' 26"	--	275
650817152341100	51	Yukon River below Tozitna River	65° 08' 17"	152° 34' 11"	--	185
645421154314900	52	Yukon River below Nowitna River	64° 54' 21"	154° 31' 49"	--	150
644323156073700	53	Yukon River below Melozitna River	64° 43' 23"	156° 07' 37"	--	140
644119156190300	54	Yukon River below Yuki River	64° 41' 19"	156° 19' 03"	--	130
644617157585300	55	Yukon River below Koyukuk River	64° 46' 17"	157° 58' 53"	--	115
623448160091000	56	Yukon River below Anvik River	62° 34' 48"	160° 09' 10"	--	70
621945159584300	57	Yukon River below Bonasila River	62° 19' 45"	159° 58' 43"	--	50
620227159575600	58	Yukon River below Innoko River	62° 02' 27"	159° 57' 56"	--	45
15565447	59	Yukon River at Pilot Station	61° 56' 04"	162° 52' 50"	321,000	20

Water-quality constituents were measured at a number of sites along the main stem of the Yukon River and 29 of its tributaries. These included suspended sediment concentration and mineralogy, major ions, nutrients, dissolved and sediment-associated trace elements, mercury, biological indicators (such as chlorophyll *a*), various forms of organic carbon, dissolved carbon gases, and stable isotopes.

In conjunction with the intensive sampling, the NASQAN Program sampled five fixed stations in the Yukon basin approximately seven times a year (once under ice and the remainder during the open water season) over the 5-year period from 2001 to 2005. (For data from this part of the Yukon River study to date, see Schuster, 2003, 2005a, 2005b). Mass fluxes calculated for the fixed stations can be used to identify source areas of chemical constituents and to estimate the delivery of these constituents to the Bering Sea. The intensive sampling described in this report will increase the interpretability of those flux measurements, provide an alternate data set that may be a more sensitive indicator of change, and provide constituent source information that is specific to the individual contributing watersheds.

Purpose and Scope

This report contains water- and sediment-quality data, as well as water discharge at times of sample collection, for the Yukon River and its major tributaries between Eagle, AK, and St. Marys, AK. In 2002, sampling was conducted along the reach of river between Eagle and the Dalton Highway Bridge. In 2003, sampling was conducted along the reach between the Dalton Highway Bridge and St. Marys (plate 1). The sample collection methods and the laboratory analytical methods also are summarized. Some of the analyses contained in this report are not routine for USGS water-quality sampling and are not contained in the USGS National Water Information System (NWIS) database. This report is being released both on compact disc (CD) and on the World Wide Web to meet both archival and data dissemination objectives.

The data presented serve three purposes. First, they provide a snapshot of the surface-water quality in this area of the Yukon basin. By itself, this is important for the local residents and the management of fish and wildlife populations that depend on the

water resources. Secondly, the data establish a baseline of information that may be used in future comparisons if and when these scientific studies are repeated. Third, they provide insight into biogeochemical processes within the basin, and their effects on the export of various constituents into the Bering Sea.

Acknowledgments

We thank the USGS Water Resources Office of the Alaska Science Center, the USGS Wisconsin Water Science Center, the Bureau of Land Management (BLM), and the citizens of the Yukon River basin that assisted us with this field endeavor. This work would not have been possible without their field expertise and continuous logistical support. Alan M. Shiller's participation was partly supported by the National Science Foundation (EAR-0001049). We would also like to thank Ank Webbers and Amy Dawson for their extensive Geographic Information System (GIS) help in preparing Plate 1.

Chapter 2. Site Descriptions

Yukon River Basin

For a detailed overview of the hydrology, geology, land cover, and climate of the Yukon River basin, see Brabets and others (2000). Much of the information contained in this chapter is derived from Brabets and others (2000). The Yukon River in Alaska has high suspended sediment concentration, giving it a brown milky coffee-colored appearance. The glacial silt and sediments in the water prevent light from penetrating to depths of more than a few centimeters. The sediment load is so heavy that silt can be heard scraping along the side of a boat as it floats down the river.

The Yukon River basin is a diverse watershed, encompassing 20 different ecoregions. There is large variability in topography, climate, soils, geology, permafrost, land cover, and water quality across this vast landscape. The Yukon River begins as a glacier melt-water stream at the foot of the Llewellyn Glacier in northwestern British Columbia. By the time the river reaches the mouth, some 2,000 miles away, the river is flowing at an average annual rate of 200,000 ft^3/sec, enough to supply the Arctic Ocean with 8 percent of its freshwater input (Aagaard and Carmack, 1989). Along the way it has descended from the mountains, flowed through a National Preserve and five immense National Wildlife Refuges, crossed the Arctic Circle, and caused enough erosion to deposit 20 million tons of sediment in flood plains and 60 million tons of sediment into the ocean every year.

On our research cruises through the 1,500-mile stretch of the Yukon River in Alaska, we experienced much of the diversity of the basin. In June 2002, we began our cruise in warm sunshine, although we saw evidence of winter while traveling through the bluffs between Eagle and Circle. Large ice blocks were still slowly melting on the shorelines and gravel bars. In the Yukon Flats, we encountered extensive woven braids of the river, and saw massive bank erosion caused by the spring ice out. Spruce and aspen were scraped, twisted, snapped off, and uprooted, and huge organic mats hung out over the water above deep cut banks. In August 2003, repeating the same stretch of river, we saw a different side of the Yukon. We began in Eagle on the tail

end of a 2–3 week period of rain, which is unusual for this part of the basin. The aspen and spruce had spread a vibrant green blanket over the land in June; in August, thousands of acres of aspen and birch exploded into a fiery yellow.

In June 2003, we began where we left off in 2002, at the Dalton Highway Bridge. Our course took us down through the beautiful Rampart canyon to the confluence of the silt-laden Tanana River. While the Yukon River channel was far less braided than it was in the Yukon Flats, navigation was still difficult due to the large amount of debris that had flushed into the river. A sea of waterlogged trees floated silently down the river, some just inches beneath the murky water surface. Along the border of the Nowitna National Wildlife Refuge, we gazed up at the Palisades (also known as the Boneyard), a series of high cliffs that are a treasure trove of prehistoric fossils (Matheus et al., 2003). We passed through the Koyukuk National Wildlife Refuge before the Yukon took a sharp turn to the south, following the Nulato Hills. Further downstream we traveled through the Innoko and Yukon Delta National Wildlife Refuges on our way to St Marys, where we ended the cruise. This point is close to where the Yukon River begins to see tidal influence from the Bering Sea.

Yukon River at Eagle

Figure 2. Yukon River at Eagle, Alaska, June 2002.

Eagle, AK (fig. 2), located just 8 miles from the Canadian border, was the starting point for the stretch of river intensively studied in 2002 (site 1, plate 1, table 1). About 200 people live in the area, which includes Eagle City and Eagle Village, a native Han Athabascan Indian village 3 miles upstream from the center of town. Founded in 1897, Eagle was the first incorporated city in interior Alaska. Possibly the most famous visitor to the town was Roald Amundsen. He arrived there in 1905, after mushing 400 miles with his dog team from Herschel Island, where his ship, the *Gjoa*, was frozen in the Beaufort Sea. His message home from Eagle was that he had successfully navigated the Northwest Passage (Eagle Historical Society, 2006). Dog mushing is as popular as ever these days, and the Yukon Quest Dog Race runs every year between Eagle and Dawson City, Canada.

Eagle is road-accessible only from April to October. Other than the Yukon River itself, the most prominent feature in town is Eagle Bluff, a 1,000-foot peak rising right out of the river. The city was named for the nesting eagles that live on the bluff. Eagle City was placed on the National Register of Historic Places in 1970, and was named a National Landmark in 1975.

There is an active USGS streamflow-gaging station at this site, and the period of record is from 1911 to 1912, and from 1950 to the present (NWIS). The USGS Alaska Science Center Water Resources Office (ASCWRO) sampled the Yukon River at Eagle for discharge and water quality (QW) approximately every 2 weeks during the ice-free season from October 2000 through September 2005 as part of the NASQAN Program.

The drainage area at this site is approximately 113,500 square miles. Major tributaries that flow into the Yukon River above Eagle include the Stewart, Pelly, Teslin, and White Rivers, all of which flow out of mountainous regions in Canada and Alaska. By the time the Yukon River has reached Eagle, its width is approximately 1,500 feet. The discharge hydrograph at Eagle frequently shows two peaks in discharge; one in early June, representing snowmelt, and a smaller one in August, representing glacial or rainfall runoff. The average June peak discharge is about 240,000 ft^3/sec.

Nation River

Figure 3. Nation River enters the Yukon River.

Figure 4. U.S. Geological Survey streamgage on the Nation River.

The Nation River flows into the Yukon River (fig. 3) about 23 river miles downstream from Eagle, AK (site 6, plate 1, table 1). It is located within the Yukon–Charley Rivers National Preserve. About 115 miles of the Yukon River is protected in this 2.5-million acre preserve that straddles the river between Eagle and Circle. This area has the highest nesting density of peregrine falcons in the United States. It also provides a calving ground for the 30,000-strong Fortymile caribou herd. Wolves, moose, and bear are also prevalent in the preserve. Most of the preserve was never glaciated, and therefore, was not covered by glacial debris. The geologic

record in this area is one of the most intact records in the United States, spanning the Precambrian through the Cenozoic Era (National Park Service, 2006).

The Nation River flows out of the Ogilvie Mountains northeast of the Yukon River, in the Yukon Territory of Canada. The watershed area is approximately 930 square miles, and drains an area underlain by discontinuous permafrost. The USGS operated a streamgage (fig. 4) on the Nation River from 1991 to 2003. The average annual discharge between WY 1998-2001 was 870 ft^3/sec, and the maximum discharge recorded was 20,400 ft^3/sec on July 24, 2001 (NWIS).

Kandik River

Figure 5. Kandik River enters The Yukon River.

Figure 6. Measuring discharge on the Kandik River.

The Kandik River flows into the Yukon River (figs. 5 and 6) about 8 miles downstream from the mouth of the Nation River (site 7, plate 1, table 1). Like the Nation River, the Kandik flows out of the Ogilvie Mountains to the northeast, and parts of the basin lie within the Yukon-Charley Rivers National Preserve. The Nation and Kandik Rivers are close geographically, and both exist partially within the preserve. Further, the basin area of the Kandik River is approximately 1,084 square miles, similar to that of the Nation River. However, their basic water chemistry is very different. Where the Nation River drains a carbonate basin, the Kandik River drains a non-carbonate basin. Data suggest that the Nation River has two to three times the

dissolved inorganic carbon (DIC), nitrate (NO_3), and sulfate (SO_4) as the Kandik River. Dissolved organic carbon (DOC) concentrations were roughly twice as high in the Kandik River as the Nation River (this report).

The USGS operated a streamgage on the Kandik River from June 1994 to September 2000. The average annual discharge for WY 1998–1999 was 694 ft^3/sec, and the maximum discharge recorded was 24,500 ft^3/sec on August 14, 2000 (NWIS).

Charley River

Figure 7. Charley River enters the Yukon River.

Figure 8. Charley River, near its mouth.

The Charley River flows into the Yukon River (fig. 7) about 14 miles downstream from the Kandik River (site 8, plate 1, table 1). The entire Charley River basin is enclosed in the Yukon–Charley Rivers National Preserve. While the Yukon River is cloudy with silt, the Charley River (fig. 8) is known for its clarity. The Charley River is considered one of the most scenic in Alaska, and is one of the few rivers listed as a National Wild and Scenic River for its entire length. The Charley River originates in the Yukon–Tanana uplands at an elevation of about 4,000 feet and flows in a northeast direction 106 miles toward the Yukon River. The Charley River drops 31 feet per mile in its upper reaches, making it a challenging Class II-IV whitewater adventure (National Park Service, 2006a). Its pristine characteristics, along with the fact that very little water-quality data exist for this river, made the Charley a prime candidate for sampling on the Yukon Project. The drainage area of the basin is approximately 1,690 square miles, and is underlain by discontinuous permafrost.

Coal Creek

Figure 9. Measuring discharge on Coal Creek.

Figure 10. Coal Creek Dredge.

Coal Creek (fig. 9) enters the Yukon about 12 miles downstream from Charley River (site 9, plate 1, table 1). Its 81 square mile watershed drains the Yukon–Tanana uplands and flows northeast toward the Yukon River. The area is underlain by discontinuous permafrost. This watershed was mined extensively in the early 1900s. Mining began with small placer claims, but grew to a major operation in the mid-1930s. A dredge was constructed in San Francisco, disassembled and crated for transport by steamer to Skagway, moved by rail to Whitehorse, barged down the Yukon River to the Coal Creek mouth, and reconstructed about 6 miles upstream from the confluence of Coal Creek and the Yukon River (fig. 10). Between 1936 and 1957, the dredge unearthed gold worth $3.2 million. Adjusted for inflation, this amounts to about $30 million in 2006 dollars. The last year that the dredge operated was in 1977. The Coal Creek properties were sold to the National Parks and Conservation Association in the early 1980s, who donated the land to the National Park Service (NPS). The NPS incorporated the land into the Yukon-Charley National Preserve, and the Coal Creek Mining Camp is now listed on the National Register of Historic Places. Another structure on the National Register is the two-story Slaven's Roadhouse, the early Alaskan version of the roadside motel. Situated on the bluff next to the mouth of Coal Creek, the roadhouse was built in 1932 (National Park Service, 2006a).

Renovated in 1993 by the NPS to serve as a public use cabin, it was our base of operations for sampling the tributaries in this area.

Woodchopper Creek

Figure 11. Woodchopper Creek enters the Yukon River.

Figure 12. Woodchopper Creek.

Woodchopper Creek (figs. 11 and 12) parallels Coal Creek, entering the Yukon River 7 miles further downstream (site 10, plate 1, table 1). It flows out of the Yukon–Tanana uplands, and has a drainage area of 82 square miles. As with the Coal Creek watershed, the Woodchopper watershed has been heavily impacted by mining, and is underlain by discontinuous permafrost. Coal and Woodchopper Creeks, traveling parallel to each other in adjoining watersheds, draining similar uplands, having similar drainage areas, and both having been heavily mined, provide an interesting side-by-side comparison for hydrologic studies.

Yukon River above Circle

Figure 13. Yukon River above Circle.

Circle, AK, is generally regarded as the start of the Yukon Flats, a lowland region where the Yukon River meanders and braids out to widths of a mile or more. Main-stem sampling and discharge measurements of the Yukon River are difficult in this region because of the extensive braiding. Therefore a site was chosen to sample the main stem about 8 miles upstream from Circle (fig. 13), before the braiding begins (site 2, plate 1, table 1). Sampling the main stem as close as possible to the start and end of the Flats provides more information on hydrologic processes occurring in this region.

The Yukon Flats National Wildlife Refuge (YFNWR) is made up of 8.6 million acres of mostly lake-dotted flood plains, with willow-choked bogs and tufty muskeg. Two million acres in the refuge are owned by Native Alaskan corporations. The Yukon River cuts a crescent arc through the southern end of the refuge; to the north, the refuge is contiguous with the Arctic National Wildlife Refuge. The area is a summer home to one of the largest densities of nesting waterfowl on the continent, including over 2 million ducks and geese that migrate between Alaska and the lower 48 states (U.S. Fish and Wildlife Service, 2006a).

Much of the Yukon River basin is underlain by varying amounts of permafrost. As temperature increases have already been documented over the past several decades, particularly in higher latitudes (Chapman and Walsh, 1993), there is concern over the effects such warming will have on the basin. Warming temperatures deepen the active layer in the soil and extend the growing season. Microbes in the soil may increasingly oxidize the carbon in the active layer. Whether this carbon is released to streams in the form of DOC, or mineralized within the soil, remains a major question. Given the vast amount of wetlands in the Yukon Flats, and the tremendous amounts of carbon stored there, it is a critical area of study.

Sheenjek River

Figure 14. Sheenjek River entering Porcupine River.

Figure 15. Sheenjek River, August 2002.

The Sheenjek River originates in the glaciated Romanzof Mountains, about 277 miles north of the Porcupine River (fig. 14, site 11, plate 1, table 1). It is a pristine, clear river, with low sediment and DOC content. The river drains an area of 5,162 square miles, and flows into the Porcupine River. The Sheenjek (fig. 15) is part of the National Wild and Scenic Rivers System and is protected for 160 miles of its length, making it one of the longest protected rivers in the nation. A 1956 expedition up the Sheenjek by naturalists Olaus and Margaret Murie provided the inspiration and preliminary research that led to the creation of the Arctic National Wildlife Range in 1960. This Range became the Arctic National Wildlife Refuge (ANWR) in 1980 under the Alaska National Interest Lands Conservation Act. Portions of the great Porcupine caribou herd pass from ANWR through the Sheenjek River basin every year on its annual migration (National Park Service, 2006b). While the upper part of the Sheenjek River basin is located within ANWR, the lower basin passes through the Yukon Flats National Wildlife Refuge. The basin is generally underlain by continuous permafrost.

The U.S. Fish and Wildlife Service (USFWS) operated a stream gage on the Sheenjek River (lat 66°54.62' N., long 144°19.91' W.) from 1993 to 1998. The maximum discharge

recorded at this site for the period of record was 22,600 ft^3/sec on July 18, 1997. The average annual maximum discharge was about 10,000 ft^3/sec (NWIS).

Black River

Figure 16. Black River and Porcupine River.

The Black River drainage begins in uplands bordering the Kandik River drainage (site 12, plate 1, table 1). The river flows north and west, dropping into the Yukon Flats and entering the Porcupine River upstream from Fort Yukon. The drainage area is approximately 6,100 square miles. Much of the area is underlain by continuous permafrost. In contrast to the Sheenjek River, the aptly named Black River is dark in color, and rich in DOC (fig. 16).

The USFWS operated a stream gage on the Black River (lat 66°18.20' N., long 142°29.22' W.) from 1993 to 1998. The maximum discharge recorded at this site for the period of record was estimated to be about 15,000 ft^3/sec on June 25, 1994. The average annual maximum discharge was about 7,800 ft^3/sec (NWIS).

Porcupine River 9.5 miles upstream from mouth

Figure 17. Porcupine River 9.5 miles upstream from mouth.

The famous Porcupine caribou herd is named after the Porcupine River, the second largest tributary to the Yukon River. The Porcupine River (fig. 17) is about 500 miles long, draining about 45,000 square miles of the northeast part of the Yukon River basin (site 13, plate 1, table 1). The Porcupine River basin covers 14 percent of the entire Yukon River basin. On average, the Porcupine River contributes close to 10 percent of the flow recorded at Pilot Station (Brabets and others, 2000). Most of the Porcupine River basin is underlain by continuous permafrost.

The NASQAN fixed station-site on the Porcupine River was located about 125 miles upriver from Fort Yukon. The sampling station there has a record from 1964 to 1979. The average annual mean stream flow between WY 1965–1978 was 14,650 ft^3/sec, and the peak flow recorded at this site was 299,000 ft^3/sec in May 1973 (NWIS).

Sampling the Porcupine River 9.5 miles upstream from the mouth provided a comparison with the fixed-station site, reflecting the contributions of tributaries such as the Sheenjek and Black Rivers.

Christian River

Figure 18. Christian River.

The Christian River (fig. 18) enters the Chandalar River before flowing into the Yukon River (site 14, plate 1, table 1). It drains 3,408 square miles of territory that begins in the foothills of the Brooks Range before entering the Yukon Flats. The upland areas are generally underlain by continuous permafrost, while the Flats area is underlain by discontinuous permafrost. The Christian River is dark and DOC-rich, similar to the Black River.

Chandalar River

Figure 19. Chandalar River.

At the mouth of the Chandalar River (fig. 19), the Yukon River reaches its northernmost point, on the Arctic Circle. The Chandalar River drains the Brooks Range, entering the Yukon River from the north (site 15, plate 1, table 1). The Chandalar and Christian Rivers both drain from the north; however, the Chandalar River basin is much larger, covering approximately

9,861 square miles. This area constitutes 4.3 percent of the entire Yukon River basin. The beautiful green color of the Chandalar River during low flow is unlike that of any other major tributary flowing into the Yukon. The basin is generally underlain by continuous permafrost.

There have been some human impacts on the basin. Gold was discovered in the upper part of the basin in 1907. Placer production through 1959 totaled 30,708 ounces. In addition, a DC-4 cargo plane taking off from the village of Venetie crashed onto a gravel bar on the Chandalar River in 1997. While most of the fuel was off-loaded from the plane, the wreck was slowly leaking hydraulic fluid. In late 2002, Alaska Governor Tony Knowles dedicated start-up funds to begin removal of the airplane (National Native News, 2006).

USGS streamflow-gaging records are available for the Chandalar River from 1963 to 1973. The average discharge for the Chandalar River is 7,400 ft^3/sec, which is about 3.2 percent of the flow at Pilot Station (Brabets and others, 2000). The peak discharge recorded for the period of record was 62,800 ft^3/sec on June 9, 1968. Some early water-quality data for the Chandalar River exists for the years 1966 to 1973 (NWIS).

Upper and Lower Birch Creek

Figure 20. Birch Creek, upstream from Upper and Lower Birch Creek.

Figure 21. Upper Birch Creek mouth.

Birch Creek has its headwaters in the Yukon-Tanana Uplands of the Steese National Conservation Area. The first 113 miles of Birch Creek is a National Wild River. The river flows

east and north toward Circle City, and then its course meanders north and west as it parallels the Yukon River (fig. 20). Above the village of Birch Creek, Birch Creek splits into two creeks, Upper Birch Creek and Lower Birch Creek. After traveling about 350 miles, both creeks enter the Yukon Flats from the south, with Upper Birch Creek (fig. 21, site 16, plate 1, table 1) entering the Yukon River about 23 miles upstream from Lower Birch Creek (site 17, plate 1, table 1). Both Upper and Lower Birch Creek were sampled during this intensive study. The drainage area of Upper Birch Creek (including the headwaters) is approximately 4,200 square miles. Most of this basin is underlain by discontinuous permafrost.

Gold was discovered on Birch Creek in 1893. Since then, Birch Creek has been subject to substantial impact from mining activities. The creek has been on the Alaska state impaired water-body list for turbidity. In 1995, over a mile of Birch Creek at one abandoned placer mine site near its headwaters underwent a BLM reclamation project. The BLM recreated meander bends, and planted willow and grass mix to cut down on the sediment load of the creek (Bureau of Land Management, 2006).

The USFWS operated a stream gage on Birch Creek (above the Upper and Lower Birch Creeks fork), (lat 66°05.98' N., long 144°44.85' W.) from 1993 to 1998. The maximum discharge recorded at this site for the period of record was 9,710 ft^3/sec on June 29, 1995. The average annual maximum discharge was approximately 4,500 ft^3/sec (NWIS).

The USGS has limited water-quality data for Birch Creek at Twelvemile House near Circle (lat 65°42'40" N., long 144°20'00" W.) for the years 1949 to1957 (NWIS).

Beaver Creek

Figure 22. Beaver Creek, September 2002.

Beaver Creek (fig. 22) is a National Wild and Scenic River. It flows out of the White Mountains north of Fairbanks, heading north and west, down into the Yukon Flats where it joins the Yukon River (site 18, plate 1, table 1). The river is of interest in this project because it drains both mountain and wetland terrain. The watershed has an area of approximately 2,095 square miles, and is underlain by discontinuous permafrost. Some mining occurs in this drainage basin.

Beaver Creek was not sampled in June 2002, due to some difficulty in locating the position of its mouth within the braided Yukon Flats. It was, however, sampled on the August 2002 trip.

The USFWS operated a stream gage on lower Beaver Creek (lat 66°15.44' N., long 146° 30.88' W.) from 1994 to1998. The maximum discharge recorded at this site for the period of record was 12,000 ft^3/sec on September 4, 1995. The average annual peak discharge was about 5,400 ft^3/sec. USFWS also operated a second gage upstream on Beaver Creek (lat 66°03.28' N., long 146°08.61' W.) for the same period (NWIS).

Hadweenzic River

Figure 23. Hadweenzic River entering Yukon River.

Figure 24. Hadweenzic River, September 2002.

The Hadweenzic River flows into the Yukon River (figs. 23 and 24) from the northwest (site 19, plate 1, table 1). The watershed area is approximately 935 square miles, most of which is located within the Yukon Flats National Wildlife Refuge. As most of the basin drains wetlands, this provided a compelling reason to choose this river for study. The watershed is underlain by discontinuous permafrost.

The USFWS maintained a gaging station on the Hadweenzic River (lat 66°39.80' N., long 146°57.30' W.) between July 1993 and September 1998. The maximum discharge recorded at this site during the period of record was 3,690 ft^3/sec on August 30, 1998. The average annual peak discharge was approximately 1,500 ft^3/sec (NWIS).

Due to time constraints in June 2002, the Hadweenzic River was only sampled in September, 2002.

Hodzana River

Figure 25. Hodzana River entering Yukon River.

Figure 26. Hodzana River, September 2002.

The Hodzana River flows out of the Kokrine-Hodzana Highlands into the Yukon River (figs. 25 and 26) from the northwest (site 20, plate 1, table 1). The drainage area is approximately 1,669 square miles, and is underlain by discontinuous permafrost.

The USFWS maintained a gaging station on the Hodzana River (lat 66°38.71' N., long 148°15.58' W.) from July 1993 to September 1998. The maximum discharge recorded at this site during the period of record was 13,600 ft^3/sec on May 27, 1998. The average annual peak discharge was approximately 6,500 ft^3/sec (NWIS).

Yukon River at Joe Devlin Island

Figure 27. Yukon River at Joe Devlin Island, September 2002.

The Yukon River just below Joe Devlin Island (fig. 27, site 3, plate 1, table 1) is a rare stretch of river within the Yukon Flats. It is one of the few locations between Circle and Stevens Village where the numerous braids of the river come together into a single channel. Given the importance of the Yukon Flats, and its contribution to the biogeochemical budgets of the entire Yukon River basin, a water sample was collected at this location on the August, 2002 trip.

Yukon River at Timber Point

Figure 28. Yukon River at Timber Point, September 2002.

The Yukon River at Timber Point (fig. 28) also narrows from a wide set of channels and sloughs to a single narrow channel (site 4, plate 1, table 1). This site is the last place within the Yukon Flats where accurate discharge measurements can be made. This site, along with the Yukon River above Circle site, provides the endpoints for studying the chemistry changes that occur within the Yukon Flats. This site was sampled in both June and August 2002.

Dall River

Figure 29. Dall River (below) entering Yukon River.

Figure 30. Dall River, September 2002.

The Dall River (figs. 29 and 30) is a slow-moving, black-water river that flows into the Yukon River from the northwest (site 21, plate 1, table 1). It drains an area of approximately 1,434 square miles.

Yukon River near Stevens Village

Figure 31. Yukon River near Stevens Village (at the Dalton Highway Bridge).

Figure 32. USGS field crew at the Dalton Highway Bridge take-out, September 2002.

Located just upstream from the Dalton Highway Bridge, the Yukon River near Stevens Village (figs. 31 and 32) marks the downstream end of the 2002 Yukon River intensive studies (site 5, plate 1, table 1). This is one of only three locations along the Yukon River in Alaska that is accessible by road (Eagle and Circle being the other two). The width of the Yukon River has grown by this point to about 2,200 feet. The drainage area of the basin above this site is approximately 196,300 square miles. There is a streamflow-gaging station at this site, and the period of record is from 1976 through 2005 (NWIS). The USGS Water Resources Office in Fairbanks sampled the Yukon River near Stevens Village for discharge and water quality approximately every 2 weeks during the ice-free season since October 2000 as part of the USGS NASQAN program. The peak discharge for this site was 827,000 ft^3/sec on June 11, 1992, while the average peak flow at this site is about 480,000 ft^3/sec (NWIS).

Ray River

Figure 33. Ray River.

The Ray River (fig. 33) enters the Yukon River 3 miles downstream from the Dalton Highway Bridge, and was the first tributary sampled during the 2003 intensive studies (site 36, plate 1, table 2). It originates on the north side of the Ray Mountains, then flows east before turning south, paralleling the Dalton Highway on its way to the Yukon River. There are hot springs in the headwaters of the Ray River. It is the smallest river sampled in 2003, with a watershed area of 676 square miles. The basin is generally underlain by discontinuous permafrost. In June 2003, snow was still visible in the hills to the north. Erosion was active along the shoreline, as clumps of earth could be heard slumping into the river every few seconds.

Hess Creek

Figure 34. Hess Creek.

Hess Creek (fig. 34) flows into the Yukon River 34 miles below Ray River (site 37, plate 1, table 2). It originates in the hills just south of the Yukon Flats National Wildlife Refuge, and just west of the White Mountains National Recreation Area. From its headwaters it meanders eastward, crossing the Dalton Highway on its way to the Yukon River. It is a slow-moving, brown-water creek, high in DOC, emptying a watershed area of 1,190 square miles. The basin is generally underlain by discontinuous permafrost. Mike Hess (after whom the creek is named) found gold in the basin as early as 1892, but most of the mining activity took place in nearby Livengood Creek (Deed Alaska, 2006).

The USGS has streamflow records for Hess Creek near Livengood (USGS Site Number 15457800) from 1970 to 1986, and there is QW data from 1970 to 1978. The maximum discharge recorded at this site during the period of record was 10,000 ft^3/sec on May 13, 1975. The average annual peak discharge was approximately 5,300 ft^3/sec (NWIS).

Tozitna River

Figure 35. Tozitna River.

The Tozitna River (fig. 35) enters the Yukon River 120 miles downstream from Hess Creek (site 38, plate 1, table 2). It begins on the southern edge of the Ray Mountains and flows south into the Yukon River. The watershed area is 1,630 square miles. The basin is underlain by moderately thick to thin permafrost. It is a brown-water river, and as with Ray River, there was considerable shoreline erosion occurring during the June 2003 sampling.

Nowitna River

Figure 36. Nowitna River.

The Nowitna River (fig. 36) empties into the Yukon River 77 miles downstream from the Tozitna River (site 39, plate 1, table 2). Of its 283 mile length, 223 miles of the Nowitna River has been designated a National Wild and Scenic River. The river originates on the northwest slopes of the Kuskokwim Mountains, and its zigzagging path winds northeast toward the Yukon River. The route passes through a 15-mile canyon, where peaks of 2,100 feet border the river, and the lower portion flows through one of the most productive waterfowl nesting areas in Alaska. The meandering lower section of the river, passing through wetlands and bogs, is subject to spring flooding behind ice dams. These dams can back the river up over 100 miles, as in 1989, when a giant lake was created hundreds of square miles in area. The Nowitna River watershed is large, covering 7,180 square miles, and the basin is underlain by moderately thick to thin permafrost.

The Nowitna River bisects the 2.1-million acre Nowitna National Wildlife Refuge. The refuge was established to protect trumpeter swans, white-fronted geese, canvasback ducks, and other birds, as well as moose, caribou, martens, wolverines, otters, salmon, sheefish, and northern pike (U.S. Fish and Wildlife Service, 2006b). In all, over 125 bird species are supported by the refuge. Along the Yukon River, upstream from the Nowitna River mouth, bluffs called the Palisades (also known as the Boneyard) are a rich storehouse of Pleistocene fossils (Matheus et al. 2003).

Melozitna River

Figure 37. USGS hydrologist measures discharge on the Melozitna River.

The Melozitna River (fig. 37) empties into the Yukon River 46 miles below the Tozitna River, and drains a watershed of 2,720 square miles (site 40, plate 1, table 2). The basin is underlain by moderately thick to thin permafrost. The headwaters of the Melozitna River begin near the southern border of the Kanuti National Wildlife Refuge. The river then flows south and west through numerous wetlands before running along the northwest edge of the Kokrines Hills. Just before entering the Yukon, the river cuts through Melozitna Canyon, flanked by hills reaching 2,000 feet in elevation. At its mouth, the river is shallow and fast moving. Hot springs can be found on two tributaries of the Melozitna, the Little Melozitna River and Hot Springs Creek.

The USGS has streamflow records for the Melozitna River from 1961 to 1973, and water-quality data from 1956 to 1972. The peak discharge recorded was 28,200 ft^3/sec on September 3, 1962, and the average annual discharge is about 2,000 ft^3/sec (NWIS).

Yukon River at Ruby

Figure 38. Yukon River near Ruby.

Just across the Yukon River from the mouth of the Melozitna River lies the town of Ruby. Most of its residents are Koyukon Athabascans of the Nowitna-Koyukuk band. Ruby, named for the red-colored stones found on the riverbank, was once a supply depot for 1,000 miners that lived in the area. By the end of World War II, most of the mines had shut down. The current population is approximately 200 (State of Alaska, 2006).

The Yukon River at Ruby (fig. 38) was the first of two main stem-sampling stations in 2003 (site 34, plate 1, table 2). It was chosen because the USGS has a daily streamflow record from 1956 to 1978, as well as water-quality data from 1957 to 1978. The peak discharge recorded at this site was 970,000 ft^3/sec on June 20, 1964, while the average annual streamflow is approximately 168,000 ft^3/sec. The watershed area at this site is 259,000 square miles.

Yuki River

Figure 39. Yuki River.

The mouth of the Yuki River (fig. 39) is 24 miles downriver from the Melozitna River (site 41, plate 1, table 2). It begins in the Kaiyuh Mountains, flowing east, then north in a sinuous path to the Yukon River. The watershed area is 1,070 square miles, and the basin is underlain by moderately thick to thin permafrost.

Koyukuk River

Figure 40. Koyukuk River.

The Koyukuk River (fig. 40) is the largest tributary sampled on the 2003 cruises, and the third largest watershed in the Yukon River basin, with an area of 31,400 square miles. The basin is underlain by moderately thick to thin permafrost.

The river enters the Yukon from the north near the village of Koyukuk, about 70 miles downstream from the Yuki River (site 42, plate 1, table 2). The river's origins are located far to the north, in the Endicott Mountains of Gates of the Arctic National Park, and in the Philip Smith Mountains near the Arctic National Wildlife Refuge. The North Fork Koyukuk River, within Gates of the Arctic, is designated a National Wild and Scenic River.

On its journey the Koyukuk River drains the Kanuti National Wildlife Refuge, before passing through the 3.5-million acre Koyukuk National Wildlife Refuge. Fourteen rivers, hundreds of streams, and over 15,000 lakes dot the refuge. Some 400,000 birds summer here. Included in the refuge is the 400,000-acre Koyukuk Wilderness, which has some of the most productive moose habitat in Alaska. The moose population in the refuge exceeds 11,000, and some areas contain up to five moose per square mile. Caribou from the 450,000-strong Western Arctic Herd often over winter in the refuge. In addition, bison have been transplanted into the

area along the south fork of the Koyukuk River. In 1965 and 1968, about 40 bison were released. Since that time, the herd has increased to about 300. An unusual feature of the refuge is the 10,000-acre Nogahabara Sand Dunes, one of only two sand dune fields in Alaska. This field was created over 10,000 years ago, when sands left by melting glaciers were blown into large dunes (U.S. Fish and Wildlife Service, 2006c).

The USGS has streamflow records for the Koyukuk River at Hughes (USGS Site Number 15564900, above the Koyukuk National Wildlife Refuge) from 1960 to 1982, and water quality data from 1955 to 1978. The maximum discharge recorded at this site during the period of record was 330,000 ft^3/sec on August 31, 1994. The average annual peak discharge was approximately 175,000 ft^3/sec (NWIS).

Nulato River

Figure 41. Nulato River.

The Nulato River (fig. 41) is located about 30 miles downstream from the mouth of the Koyukuk River (site 43, plate 1, table 2). It drains a watershed with an area of 883 square miles, making it one of the smallest tributaries studied in 2003. The basin is underlain by moderately thick to thin permafrost.

The river originates in the Nulato Hills, and flows north and east before emptying into the Yukon River near the village of Nulato. A trading post was established in the village in 1839 by the Russian explorer Malakov. It was a center of missionary activity, and many of the local

Koyukon Athabascans moved to the village after the "Our Lady of Snows" mission was completed in 1887 (Alaska Wilderness Recreation & Tourism Association, 2006).

Yukon River near Kaltag

Figure 42. Yukon River near Kaltag.

The Yukon River near Kaltag (fig. 42) was the second of two main-stem sites that were sampled during the 2003 research cruises (site 35, plate 1, table 2). The site was chosen because the USGS has discharge records here from 1956 to 1966, and some water quality records from 1956 to 1962. The peak discharge recorded here was 1,030,000 ft^3/sec on June 22, 1964, and the average annual discharge for the period of record is about 221,000 ft^3/sec (NWIS). The approximate watershed area at this point on the Yukon River is 296,000 square miles.

Anvik River

Figure 43. Anvik River.

The mouth of the Anvik River (fig. 43) is about 158 miles below Kaltag (site 44, plate 1, table 2). The river begins in the Nulato Hills, and runs south before turning east to enter the Yukon River near the village of Anvik. The Anvik River drains an area of 1,780 square miles, and the basin is underlain by moderately thick to thin permafrost. Prospecting in the headwaters of the Anvik River occurred as early as 1900, with evidence of gold and platinum being found. But apparently the quantities were insufficient, and there are no references to mining here after 1919 (Dashevsky, 2002).

The USGS operated a streamflow gage near here (USGS Site Number 15565400), and the period of record is from July 2001 through September 2004. The peak discharge recorded was 20,700 ft^3/sec on May 25, 2002, while the average annual discharge for WY 2002-2003 was approximately 1,700 ft^3/sec (NWIS).

Bonasila River

Figure 44. Bonasila River.

The Bonasila River (fig. 44) enters the Yukon River 13 miles below the Anvik River (site 45, plate 1, table 2). The Bonasila parallels the Anvik, originating in the Nulato Hills, flowing south, then east to the Yukon River. It drains an area of 1,160 square miles, and the basin is underlain by moderately thick to thin permafrost.

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Innoko River

Figure 45. Innoko River.

The Innoko River (fig. 45) enters the Yukon River about 33 miles below the Bonasila River (site 46, plate 1, table 2). The Innoko River drains an area of 14,100 square miles, making it the second largest tributary sampled in 2003. The basin is underlain by moderately thick to thin permafrost. The watershed encompasses a vast area of wetlands and bogs, located within the 3.85-million acre Innoko National Wildlife Refuge. The refuge is home to over 300,000 waterfowl each summer, and the Beaver Mountain caribou herd winters here. In some years, 40 percent of all beaver trapped in Alaska come from the Innoko refuge. Over a million acres of the refuge is designated wilderness (U.S. Fish and Wildlife Service, 2006d).

Atchuelinguk River

Figure 46. Atchuelinguk River.

The Atchuelinguk River (fig. 46) enters the Yukon River 188 miles below the Innoko River (site 47, plate 1, table 2). As with the Anvik and Bonasila Rivers, the Atchuelinguk River originates in the Nulato Hills, flowing south on its way to the Yukon River. It drains an area of 2,100 square miles, and the basin is underlain by moderately thick to thin permafrost.

Yukon River at Pilot Station

Figure 47. Yukon River at Pilot Station.

The Yukon River at Pilot Station (fig. 47) is a fixed-station sampling site for the USGS NASQAN Program (site 59, plate 1, table 2). This is the last point on the river before the Yukon Delta where discharge can be measured accurately and is not influenced by tidal flow. The USGS ASCWRO in Anchorage has been sampling here for water quality and discharge approximately every 2 weeks during the ice-free season since 2001. Historical discharge records date back to 1975. The peak discharge for the period of record was approximately 1,200,000 ft^3/sec, in May 2005. Water quality sampling at this site dates back to 1954 (NWIS). The watershed area at Pilot Station is 321,000 square miles.

Andreafsky River

Figure 48. Andreafsky River.

The Andreafsky River (fig. 48) enters the Yukon River 27 miles below Pilot Station (site 48, plate 1, table 2). The Andreafsky River, along with the East Fork Andreafsky River, drain an area of 2,100 square miles. In 1980, 124 miles of the Andreafsky River and 137 miles of the East Fork were designated as National Wild and Scenic River areas. These stretches of wild river lie within the 1.3-million acre Andreafsky Wilderness (National Park Service, 2006c). The basin is underlain by moderately thick to thin permafrost.

Sites for Main-Stem Grab Samples

In addition to the main-stem stations where discharge and a full set of chemistry samples were collected using EDI (Equal Discharge Increment, see Chapter 4. Methods), there were 21 stations where centroid surface grabs for carbon gases, dissolved organic carbon (DOC) and ultraviolet (UV) absorbance, and major cations and anions were collected (plate 1, tables 1 and 2). These sites were chosen below where various tributaries entered the Yukon River. These samples are used to help interpret the influence of the tributaries on the water quality of the main stem.

Chapter 3. Yukon River Hydrology, 2002 and 2003

In 2002, our goal was to run our first research cruise down river as close to the peak flow as possible. It is during the period of peak flow that a large proportion of the annual loads of various constituents occurs. Therefore, sampling close to peak flow aids in the accurate calculation of annual loads. The 53-year annual mean for discharge at Eagle (fig. 49) illustrates that peak flow typically occurs around June 15 (although over the last 20 years, the peak has occurred anywhere between May 16 and June 28). NRP sampling at Eagle was on June 11, only 2 days off from the peak flow. The peak flow on June 13 was 224,000 ft^3/sec, slightly less than the 53-year annual mean. On the day we took water-quality samples, the discharge was 185,000 ft^3/sec.

In many years there is a smaller secondary peak in the hydrograph in late July-early August, due to glacial melting or rainfall in the upper headwaters and tributaries of the Yukon River (as it is frequently much smaller than the primary peak, it does not show up on the 53-year annual mean). Our goal for the second cruise was to begin as late in the season as possible, to collect water samples on the receding hydrograph. Winter weather can arrive in Alaska very early in the fall; therefore, timing of the cruise also had to take into account safety considerations. The NRP crew departed Eagle in a cold rain on August 23, when the discharge on the Yukon River was 201,000 ft^3/sec, and rising. Five days later, on August 28, the flow finally peaked at 226,000 ft^3/sec, greater than the primary peak in June. Thus, our second cruise water-quality samples represent the combination of rainfall and glacial melting.

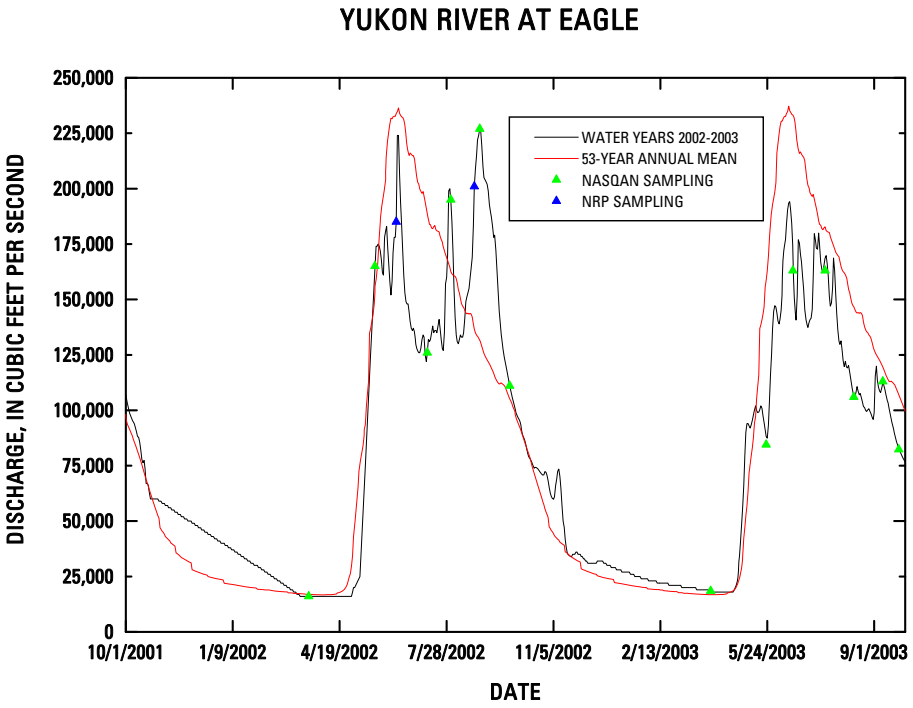

Figure 49. Hydrograph for Yukon River at Eagle, Alaska. Sampling dates indicate both NRP synoptic sampling and the periodic fixed station NASQAN sampling carried out by the USGS Alaska Science Center Water Resources Office in Fairbanks.

Fig. 49 also indicates the dates of the fixed-station sampling conducted by the USGS ASCWRO for the NASQAN Program. Their dataset provides extremely valuable information that greatly aids in the interpretation of the synoptic river data, and allows for the calculation of loads being carried by the river on an annual and seasonal basis.

Fig. 50 shows the hydrograph for the Porcupine River near Fort Yukon. This fixed-station site is located approximately 124 miles upriver from its mouth. The discharge data for the WY 2002 indicate a lag time for the peak flow behind the 16-year annual mean. In 2002, the primary peak occurred on June 24, with a discharge of 60,556 ft^3/sec. This peak was 23 days behind the 16-year annual mean peak discharge of 94,620 ft^3/sec on June 1. On June 26, during NASQAN sampling, the discharge was 48,900 ft^3/sec, relatively close to the peak discharge on June 24.

The secondary peak in 2002 was much higher than the 16-year mean, again due to the unusual rainfall in the basin in middle to late August. Peak flow was 63,580 ft^3/sec, occurring on August 21, 2002. This compares to the mean peak flow of 35,870 ft^3/sec,

occurring on August 18. The NRP sampled the Porcupine (9.5 miles upriver from its mouth), Black, and Sheenjek Rivers on August 28, 2002, when the discharge was 31,678 ft^3/sec, already much lower than the secondary peak flow (124 miles up from the mouth) one week earlier. It was still, however, higher than the 16-year mean, and reflects the rain input into the basin.

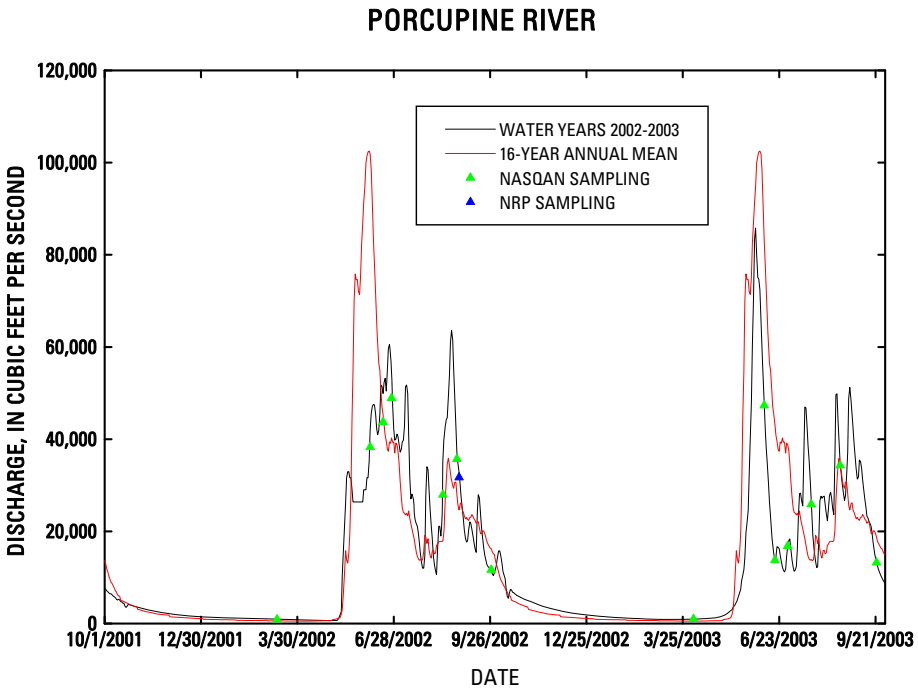

Figure 50. Hydrograph for Porcupine River near Fort Yukon, Alaska. Sampling dates indicate both NRP synoptic sampling and the periodic fixed station NASQAN sampling carried out by the USGS Alaska Science Center Water Resources Office in Fairbanks.

Water-quality sampling and discharge measurements are time consuming, as are the logistics of transporting a crew and supplies down the Yukon River with very little road access or land-based support. While it would have been desirable, it was impossible to run the river at a speed required to follow the hydrograph peak on its path from Eagle to Stevens Village, given our intensive sampling strategy. By the time our boat crew reached the Dalton Highway Bridge near Stevens Village on June 24, 2002, peak flow had long passed at this point on the river. The 2002 peak occurred on May 26, with a discharge of 461,000 ft^3/sec (fig. 51). On June 24, the flow was 223,000 ft^3/sec, over 50 percent lower than the May 26 peak. Our colleagues at the USGS ASCWRO in

Fairbanks sampled there on June 4 as part of their bi-weekly NASQAN summer sampling schedule. Given that the 26-year annual mean peak flow occurs on June 10, this sampling would historically have been quite close to the peak flow. However, even on June 4, the discharge was 249,000 ft^3/sec, just over half the peak flow recorded on May 26. NRP water-quality samples for June were thus taken on the falling limb of the hydrograph.

As with the other sites, a secondary peak in discharge due to rain events is evident in late August 2002. On August 28, the flow was 289,000 ft^3/sec. The USGS ASCWRO crew sampled on either side of this date, on August 23 (when the flow was 264,000 ft^3/sec) and on September 4 (when the flow was 255,000 ft^3/sec). September 4 was also when the NRP river crew arrived at the bridge.

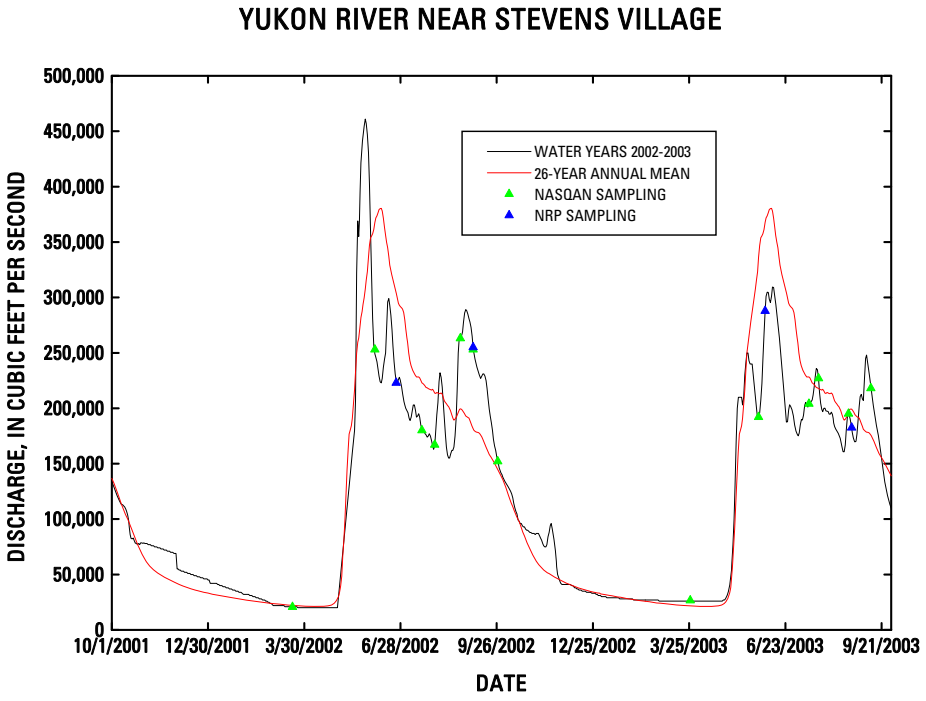

Figure 51. Hydrograph for Yukon River near Stevens Village, Alaska. Sampling dates indicate both NRP synoptic sampling and the periodic fixed station NASQAN sampling carried out by the USGS Alaska Science Center Water Resources Office in Fairbanks.

The second cruise water-quality sampling did not coincide with low-flow conditions due to heavy rainfall. Water quality that reflects rain events may be different

than the water quality due to early season snowmelt, and therefore may improve understanding of the processes that influence biogeochemical fluxes in the Yukon River basin. Furthermore, while we may have missed the low-flow chemistry on the tributaries, the USGS ASCWRO in Fairbanks had sampled the main stem of the Yukon River at Eagle and Stevens Village in late September, as well as under ice in March. These sampling times capture the base conditions in the main stem, yielding data that aid in the calculation of carbon, nutrient, and metal fluxes through the Yukon River basin.

In 2003, we began our research cruises at the Yukon River near Stevens Village (at the Dalton Highway Bridge). The June cruise started on June 4, 2003. It was a fortuitous beginning, as the NRP sampling occurred on the rising limb of the hydrograph, just one week before the peak on June 11 (fig. 51). The flow on June 4 was 287,700 ft^3/sec, relatively close to the peak of 309,300 ft^3/sec recorded on June 11. This peak was much smaller than the peak in 2002, and substantially below the 26-year mean value, illustrating the large interannual variation in discharge.

The second research cruise of 2003 began at the bridge on August 24, when the discharge was 182,500 ft^3/sec. As with 2002, there was a secondary peak in the hydrograph, although it was not quite as large as that in 2002. The secondary peak occurred on September 7, with a discharge of 248,000 ft^3/sec, well above the 26-year mean.

Our 2003 cruises ended at the town of St. Marys, about 870 river miles below the Dalton Highway Bridge. St. Marys is located about 25 miles downstream from Pilot Station, the last NASQAN fixed station on the Yukon River. On the first cruise, we passed through Pilot Station on June 13 (see fig. 52). The discharge on this date was 506,000 ft^3/sec, close to the peak flow of 541,000 ft^3/sec recorded on June 19. The peak was below the 24-year mean value, quite the opposite from 2002, when the peak flow reached 884,000 ft^3/sec. This again illustrates the large interannual variation in discharge that we have seen on the Yukon River.

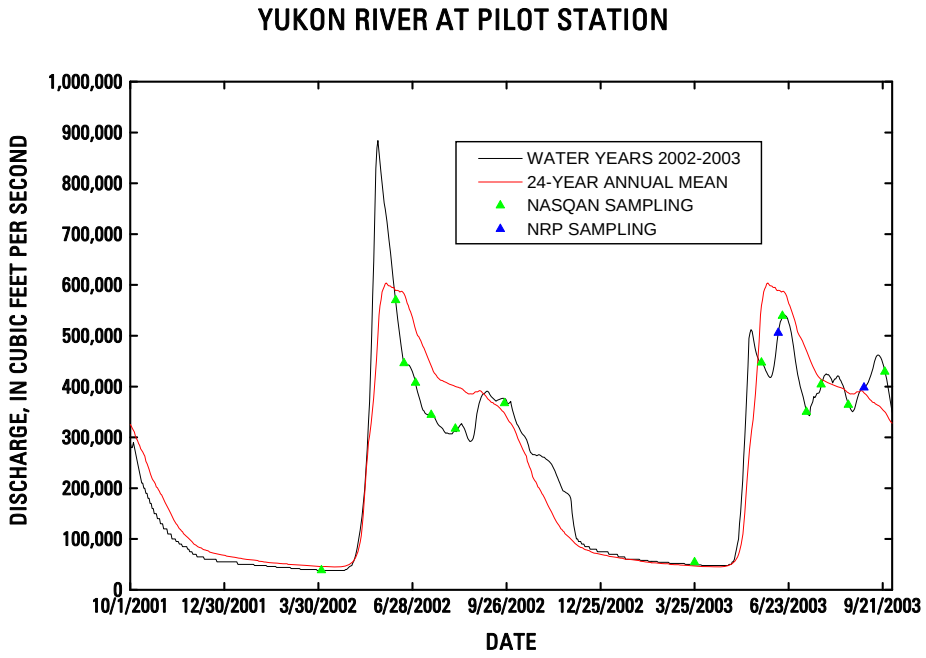

Figure 52. Hydrograph for Yukon River at Pilot Station, Alaska. Sampling dates indicate both NRP synoptic sampling and the periodic fixed station NASQAN sampling carried out by the USGS Alaska Science Center Water Resources Office in Anchorage.

The second 2003 cruise reached Pilot Station on September 3, when the discharge was 398,000 ft^3/sec. A late secondary peak occurred on September 17, with a discharge of 462,000 ft^3/sec.

Chapter 4. Methods

Sample Collection and Processing

For a detailed description of sample collection and processing, see Schuster (2003). Standard USGS protocols, described by Edwards and Glysson (1988), were used for the collection of EDI samples at all major sites. A minimum of two-person field teams collected samples to reduce the opportunity for contamination of low-concentration analytes, following the protocols of Horowitz and others (1991). Samples were processed according to established USGS protocols (USGS, 1997–99). In addition to the main-stem stations chosen for full sampling, 21 main-stem stations were chosen for quick centroid surface grabs. These sites were located below the confluence of tributaries with the Yukon River. Grabs were taken for major ions, DOC and ultraviolet (UV) absorbance, and carbon gases.

Laboratory Analyses

For a complete description of laboratory analyses, see Schuster (2003). Dissolved organic carbon (DOC) concentration, UV absorbance, specific UV absorbance (SUVA), DOC fractionation, carbon gases, dissolved trace elements, major anions and cations, laboratory alkalinity, NO_2, NH_4, PO_4, and sediment mineralogy were analyzed at the USGS laboratories in Boulder, Colo. Percent organic matter (OM) was analyzed at the Huffman Laboratories in Golden, Colo. Particulate carbon (PC) and particulate nitrogen (PN) were analyzed at the Chesapeake Bay Laboratories in Maryland. Mercury, both dissolved and particulate, were analyzed at the USGS Wisconsin Water Science Center Mercury Laboratory in Madison, Wis. Dissolved and colloidal trace elements from centroid grab samples were analyzed at the University of Southern Mississippi in Hattiesbury, Miss. The Cascades Volcano Observatory in Vancouver, Wash., analyzed total suspended sediment concentrations and the percent fines. Total suspended sediment concentrations, as well as suspended sediment chemistry, were analyzed at the USGS laboratories in Atlanta, Ga. Tritium was analyzed at the USGS laboratories in Menlo Park, Calif. Deuterium and ^{18}O, as well as uranium isotopes, were analyzed at the USGS

laboratories in Reston, Va. ^{13}C-DIC was analyzed at Florida State University in Tallahassee, Fla. Chlorophyll-*a*, total dissolved nitrogen (TDN), total dissolved phosphorus (TDP), soluble reactive phosphorus (SRP), and particulate phosphorus (PP) were analyzed at the University of Minnesota in Minneapolis, Minn.

Chapter 5. Water and Sediment Quality and Water Discharge

Water Discharge and Field Water Quality

Discharge was measured using an Acoustic Doppler Current Profiler (ADCP) (Oberg and others, 2005). In streams too small to use the ADCP, a wading discharge was done (Rantz and others, 1982). Water temperature, pH, oxygen, and specific conductivity were measured using a calibrated Hydrolab Minisonde water-quality multi-probe. Field alkalinity was determined by incremental titration (USGS, 1997–99). Field measurement results for year 2002 are given in table 3, and results for year 2003 are given in table 4.

Table 3. Field measurements, year 2002

[Site name, refer to Table 1 and Plate 1 for location; ft^3/s, cubic feet per second; temp, temperature; °C, degrees Celsius; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter; --, not available]

Site	Date	Discharge (ft^3/s)	Water Temp (°C)	pH (Standard Units)	Oxygen (mg/L)	Specific Conductivity (µS/cm)	Alkalinity (mg/L as $CaCO_3$)
Trip 1							
Yukon River at Eagle	6/11/2002	183,000	13.0	8.10	9.6	182	62
Nation River	6/13/2002	2,670	11.9	7.96	9.9	116	81
Kandik River	6/15/2002	2,330	10.4	7.41	11.1	111	38
Coal Creek	6/15/2002	45	11.0	7.50	10.4	377	--
Charley River	6/16/2002	2,020	11.2	7.51	10.8	79	29
Woodchopper Creek	6/16/2002	19	8.9	7.16	10.4	445	--
Yukon River above Circle	6/17/2002	191,600	13.7	8.18	10.1	191	67
Sheenjek River	6/20/2002	9,030	10.0	8.00	11.2	207	79
Black River	6/20/2002	6,180	13.3	7.68	9.5	134	54
Upper Mouth Birch Creek	6/21/2002	883	14.4	7.53	9.2	114	34
Chandalar River	6/22/2002	10,700	9.9	7.89	11.3	250	97
Christian River	6/22/2002	580	12.1	7.58	9.1	94	48
Lower Mouth Birch Creek	6/23/2002	1,670	14.1	7.85	11.5	126	--
Yukon River at Timber Point	6/24/2002	225,900	13.4	8.20	11.3	191	65
Hodzana River	6/24/2002	918	12.0	7.75	9.9	116	42
Yukon River near Stevens Village	6/24/2002	223,000	13.1	8.10	12.6	195	66

Table 3. Field measurements, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; ft^3/s, cubic feet per second; °C, degrees Celsius; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter; --, not available]

Site	Date	Discharge (ft^3/s)	Water Temp (°C)	pH (Standard Units)	Oxygen (mg/L)	Specific Conductivity (µS/cm)	Alkalinity (mg/L as $CaCO_3$)
Trip 2							
Yukon River at Eagle	8/22/2002	182,000	10.0	8.13	12.0	212	--
Yukon River below Tatonduk River	8/23/2002	--	9.6	--	--	--	--
Nation River	8/23/2002	4,220	5.0	8.00	13.4	327	115
Yukon River below Nation River	8/23/2002	--	9.6	--	--	--	--
Kandik River	8/24/2002	3,220	5.6	7.30	11.1	88	44
Yukon River below Kandik River	8/23/2002	--	9.6	--	--	--	--
Charley River	8/24/2002	4,964	7.8	7.41	11.2	53	29
Yukon River below Charley River	8/23/2002	--	9.6	--	--	--	--
Coal Creek	8/25/2002	169	4.2	7.45	12.5	250	49
Yukon River below Coal Creek	8/25/2002	--	9.6	--	--	--	--
Woodchopper Creek	8/24/2002	143	5.3	7.40	11.5	159	47
Yukon River below Woodchopper Creek	8/25/2002	--	9.6	--	--	--	--
Yukon River above Circle	8/26/2002	223,171	11.0	7.79	11.7	193	67
Yukon River above Twentytwo Mile Village	8/27/2002	--	10.2	--	--	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	10.4	--	--	--	--
Yukon River above Twelvemile Island	8/27/2002	--	10.6	--	--	--	--
Sheenjek River	8/28/2002	1,437	10.2	7.83	10.2	291	123
Black River	8/28/2002	7,388	10.1	7.57	10.4	151	59
Porcupine River 9.5 Miles upstream from mouth	8/28/2002	38,183	9.9	7.66	10.4	187	65
Chandalar River	8/30/2002	4,006	9.2	7.99	10.5	362	119
Christian River	8/30/2002	353	10.3	7.73	10.2	157	62
Upper Mouth Birch Creek	8/31/2002	1,980	9.7	7.36	10.1	112	32
Lower Mouth Birch Creek	8/31/2002	3,688	10.0	7.33	10.1	114	33
Yukon River below Porcupine River	9/2/2002	--	11.8	--	--	--	--
Hadweenzic River	9/2/2002	57	10.5	7.65	9.3	247	115
Yukon River at Joe Devlin Island	9/2/2002	244,975	11.3	7.90	10.4	218	70
Beaver Creek	9/3/2002	2,537	10.1	7.63	11.6	154	48
Hodzana River	9/3/2002	365	10.7	7.71	9.8	141	49
Yukon River below Hodzana River	9/4/2002	--	12.1	--	--	--	--
Yukon River at Timber Point	9/4/2002	243,000	11.3	7.91	11.4	224	69
Yukon River at Adams Island	9/4/2002	--	12.1	--	--	--	--
Dall River	9/4/2002	206	9.8	7.32	10.0	104	41
Yukon River near Stevens Village	9/4/2002	253,000	11.3	7.80	9.9	213	69

Table 4. Field measurements, year 2003

[Site name, refer to Table 2 and Plate 1 for location; ft^3/s, cubic feet per second; °C, degrees Celsius; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter; --, not available]

Site	Date	Discharge (ft^3/s)	Water Temp (°C)	pH (Standard Units)	Oxygen (mg/L)	Specific Conductivity (mS/cm)	Alkalinity (mg/L as $CaCO_3$)
Trip 1							
Yukon River near Stevens Village	6/4/2003	287,734	11.6	7.83	9.5	167	--
Ray River	6/4/2003	1,340	6.2	6.90	11.8	47	20
Yukon River below Ray River	6/4/2003	--	11.4	--	--	--	--
Hess Creek	6/4/2003	989	9.8	7.20	10.6	119	39
Yukon River below Hess Creek	6/4/2003	--	11.5	--	--	--	--
Tozitna River	6/5/2003	6,940	6.3	6.72	11.1	35	15
Yukon River below Tozitna River	6/5/2003	--	12.4	--	--	--	--
Nowitna River	6/6/2003	17,600	9.5	7.07	8.8	68	29
Yukon River below Nowitna River	6/6/2003	--	12.0	--	--	--	--
Melozitna River	6/6/2003	10,700	9.7	6.96	10.0	36	14
Yukon River below Melozitna River	6/8/2003	--	13.6	--	--	--	--
Yukon River at Ruby	6/8/2003	414,000	12.1	7.80	10.5	145	59
Yuki River	6/8/2003	1,410	14.0	6.86	9.9	48	23
Yukon River below Yuki River	6/8/2003	--	12.2	--	--	--	--
Koyukuk River	6/9/2003	101,000	10.6	7.60	10.0	128	49
Yukon River below Koyukuk River	6/9/2003	--	11.8	--	--	--	--
Nulato River	6/9/2003	6,870	6.0	7.30	12.1	96	42
Yukon River at Kaltag	6/10/2003	545,000	12.2	7.70	9.5	143	61
Anvik River	6/11/2003	6,490	7.8	7.20	11.4	62	25
Yukon River below Anvik River	6/11/2003	--	12.9	--	--	--	--
Bonasila River	6/11/2003	2,900	13.7	7.62	12.1	50	24
Yukon River below Bonasila River	6/11/2003	--	12.8	--	--	--	--
Innoko River	6/12/2003	17,100	14.0	7.00	8.5	80	30
Yukon River below Innoko River	6/12/2003	--	13.5	--	--	--	--
Atchuelinguk River	6/13/2003	--	15.2	7.49	10.5	127	47
Yukon River at Pilot Station	6/13/2003	--	13.9	--	--	--	--
Andreafsky River	6/13/2003	--	15.0	7.68	10.8	95	41

Table 4. Field measurements, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; ft^3/s, cubic feet per second; °C, degrees Celsius; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter; --, not available]

Site	Date	Discharge (ft^3/s)	Water Temp (°C)	pH (Standard Units)	Oxygen (mg/L)	Specific Conductivity (mS/cm)	Alkalinity (mg/L as $CaCO_3$)
Trip 2							
Yukon River near Stevens Village	8/24/2003	188,000	12.7	8.05	10.3	195	68
Ray River	8/25/2003	184	9.9	7.43	9.5	85	45
Yukon River below Ray River	8/25/2003	--	12.2	--	--	--	--
Hess Creek	8/25/2003	1,370	8.7	7.62	11.0	95	43
Yukon River below Hess Creek	8/25/2003	--	12.4	--	--	--	--
Tozitna River	8/26/2003	7,780	7.1	7.02	11.2	41	21
Yukon River below Tozitna River	8/26/2003	--	12.2	--	--	--	--
Nowitna River	8/27/2003	8,670	11.3	7.61	9.4	155	64
Yukon River below Nowitna River	8/27/2003	--	12.1	--	--	--	--
Melozitna River	8/27/2003	4,350	9.3	7.60	11.7	71	25
Yukon River below Melozitna River	8/28/2003	--	12.7	--	--	--	--
Yukon River at Ruby	8/28/2003	283,000	12.3	8.00	9.9	217	69
Yuki River	8/28/2003	3,680	10.1	6.77	9.9	47	20
Yukon River below Yuki River	8/28/2003	--	12.7	--	--	--	--
Koyukuk River	8/29/2003	70,100	11.4	7.75	10.3	220	64
Yukon River below Koyukuk River	8/29/2003	--	12.0	--	--	--	--
Nulato River	8/30/2002	1,992	8.3	7.59	10.6	162	69
Yukon River at Kaltag	8/30/2003	358,000	12.5	7.93	9.5	222	65
Anvik River	9/1/2003	3,870	10.0	7.52	12.1	99	41
Yukon River below Anvik River	9/1/2003	--	13.3	--	--	--	--
Bonasila River	9/1/2003	1,870	12.5	7.33	10.5	81	37
Yukon River below Bonasila River	9/1/2003	--	12.9	--	--	--	--
Innoko River	9/2/2003	20,500	13.2	7.31	8.8	97	38
Yukon River below Innoko River	9/2/2003	--	12.9	--	--	--	--
Atchuelinguk River	9/3/2003	5,930	13.5	7.96	10.1	160	55
Yukon River at Pilot Station	9/3/2003	--	12.9	--	--	--	--
Andreafsky River	9/3/2003	5,670	11.2	7.71	10.7	105	50

Dissolved Organic Carbon

by George R. Aiken

A description of sample collection and processing of samples for dissolved organic carbon (DOC), ultraviolet (UV) absorbance spectroscopy, specific UV absorbance (SUVA), and DOC fractionation analyses is given in Schuster (2003). Sample analysis results for year 2002 are given in table 5, and results for year 2003 are given in table 6.

Table 5. Dissolved organic carbon concentrations and fractionation data, year 2002

[Site name, refer to Table 1 and Plate 1 for location; DOC, dissolved organic carbon; mg C/L, milligrams carbon per liter; UV (abs @ 254 nm), ultraviolet absorbance at the 254 nanometer wavelength; SUVA, specific UV absorbance; (L/mg C/m), liters per milligram per one meter path length; %, percent; --, not available]

Site	Date	DOC (mg C/L)	UV (abs @ 254 nm)	Whole Water SUVA (L/mg C/m)	Hydrophobic Acid SUVA (L/mg C/m)	Hydrophobic Acid (%)	Hydrophilic Organic Matter SUVA (L/mg C/m)	Hydrophilic Organic Matter (%)	Transphylic Acid SUVA (L/mg C/m)	Transphylic Acid (%)
Trip 1										
Yukon River at Eagle	6/11/2002	6.1	0.227	3.7	3.9	62	1.3	17	3.1	19
Nation River	6/13/2002	10.7	0.430	4.0	4.1	57	2.3	13	2.9	17
Kandik River	6/15/2002	13.9	0.568	4.1	4.0	56	1.9	16	3.3	17
Coal Creek	6/15/2002	10.2	0.361	3.6	3.9	52	2.8	17	2.9	17
Charley River	6/16/2002	10.4	0.395	3.8	4.2	57	2.1	15	3.0	16
Woodchopper Creek	6/16/2002	6.9	0.210	3.1	3.7	51	1.8	19	2.8	16
Yukon River above Circle	6/17/2002	6.3	0.225	3.6	4.1	51	2.1	15	3.0	17
Sheenjek River	6/20/2002	7.6	0.246	3.3	3.8	48	2.0	16	2.9	18
Black River	6/20/2002	15.0	0.589	3.9	4.1	57	3.1	13	3.0	17
Upper Mouth Birch Creek	6/21/2002	15.4	0.607	4.0	4.1	56	1.6	15	3.2	16
Chandalar River	6/22/2002	2.5	0.063	2.5	3.0	47	0.4	34	1.9	23
Christian River	6/22/2002	11.5	0.386	3.4	3.6	56	2.6	16	2.7	16
Lower Mouth Birch Creek	6/23/2002	15.7	0.553	3.5	--	--	--	--	--	--
Yukon River at Timber Point	6/24/2002	6.5	0.180	2.8	3.8	53	1.9	19	3.0	19
Hodzana River	6/25/2002	6.0	0.221	3.7	3.7	49	2.8	20	2.9	21
Yukon River near Stevens Village	6/24/2002	6.3	0.215	3.4	3.9	49	1.9	19	3.4	21

Table 5. Dissolved organic carbon concentrations and fractionation data, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; DOC, dissolved organic carbon; mg C/L, milligrams carbon per liter; UV (abs @ 254 nm), ultraviolet absorbance at the 254 nanometer wavelength; SUVA, specific UV absorbance; (L/mg C/m), liters per milligram per one meter path length; %, percent; --, not available]

Site	Date	DOC (mg C/L)	UV (abs @ 254 nm)	Whole Water SUVA (L/mg C/m)	Hydrophobic Acid SUVA (L/mg C/m)	Hydrophobic Acid (%)	Hydrophilic Organic Matter SUVA (L/mg C/m)	Hydrophilic Organic Matter (%)	Transphylic Acid SUVA (L/mg C/m)	Transphylic Acid (%)
Trip 2										
Yukon River at Eagle	8/22/2002	4.8	0.151	3.2	3.7	53	1.9	20	2.6	18
Yukon River below Tatonduk River	8/23/2002	5.9	0.199	3.4	--	--	--	--	--	--
Nation River	8/23/2002	6.5	0.234	3.6	3.9	58	1.9	20	3.1	17
Yukon River below Nation River	8/23/2002	6.3	0.218	3.5	--	--	--	--	--	--
Kandik River	8/24/2002	11.4	0.455	4.0	4.2	57	2.6	16	3.1	18
Yukon River below Kandik River	8/23/2002	5.7	0.193	3.4	--	--	--	--	--	--
Charley River	8/24/2002	7.8	0.294	3.8	4.0	55	2.2	16	3.1	19
Yukon River below Charley River	8/23/2002	5.5	0.182	3.3	--	--	--	--	--	--
Coal Creek	8/25/2002	13.4	0.516	3.9	4.0	56	2.8	15	2.9	21
Yukon River below Coal Creek	8/25/2002	7.0	0.253	3.6	--	--	--	--	--	--
Woodchopper Creek	8/24/2002	12.7	0.472	3.7	4.0	57	2.2	14	3.2	17
Yukon River below Woodchopper Creek	8/25/2002	6.9	0.258	3.7	--	--	--	--	--	--
Yukon River above Circle	8/26/2002	7.0	0.252	3.6	4.1	56	1.9	22	3.1	16
Yukon River above Twentytwo Mile Village	8/27/2002	6.9	0.248	3.6	--	--	--	--	--	--
Yukon River near Halfway Whirlpool	8/27/2002	6.8	0.248	3.7	--	--	--	--	--	--
Yukon River above Twelvemile Island	8/27/2002	6.9	0.249	3.6	--	--	--	--	--	--
Sheenjek River	8/28/2002	2.4	0.039	1.7	2.8	39	1.4	32	2.2	20
Black River	8/28/2002	12.0	0.460	3.8	4.1	58	2.8	14	2.9	15
Porcupine River 9.5 miles upstream from mouth	8/28/2002	10.2	0.376	3.7	4.1	56	2.3	19	2.9	17
Chandalar River	8/30/2002	1.6	0.024	1.5	2.5	32	1.5	43	2.0	19
Christian River	8/30/2002	6.3	0.184	2.9	3.1	46	1.3	28	2.5	20
Upper Mouth Birch Creek	8/31/2002	13.4	0.486	3.6	4.0	50	2.9	18	3.1	19
Lower Mouth Birch Creek	8/31/2002	13.6	0.495	3.6	4.1	56	2.1	18	3.2	16
Yukon River below Porcupine River	9/2/2002	6.5	0.234	3.6	--	--	--	--	--	--
Hadweenzic River	9/2/2002	9.3	0.271	2.9	3.1	50	2.6	20	2.5	19
Yukon River at Joe Devlin Island	9/2/2002	6.0	0.215	3.6	3.8	50	2.9	16	3.2	19
Beaver Creek	9/3/2002	5.7	0.205	3.7	3.7	53	3.4	17	2.9	16
Hodzana River	9/3/2002	3.8	0.115	3.0	3.0	50	3.6	19	2.5	18
Yukon River below Hodzana River	9/4/2002	5.9	0.191	3.3	--	--	--	--	--	--
Yukon River at Timber Point	9/4/2002	5.6	0.205	3.6	3.9	55	2.1	18	2.9	17
Yukon River at Adams Island	9/4/2002	5.9	0.198	3.4	--	--	--	--	--	--
Dall River	9/4/2002	12.2	0.480	4.0	4.1	44	3.1	16	3.3	17
Yukon River near Stevens Village	9/4/2002	6.1	0.205	3.4	3.8	51	2.4	16	3.2	16

Table 6. Dissolved organic carbon concentrations and fractionation data, year 2003

[Site name, refer to Table 2 and Plate 1 for location; DOC, dissolved organic carbon; mg C/L, milligrams carbon per liter; UV (abs @ 254 nm), ultraviolet absorbance at the 254 nanometer wavelength; SUVA, specific UV absorbance; (L/mg C/m), liters per milligram per one meter path length; %, percent; --, not available]

Site	Date	DOC (mg C/L)	UV (abs @ 254 nm)	Whole Water SUVA (L/mg C/m)	Hydrophobic Acid SUVA (L/mg C/m)	Hydrophobic Acid (%)	Hydrophilic Organic Matter SUVA (L/mg C/m)	Hydrophilic Organic Matter (%)	Transphylic Acid SUVA (L/mg C/m)	Transphylic Acid (%)
Trip 1										
Yukon River near Stevens Village	6/4/2003	11.7	0.412	3.5	4.2	52	2.0	16	2.9	16
Ray River	6/4/2003	22.8	0.918	4.0	4.3	59	2.9	12	3.1	15
Yukon River below Ray River	6/4/2003	11.6	0.410	3.5	--	--	--	--	--	--
Hess Creek	6/4/2003	22.3	0.816	3.7	4.0	52	1.8	13	2.9	18
Yukon River below Hess Creek	6/4/2003	11.9	0.429	3.6	--	--	--	--	--	--
Tozitna River	6/5/2003	17.4	0.710	4.1	4.6	58	3.3	13	3.1	15
Yukon River below Tozitna River	6/5/2003	11.5	0.426	3.7	--	--	--	--	--	--
Nowitna River	6/6/2003	27.0	1.020	3.8	4.0	56	3.1	12	2.9	15
Yukon River below Nowitna River	6/6/2003	12.7	0.481	3.8	--	--	--	--	--	--
Melozitna River	6/6/2003	15.0	0.596	4.0	4.2	56	2.4	13	3.1	15
Yukon River below Melozitna River	6/8/2003	11.2	0.410	3.7	--	--	--	--	--	--
Yukon River at Ruby	6/8/2003	11.1	0.402	3.6	4.1	54	2.0	15	3.0	18
Yuki River	6/8/2003	13.8	0.579	4.2	4.4	51	3.6	19	3.1	17
Yukon River below Yuki River	6/8/2003	--	--	--	--	--	--	--	--	--
Koyukuk River	6/9/2003	10.1	0.363	3.6	4.3	52	2.1	15	3.1	16
Yukon River below Koyukuk River	6/9/2003	10.8	0.409	3.8	--	--	--	--	--	--
Nulato River	6/9/2003	3.2	0.087	3.3	4.0	39	1.9	19	2.8	17
Yukon River at Kaltag	6/10/2003	10.8	0.389	3.6	4.1	48	2.0	16	3.0	16
Anvik River	6/11/2003	3.1	0.093	3.0	--	--	--	--	--	--
Yukon River below Anvik River	6/11/2003	11.3	0.412	3.6	--	--	--	--	--	--
Bonasila River	6/11/2003	4.8	0.173	3.6	4.1	44	4.8	21	2.6	13
Yukon River below Bonasila River	6/11/2003	11.3	0.398	3.5	--	--	--	--	--	--
Innoko River	6/12/2003	15.2	0.639	4.2	4.3	58	5.0	15	3.0	17
Yukon River below Innoko River	6/12/2003	11.3	0.405	3.6	--	--	--	--	--	--
Atchuelinguk River	6/13/2003	10.2	0.355	3.5	4.0	56	2.8	18	3.0	15
Yukon River at Pilot Station	6/13/2003	11.5	0.413	3.6	4.0	53	2.0	18	3.0	16
Andreafsky River	6/13/2003	3.5	0.089	2.6	4.3	33	2.7	20	2.6	17

Table 6. Dissolved organic carbon concentrations and fractionation data, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; DOC, dissolved organic carbon; mg C/L, milligrams carbon per liter; UV (abs @ 254 nm), ultraviolet absorbance at the 254 nanometer wavelength; SUVA, specific UV absorbance; (L/mg C/m), liters per milligram per one meter path length; %, percent; --, not available]

Site	Date	DOC (mg C/L)	UV (abs @ 254 nm)	Whole Water SUVA (L/mg C/m)	Hydrophobic Acid SUVA (L/mg C/m)	Hydrophobic Acid (%)	Hydrophilic Organic Matter SUVA (L/mg C/m)	Hydrophilic Organic Matter (%)	Transphilic Acid SUVA (L/mg C/m)	Transphilic Acid (%)
Trip 2										
Yukon River near Stevens Village	8/24/2003	4.0	0.122	3.0	3.7	49	1.6	19	2.7	20
Ray River	8/25/2003	12.4	0.459	3.7	3.8	55	2.7	18	3.0	19
Yukon River below Ray River	8/25/2003	4.0	0.119	3.0	--	--	--	--	--	--
Hess Creek	8/25/2003	24.5	0.913	3.7	3.9	56	2.2	15	3.0	20
Yukon River below Hess Creek	8/25/2003	3.8	0.134	3.5	--	--	--	--	--	--
Tozitna River	8/26/2003	11.6	0.474	4.1	4.0	59	3.1	15	3.3	15
Yukon River below Tozitna River	8/26/2003	3.9	0.127	3.2	--	--	--	--	--	--
Nowitna River	8/27/2003	14.3	0.594	4.2	4.0	58	4.5	17	3.0	18
Yukon River below Nowitna River	8/27/2003	5.3	0.220	4.1	--	--	--	--	--	--
Melozitna River	8/27/2003	7.3	0.269	3.7	4.3	56	3.2	15	3.0	17
Yukon River below Melozitna River	8/28/2003	4.6	0.173	3.7	--	--	--	--	--	--
Yukon River at Ruby	8/28/2003	4.6	0.143	3.1	3.9	47	2.0	17	2.8	18
Yuki River	8/28/2003	20.4	0.874	4.3	4.4	61	3.2	15	3.5	18
Yukon River below Yuki River	8/28/2003	4.5	0.146	3.2	--	--	--	--	--	--
Koyukuk River	8/29/2003	6.7	0.236	3.5	3.9	50	2.4	14	2.8	16
Yukon River below Koyukuk River	8/29/2003	6.0	0.212	3.5	--	--	--	--	--	--
Nulato River	8/30/2002	2.5	0.066	2.7	3.3	45	1.9	22	2.4	22
Yukon River at Kaltag	8/30/2003	5.1	0.160	3.1	3.9	48	2.1	18	2.8	17
Anvik River	9/1/2003	4.3	0.164	3.9	4.1	53	4.0	16	2.9	21
Yukon River below Anvik River	9/1/2003	5.3	0.178	3.4	--	--	--	--	--	--
Bonasila River	9/1/2003	5.1	0.253	4.9	4.1	52	--	14	3.1	14
Yukon River below Bonasila River	9/1/2003	5.2	0.180	3.5	--	--	--	--	--	--
Innoko River	9/2/2003	15.3	0.706	4.6	4.3	60	5.1	13	3.3	16
Yukon River below Innoko River	9/2/2003	5.0	0.184	3.7	--	--	--	--	--	--
Atchuelinguk River	9/3/2003	5.3	0.209	3.9	4.2	53	--	16	2.8	18
Yukon River at Pilot Station	9/3/2003	5.1	0.162	3.2	3.8	52	1.8	16	2.7	19
Andreafsky River	9/3/2003	3.3	0.104	3.1	3.9	46	--	20	2.7	18

Dissolved Inorganic Carbon

by Robert G. Striegl

A description of sample collection and processing of samples for carbon dioxide (CO_2), methane (CH_4), and dissolved inorganic carbon (DIC) is given in Schuster (2003). A description for the processing of samples for carbon isotopes (^{13}C-DIC) can be found in Chasar and others (2000). Sample analysis results for year 2002 are given in table 7, and results for year 2003 are given in table 8.

Table 7. Inorganic carbon concentration and carbon isotope data, year 2002

[Site name, refer to Table 1 and Plate 1 for location; CO_2, carbon dioxide; µmol/L, micromoles per liter; P_{CO2}, partial pressure of CO_2; ppm, parts per million; CH_4, methane, P_{CH4}, partial pressure of CH_4; DIC, dissolved inorganic carbon; Corrected, adjusted for temperature and altitude; --, not available]

Site	Date	CO_2 (µmol/L)	Corrected P_{CO2} (ppm)	CH_4 (µmol/L)	Corrected P_{CH4} (ppm)	DIC (µmol/L)	^{13}C-DIC (per mil)
Trip 1							
Yukon River at Eagle	6/11/2002	45.2	901	0.121	2.5	1,610	-5.84
Nation River	6/13/2002	91.5	1,670	0.118	2.6	1,970	-6.63
Kandik River	6/15/2002	79.5	1,470	0.170	3.8	904	-8.97
Coal Creek	6/15/2002	83.3	1,570	0.090	2.0	1,620	-3.35
Charley River	6/16/2002	69.5	1,320	0.131	2.9	747	-7.39
Woodchopper Creek	6/16/2002	154	2,710	0.092	2.0	2,165	-3.56
Yukon River above Circle	6/17/2002	55.3	1,140	0.130	2.9	1,680	-5.78
Sheenjek River	6/20/2002	72.9	1,340	0.291	6.5	2,185	-7.50
Black River	6/20/2002	80.7	1,650	0.330	7.5	1,070	-9.59
Upper Mouth Birch Creek	6/21/2002	107	2,260	0.491	11.0	792	-10.56
Chandalar River	6/22/2002	76.1	1,390	0.163	3.6	2,380	-6.30
Christian River	6/22/2002	115	2,260	0.480	11.0	1,190	--
Lower Mouth Birch Creek	6/23/2002	--	--	--	--	--	--
Yukon River at Timber Point	6/24/2002	48.6	999	0.152	3.4	1,500	-6.48
Hodzana River	6/25/2002	74.5	1,460	1.565	35.0	1,200	-9.52
Yukon River near Stevens Village	6/24/2002	56.5	1,150	0.164	3.7	1,210	-5.81

Table 7. Inorganic carbon concentration and carbon isotope data, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; CO_2, carbon dioxide; µmol/L, micromoles per liter; P_{CO2}, partial pressure of CO_2; ppm, parts per million; CH_4, methane, P_{CH4}, partial pressure of CH_4; DIC, dissolved inorganic carbon; Corrected; adjusted for temperature and altitude; --, not available]

Site	Date	CO_2 (µmol/L)	Corrected P_{CO2} (ppm)	CH_4 (µmol/L)	Corrected P_{CH4} (ppm)	DIC (µmol/L)	^{13}C-DIC (per mil)
Trip 2							
Yukon River at Eagle	8/22/2002	41.1	512	0.265	5.9	1,640	-5.70
Yukon River below Tatonduk River	8/23/2002	48.1	864	0.181	4.0	1,670	--
Nation River	8/23/2002	80.2	1,240	0.202	4.4	2,720	-6.53
Yukon River below Nation River	8/23/2002	--	--	--	--	1,040	--
Kandik River	8/24/2002	90.1	1,410	0.252	5.5	1,040	-8.47
Yukon River below Kandik River	8/23/2002	47.8	860	0.119	2.6	1,750	--
Charley River	8/24/2002	--	--	--	--	699	-6.35
Yukon River below Charley River	8/23/2002	46.0	827	0.131	2.9	1,660	--
Coal Creek	8/25/2002	93.6	1,400	0.244	5.3	1,190	-4.54
Yukon River below Coal Creek	8/25/2002	50.0	918	0.129	2.9	1,600	--
Woodchopper Creek	8/24/2002	97.8	1,510	0.263	5.7	1,040	-4.60
Yukon River below Woodchopper Creek	8/25/2002	--	--	--	--	--	--
Yukon River above Circle	8/26/2002	43.1	850	0.165	3.7	1,520	-6.09
Yukon River above Twentytwo Mile Village	8/27/2002	--	--	0.119	2.7	2,290	--
Yukon River near Halfway Whirlpool	8/27/2002	51.5	952	0.156	3.5	1,630	--
Yukon River above Twelvemile Island	8/27/2002	48.6	904	0.117	2.6	1,640	--
Sheenjek River	8/28/2002	204	3,770	0.357	8.0	2,800	-7.74
Black River	8/28/2002	96.3	1,770	0.276	5.5	1,360	-9.34
Porcupine River 9.5 miles upstream from mouth	8/28/2002	69.2	1,260	0.218	4.9	1,610	-7.76
Chandalar River	8/30/2002	70.4	1,260	0.231	4.1	2,690	-6.00
Christian River	8/30/2002	160	2,960	0.626	14.0	1,430	-9.64
Upper Mouth Birch Creek	8/31/2002	139	2,520	0.377	8.4	732	-8.69
Lower Mouth Birch Creek	8/31/2002	742	13,600	0.318	7.8	738	-8.69
Yukon River below Porcupine River	9/2/2002	46.9	913	0.120	2.7	1,680	--
Hadweenzic River	9/2/2002	145	2,710	8.05	180	2,810	-9.83
Yukon River at Joe Devlin Island	9/2/2002	45.8	879	0.205	4.6	1,690	--
Beaver Creek	9/3/2002	54.7	1,110	0.394	8.8	1,180	-8.49
Hodzana River	9/3/2002	183	3,440	1.40	32.0	1,230	-7.96
Yukon River below Hodzana River	9/4/2002	48.6	959	0.188	4.2	1,730	--
Yukon River at Timber Point	9/4/2002	70.7	1,360	0.247	5.5	1,690	-6.39
Yukon River at Adams Island	9/4/2002	48.1	947	0.200	4.5	1,650	--
Dall River	9/4/2002	92.9	1,680	0.546	12.0	986	-8.91
Yukon River near Stevens Village	9/4/2002	53.3	1,030	0.185	4.1	1,630	-6.43

Table 8. Inorganic carbon concentration and carbon isotope data, year 2003

[Site name, refer to Table 2 and Plate 1 for location; CO_2, carbon dioxide; µmol/L, micromoles per liter; P_{CO2}, partial pressure of CO_2; ppm, parts per million; CH_4, methane, P_{CH4}, partial pressure of CH_4; DIC, dissolved inorganic carbon; Corrected, adjusted for temperature and altitude; --, not available]

Site	Date	CO_2 (µmol/L)	Corrected P_{CO2} (ppm)	CH_4 (µmol/L)	Corrected P_{CH4} (ppm)	DIC (µmol/L)	^{13}C-DIC (per mil)
Trip 1							
Yukon River near Stevens Village	6/4/2003	50.0	974	0.128	2.9	1,430	-6.75
Ray River	6/4/2003	111	1,740	0.432	9.4	462	-11.63
Yukon River below Ray River	6/4/2003	56.0	1,080	0.289	6.5	1,430	--
Hess Creek	6/4/2003	128	2,270	0.720	16.0	993	-11.01
Yukon River below Hess Creek	6/4/2003	38.6	749	0.173	3.9	1,440	-6.94
Tozitna River	6/5/2003	114	1,780	0.385	8.4	360	-11.35
Yukon River below Tozitna River	6/5/2003	47.3	948	0.162	3.7	1,520	-7.45
Nowitna River	6/6/2003	159	2,840	0.215	4.8	770	-10.46
Yukon River below Nowitna River	6/6/2003	79.5	1,570	0.320	7.2	1,450	-7.69
Melozitna River	6/6/2003	55.1	999	0.125	2.8	343	-10.11
Yukon River below Melozitna River	6/8/2003	47.0	980	0.238	5.4	1,460	-7.51
Yukon River at Ruby	6/8/2003	62.8	1,230	0.205	4.6	1,510	-7.20
Yuki River	6/8/2003	90.3	1,820	0.878	19.8	634	-11.83
Yukon River below Yuki River	6/8/2003	39.1	780	0.184	4.1	1,390	-7.61
Koyukuk River	6/9/2003	57.8	1,090	0.194	4.3	1,160	-7.86
Yukon River below Koyukuk River	6/9/2003	60.4	1,190	0.201	4.5	1,290	-7.55
Nulato River	6/9/2003	63.6	1,020	0.244	5.4	1,140	-8.53
Yukon River at Kaltag	6/10/2003	58.7	1,170	0.169	3.8	1,400	-7.68
Anvik River	6/11/2003	52.2	897	0.525	11.6	651	-9.44
Yukon River below Anvik River	6/11/2003	50.5	1,030	0.232	5.2	1,500	-8.31
Bonasila River	6/11/2003	25.7	539	0.259	5.9	551	-7.19
Yukon River below Bonasila River	6/11/2003	46.8	955	0.180	4.1	1,470	-7.92
Innoko River	6/12/2003	95.7	2,030	0.200	4.5	836	-10.12
Yukon River below Innoko River	6/12/2003	51.5	1,070	0.201	4.5	1,480	-8.03
Atchuelinguk River	6/13/2003	47.1	1,040	0.634	14.5	1,140	-7.83
Yukon River at Pilot Station	6/13/2003	65.4	1,380	0.257	5.8	1,480	-7.87
Andreafsky River	6/13/2003	31.7	694	0.712	16.2	1,030	-7.91

Table 8. Inorganic carbon concentration and carbon isotope data, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; CO_2, carbon dioxide; µmol/L, micromoles per liter; P_{CO2}, partial pressure of CO_2; ppm, parts per million; CH_4, methane, P_{CH4}, partial pressure of CH_4; DIC, dissolved inorganic carbon; --, not available]

Site	Date	CO_2 (µmol/L)	Corrected P_{CO2} (ppm)	CH_4 (µmol/L)	Corrected P_{CH4} (ppm)	DIC (µmol/L)	^{13}C-DIC (per mil)
Trip 2							
Yukon River near Stevens Village	8/24/2003	45.4	917	0.163	3.7	1,800	-5.37
Ray River	8/25/2003	93.7	1,770	1.66	37.1	1,150	-10.87
Yukon River below Ray River	8/25/2003	40.3	801	0.210	4.7	1,900	--
Hess Creek	8/25/2003	106	1,920	0.446	9.9	1,100	-10.69
Yukon River below Hess Creek	8/25/2003	32.3	645	0.157	3.5	1,850	--
Tozitna River	8/26/2003	92.0	1,640	0.319	7.1	551	-10.18
Yukon River below Tozitna River	8/26/2003	52.3	1,040	0.193	4.4	1,790	--
Nowitna River	8/27/2003	133	2,640	0.366	8.2	1,730	-9.94
Yukon River below Nowitna River	8/27/2003	38.7	766	0.348	7.8	1,820	--
Melozitna River	8/27/2003	40.6	733	0.146	3.2	628	-7.13
Yukon River below Melozitna River	8/28/2003	34.6	701	0.243	5.5	1,930	--
Yukon River at Ruby	8/28/2003	46.7	971	0.243	5.5	1,820	-6.81
Yuki River	8/28/2003	134	2,590	0.944	21.2	548	-11.69
Yukon River below Yuki River	8/28/2003	33.4	676	0.186	4.2	1,820	--
Koyukuk River	8/29/2003	55.1	1,100	0.242	5.4	1,670	-6.73
Yukon River below Koyukuk River	8/29/2003	37.6	745	0.237	5.3	1,800	--
Nulato River	8/30/2002	85.7	1,560	0.369	8.2	1,720	-9.53
Yukon River at Kaltag	8/30/2003	69.6	1,470	0.232	5.3	1,760	-6.36
Anvik River	9/1/2003	106	2,030	0.737	16.5	1,090	-9.96
Yukon River below Anvik River	9/1/2003	42.2	873	0.307	6.9	1,820	--
Bonasila River	9/1/2003	129	2,690	0.508	11.5	1,020	-11.11
Yukon River below Bonasila River	9/1/2003	30.0	613	0.200	4.5	1,700	--
Innoko River	9/2/2003	118	2,480	0.194	4.4	978	-9.76
Yukon River below Innoko River	9/2/2003	39.9	816	0.210	4.7	1,760	--
Atchuelinguk River	9/3/2003	41.3	875	0.885	20.1	1,350	-6.99
Yukon River at Pilot Station	9/3/2003	39.1	801	0.309	7.0	1,730	--
Andreafsky River	9/3/2003	46.5	927	0.517	11.6	1,260	-8.80

Mercury

by John F. DeWild and Mark L. Olson

A description of sample collection and processing of samples for filtered methyl mercury, filtered total mercury, particulate methyl mercury, and particulate total mercury is given in Schuster (2003). Sample analysis results for year 2002 are given in table 9, and results for year 2003 are given in table 10.

Table 9. Mercury concentrations, year 2002

[Site name, refer to Table 1 and Plate 1 for location; Hg, mercury; ng/L, nanograms per liter; <, less than; --, not available; E, estimate]

Site	Date	Filtered Methyl-Hg (ng/L)	Filtered Total-Hg (ng/L)	Particulate Methyl-Hg (ng/L)	Particulate Total-Hg (ng/L)
Trip 1					
Yukon River at Eagle	6/11/2002	0.07	2.06	--	8.16
Nation River	6/13/2002	<0.04	3.57	0.038	3.61
Kandik River	6/15/2002	0.14	4.48	<0.026	4.15
Coal Creek	6/15/2002	0.06	3.49	<0.024	3.70
Charley River	6/16/2002	0.07	2.70	--	<0.08
Woodchopper Creek	6/16/2002	0.24	1.55	--	<0.07
Yukon River above Circle	6/17/2002	0.06	2.28	0.032	8.21
Sheenjek River	6/20/2002	0.06	2.18	0.037	4.24
Black River	6/20/2002	0.12	3.56	<0.022	E0.29
Upper Mouth Birch Creek	6/21/2002	0.17	3.86	<0.022	--
Chandalar River	6/22/2002	<0.04	1.08	<0.023	--
Christian River	6/22/2002	0.13	3.33	0.032	--
Lower Mouth Birch Creek	6/23/2002	--	--	--	--
Yukon River at Timber Point	6/24/2002	0.05	1.94	--	25.62
Hodzana River	6/25/2002	0.11	1.59	--	4.74
Yukon River near Stevens Village	6/24/2002	--	--	--	--

Table 9. Mercury concentrations, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; Hg, mercury; ng/L, nanograms per liter; <, less than; --, not available]

Site	Date	Filtered Methyl-Hg (ng/L)	Filtered Total-Hg (ng/L)	Particulate Methyl-Hg (ng/L)	Particulate Total-Hg (ng/L)
Trip 2					
Yukon River at Eagle	8/22/2002	<0.04	2.01	<0.069	27.16
Yukon River below Tatonduk River	8/23/2002	--	--	--	--
Nation River	8/23/2002	<0.04	1.94	<0.068	4.54
Yukon River below Nation River	8/23/2002	--	--	--	--
Kandik River	8/24/2002	0.06	4.36	<0.068	23.64
Yukon River below Kandik River	8/23/2002	--	--	--	--
Charley River	8/24/2002	<0.04	2.04	<0.066	0.82
Yukon River below Charley River	8/23/2002	--	--	--	--
Coal Creek	8/25/2002	1.35	4.34	0.525	13.30
Yukon River below Coal Creek	8/25/2002	--	--	--	--
Woodchopper Creek	8/24/2002	0.04	3.62	<0.066	2.04
Yukon River below Woodchopper Cr	8/25/2002	--	--	--	--
Yukon River above Circle	8/26/2002	<0.04	2.24	<0.067	15.48
Yukon River above Twentytwo Mile Village	8/27/2002	--	--	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--	--	--
Sheenjek River	8/28/2002	<0.04	0.44	<0.068	0.20
Black River	8/28/2002	0.06	2.80	<0.071	0.56
Porcupine River 9.5 miles upstream from mouth	8/28/2002	0.04	2.09	<0.069	18.98
Chandalar River	8/30/2002	<0.04	0.37	<0.068	<0.25
Christian River	8/30/2002	<0.04	1.00	<0.070	0.93
Upper Mouth Birch Creek	8/31/2002	0.06	3.08	<0.070	1.86
Lower Mouth Birch Creek	8/31/2002	0.05	3.11	<0.069	4.16
Yukon River below Porcupine River	9/2/2002	--	--	--	--
Hadweenzic River	9/2/2002	0.05	0.65	<0.065	0.24
Yukon River at Joe Devlin Island	9/2/2002	<0.04	2.53	<0.062	19.65
Beaver Creek	9/3/2002	0.06	2.17	<0.068	1.76
Hodzana River	9/3/2002	0.05	0.65	<0.064	0.37
Yukon River below Hodzana River	9/4/2002	--	--	--	--
Yukon River at Timber Point	9/4/2002	0.05	1.97	<0.071	13.06
Yukon River at Adams Island	9/4/2002	--	--	--	--
Dall River	9/4/2002	0.07	1.94	<0.069	0.49
Yukon River near Stevens Village	9/4/2002	<0.04	2.01	0.060	14.52

Table 10. Mercury concentrations, year 2003

[Site name, refer to Table 2 and Plate 1 for location; Hg, mercury; ng/L, nanograms per liter; <, less than; --, not available]

Site	Date	Filtered Methyl-Hg (ng/L)	Filtered Total-Hg (ng/L)	Particulate Methyl-Hg (ng/L)	Particulate Total-Hg (ng/L)
Trip 1					
Yukon River near Stevens Village	6/4/2003	0.04	3.61	0.094	17.80
Ray River	6/4/2003	<0.04	6.09	0.038	--
Yukon River below Ray River	6/4/2003	--	--	--	--
Hess Creek	6/4/2003	0.11	6.29	--	1.61
Yukon River below Hess Creek	6/4/2003	--	--	--	--
Tozitna River	6/5/2003	0.06	5.33	0.036	9.47
Yukon River below Tozitna River	6/5/2003	--	--	--	--
Nowitna River	6/6/2003	<0.04	5.60	0.048	9.81
Yukon River below Nowitna River	6/6/2003	--	--	--	--
Melozitna River	6/6/2003	<0.04	5.28	0.076	8.61
Yukon River below Melozitna River	6/8/2003	--	--	--	--
Yukon River at Ruby	6/8/2003	0.04		0.089	
Yuki River	6/8/2003	<0.04	3.16	<0.017	1.83
Yukon River below Yuki River	6/8/2003	--	--	--	--
Koyukuk River	6/9/2003	<0.04	3.15	0.088	34.68
Yukon River below Koyukuk River	6/9/2003	--	--	--	--
Nulato River	6/9/2003	<0.04	2.26	0.047	6.44
Yukon River at Kaltag	6/10/2003	<0.04	3.60	0.111	24.23
Anvik River	6/11/2003	<0.04	1.11	0.023	3.21
Yukon River below Anvik River	6/11/2003	--	--	--	--
Bonasila River	6/11/2003	<0.04	0.95	0.011	0.67
Yukon River below Bonasila River	6/11/2003	--	--	--	--
Innoko River	6/12/2003	<0.04	3.02	<0.010	1.52
Yukon River below Innoko River	6/12/2003	--	--	--	--
Atchuelinguk River	6/13/2003	<0.04	1.78	<0.010	0.99
Yukon River at Pilot Station	6/13/2003	--	--	--	--
Andreafsky River	6/13/2003	0.07	1.05	0.014	0.52

Table 10. Mercury concentrations, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; Hg, mercury; ng/L, nanograms per liter; <, less than; E, estimate; --, not available]

Site	Date	Filtered Methyl-Hg (ng/L)	Filtered Total-Hg (ng/L)	Particulate Methyl-Hg (ng/L)	Particulate Total-Hg (ng/L)
Trip 2					
Yukon River near Stevens Village	8/24/2003	<0.04	50.90	<0.036	16.12
Ray River	8/25/2003	0.09	1.48	<0.022	0.21
Yukon River below Ray River	8/25/2003	--	--	--	--
Hess Creek	8/25/2003	0.08	4.54	0.190	2.85
Yukon River below Hess Creek	8/25/2003	--	--	--	--
Tozitna River	8/26/2003	<0.04	3.00	0.059	9.01
Yukon River below Tozitna River	8/26/2003	--	--	--	--
Nowitna River	8/27/2003	0.08	2.05	<0.028	0.89
Yukon River below Nowitna River	8/27/2003	--	--	--	--
Melozitna River	8/27/2003	E0.05	1.68	<0.021	0.01
Yukon River below Melozitna River	8/28/2003	--	--	--	--
Yukon River at Ruby	8/28/2003	<0.04	1.21	0.033	18.23
Yuki River	8/28/2003	0.06	5.31	<0.021	3.93
Yukon River below Yuki River	8/28/2003	--	--	--	--
Koyukuk River	8/29/2003	<0.04	1.91	0.031	16.36
Yukon River below Koyukuk River	8/29/2003	--	--	--	--
Nulato River	8/30/2002	<0.04	0.80	<0.011	0.55
Yukon River at Kaltag	8/30/2003	<0.04	1.30	0.036	19.71
Anvik River	9/1/2003	0.06	0.86	<0.011	0.77
Yukon River below Anvik River	9/1/2003	--	--	--	--
Bonasila River	9/1/2003	E0.04	0.64	<0.010	0.20
Yukon River below Bonasila River	9/1/2003	--	--	--	--
Innoko River	9/2/2003	0.08	2.45	<0.020	3.96
Yukon River below Innoko River	9/2/2003	--	--	--	--
Atchuelinguk River	9/3/2003	<0.04	1.22	<0.032	6.64
Yukon River at Pilot Station	9/3/2003	--	--	21.434	1.22
Andreafsky River	9/3/2003	0.06	1.04	<0.010	0.37

Uranium

by Thomas F. Kraemer

A description of sample collection and processing of samples for uranium concentrations and uranium activity ratios (UAR) is given in Schuster (2003). Sample analysis results for year 2002 are given in table 11, and results for year 2003 are given in table 12.

Table 11. Uranium concentration and $^{234}U/^{238}U$ activity ratios, year 2002

[Site name, refer to Table 1 and Plate 1 for location; U, uranium; μg/L, micrograms per liter; --, not available; *, samples from Trip 1 and Trip 2 combined to get measurable activity ratio]

Site	Date	U (μg/L)	$^{234}U/^{238}U$ Activity Ratio (±1 sigma uncertainty)
Trip 1			
Yukon River at Eagle	6/11/2002	0.75	1.455±0.019
Nation River	6/13/2002	0.33	1.891±0.033
Kandik River	6/15/2002	0.06	2.538±0.021*
Coal Creek	6/15/2002	--	--
Charley River	6/16/2002	1.16	1.189±0.019
Woodchopper Creek	6/16/2002	--	--
Yukon River above Circle	6/17/2002	0.77	1.430±0.020
Sheenjek River	6/20/2002	0.46	1.735±0.037
Black River	6/20/2002	0.14	2.731±0.012*
Upper Mouth Birch Creek	6/21/2002	0.23	1.314±0.022
Chandalar River	6/22/2002	0.91	1.602±0.007
Christian River	6/22/2002	0.05	1.635±0.018*
Lower Mouth Birch Creek	6/23/2002	--	--
Yukon River at Timber Point	6/24/2002	0.70	1.466±0.015
Hodzana River	6/25/2002	0.34	1.407±0.011
Yukon River near Stevens Village	6/24/2002	0.68	1.501±0.012

Table 11. Uranium concentration and $^{234}U/^{238}U$ activity ratios, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; U, uranium; μg/L, micrograms per liter; --, not available; *, samples from Trip 1 and Trip 2 combined to get measurable activity ratio]

Site	Date	U (μg/L)	$^{234}U/^{238}U$ Activity Ratio (±1 sigma uncertainty)
Trip 2			
Yukon River at Eagle	8/22/2002	--	--
Yukon River below Tatonduk River	8/23/2002	--	--
Nation River	8/23/2002	0.50	1.870±0.016
Yukon River below Nation River	8/23/2002	--	--
Kandik River	8/24/2002	0.08	2.538±0.018*
Yukon River below Kandik River	8/23/2002	--	--
Charley River	8/24/2002	0.98	1.175±0.017
Yukon River below Charley River	8/23/2002	--	--
Coal Creek	8/25/2002	0.24	1.254±0.013
Yukon River below Coal Creek	8/25/2002	--	--
Woodchopper Creek	8/24/2002	1.27	1.201±0.011
Yukon River below Woodchopper Creek	8/25/2002	--	--
Yukon River above Circle	8/26/2002	0.79	1.465±0.024
Yukon River above Twentytwo Mile Village	8/27/2002	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--
Sheenjek River	8/28/2002	0.72	1.659±0.016
Black River	8/28/2002	0.15	2.731±0.012*
Porcupine River 9.5 miles upstream from mouth	8/28/2002	--	--
Chandalar River	8/30/2002	1.04	1.648±0.008
Christian River	8/30/2002	0.12	1.635±0.018*
Upper Mouth Birch Creek	8/31/2002	0.20	1.277±0.044
Lower Mouth Birch Creek	8/31/2002	0.19	1.299±0.037
Yukon River below Porcupine River	9/2/2002	--	--
Hadweenzic River	9/2/2002	0.27	1.256±0.041
Yukon River at Joe Devlin Island	9/2/2002	0.78	1.441±0.024
Beaver Creek	9/3/2002	0.28	1.593±0.019
Hodzana River	9/3/2002	0.21	1.423±0.017
Yukon River below Hodzana River	9/4/2002	--	--
Yukon River at Timber Point	9/4/2002	0.77	1.447±0.033
Yukon River at Adams Island	9/4/2002	--	--
Dall River	9/4/2002	0.34	1.371±0.044
Yukon River near Stevens Village	9/4/2002	0.74	1.453±0.012

Table 12. Uranium concentration and $^{234}U/^{238}U$ activity ratios, year 2003

[Site name, refer to Table 2 and Plate 1 for location; U, uranium; μg/L, micrograms per liter; --, not available]

Site	Date	U (μg/L)	$^{234}U/^{238}U$ Activity Ratio (±1 sigma uncertainty)
Trip 1			
Yukon River near Stevens Village	6/4/2003	--	--
Ray River	6/4/2003	1.70	1.426±0.011
Yukon River below Ray River	6/4/2003	--	--
Hess Creek	6/4/2003	0.12	--
Yukon River below Hess Creek	6/4/2003	--	--
Tozitna River	6/5/2003	0.32	--
Yukon River below Tozitna River	6/5/2003	--	--
Nowitna River	6/6/2003	0.10	--
Yukon River below Nowitna River	6/6/2003	--	--
Melozitna River	6/6/2003	0.76	1.429±0.020
Yukon River below Melozitna River	6/8/2003	--	--
Yukon River at Ruby	6/8/2003	0.66	1.374±0.032
Yuki River	6/8/2003	0.05	--
Yukon River below Yuki River	6/8/2003	--	--
Koyukuk River	6/9/2003	0.38	1.374±0.015
Yukon River below Koyukuk River	6/9/2003	--	--
Nulato River	6/9/2003	0.07	2.647±0.034
Yukon River at Kaltag	6/10/2003	0.60	1.491±0.027
Anvik River	6/11/2003	0.02	--
Yukon River below Anvik River	6/11/2003	--	--
Bonasila River	6/11/2003	0.02	--
Yukon River below Bonasila River	6/11/2003	--	--
Innoko River	6/12/2003	0.15	1.610±0.013
Yukon River below Innoko River	6/12/2003	--	--
Atchuelinguk River	6/13/2003	0.31	1.459±0.011
Yukon River at Pilot Station	6/13/2003	--	--
Andreafsky River	6/13/2003	0.05	--

Table 12. Uranium concentration and $^{234}U/^{238}U$ activity ratios, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; U, uranium; μg/L, micrograms per liter; --, not available]

Site	Date	U (μg/L)	$^{234}U/^{238}U$ Activity Ratio (±1 sigma uncertainty)
Trip 2			
Yukon River near Stevens Village	8/24/2003	--	--
Ray River	8/25/2003	1.11	1.466±0.016
Yukon River below Ray River	8/25/2003	--	--
Hess Creek	8/25/2003	0.15	1.372±0.040
Yukon River below Hess Creek	8/25/2003	--	--
Tozitna River	8/26/2003	0.22	1.373±0.009
Yukon River below Tozitna River	8/26/2003	--	--
Nowitna River	8/27/2003	0.22	2.585±0.022
Yukon River below Nowitna River	8/27/2003	--	--
Melozitna River	8/27/2003	0.22	1.341±0.006
Yukon River below Melozitna River	8/28/2003	--	--
Yukon River at Ruby	8/28/2003	0.80	1.403±0.011
Yuki River	8/28/2003	0.09	1.484±0.019
Yukon River below Yuki River	8/28/2003	--	--
Koyukuk River	8/29/2003	0.87	1.344±0.011
Yukon River below Koyukuk River	8/29/2003	--	--
Nulato River	8/30/2002	0.12	2.466±0.017
Yukon River at Kaltag	8/30/2003	0.80	1.373±0.028
Anvik River	9/1/2003	0.03	2.491±0.029
Yukon River below Anvik River	9/1/2003	--	--
Bonasila River	9/1/2003	0.02	1.684±0.032
Yukon River below Bonasila River	9/1/2003	--	--
Innoko River	9/2/2003	0.15	1.468±0.022
Yukon River below Innoko River	9/2/2003	--	--
Atchuelinguk River	9/3/2003	0.48	1.374±0.012
Yukon River at Pilot Station	9/3/2003	--	--
Andreafsky River	9/3/2003	0.05	2.339±0.025

Nutrients

by Howard E. Taylor and Jacques Finlay

A description of processing of samples for nitrite (NO_2), ammonium (NH_4), and phosphate (PO_4) is found in Antweiler and others (1996). A description of processing of samples for total dissolved nitrate (TDN) and total dissolved phosphorus (TDP) is found in Valderrama (1981). A description of processing of samples for soluble reactive phosphorus (SRP) is found in Eaton and others (1995). A description of processing of samples for particulate phosphorus (PP) is found in Strickland and Parsons (1972). Sample analysis results for year 2002 are given in table 13, and results for year 2003 are given in table 14.

Table 13. Nutrient concentrations, year 2002

[Site name, refer to Table 1 and Plate 1 for location; N, nitrogen; P, phosphorus; NO_2, nitrite; NH_4, ammonium; PO_4, phosphate; mg N/L, milligrams N per liter; µg P/L, micrograms P per liter; <, less than; --, not available]

Site	Date	Total Dissolved N (mg N/L)	Total Dissolved P (µg P/L)	Soluble Reactive P (µg P/L)	Particulate P (µg P/L)	NO_2 (mg N/L)	NH_4 (mg N/L)	PO_4 (mg P/L)
Trip 1								
Yukon River at Eagle	6/11/2002	--	3.58	--	163.91	--	--	--
Nation River	6/13/2002	0.35	3.71	0.24	45.75	0.002	< 0.008	< 0.008
Kandik River	6/15/2002	--	--	--	--	0.002	< 0.008	< 0.008
Coal Creek	6/15/2002	--	--	--	--	--	--	--
Charley River	6/16/2002	--	--	--	--	< 0.001	< 0.008	< 0.008
Woodchopper Creek	6/16/2002	--	--	--	--	--	--	--
Yukon River above Circle	6/17/2002	0.21	10.71	1.44	129.26	< 0.001	< 0.008	< 0.008
Sheenjek River	6/20/2002	0.20	7.18	<0.10	29.40	< 0.001	< 0.008	< 0.008
Black River	6/20/2002	0.40	14.98	1.12	12.31	0.002	< 0.008	< 0.008
Upper Mouth Birch Creek	6/21/2002	0.40	4.44	<0.10	14.31	0.001	< 0.008	< 0.008
Chandalar River	6/22/2002	0.13	2.88	<0.10	11.46	< 0.001	< 0.008	< 0.008
Christian River	6/22/2002	0.40	37.19	10.41	19.43	< 0.001	< 0.008	< 0.008
Lower Mouth Birch Creek	6/23/2002	--	--	1.80	--	0.002	< 0.008	< 0.008
Yukon River at Timber Point	6/24/2002	--	10.16	1.02	114.84	< 0.001	< 0.008	< 0.008
Hodzana River	6/25/2002	--	17.29	1.65	5.16	< 0.001	< 0.008	< 0.008
Yukon River near Stevens Village	6/24/2002	--	--	--	--	--	--	--

Table 13. Nutrient concentrations, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; N, nitrogen; P, phosphorus; NO_2, nitrite; NH_4, ammonium; PO_4, phosphate; mg N/L, milligrams N per liter; µg P/L, micrograms phosphorus per liter; <, less than; --, not available]

Site	Date	Total Dissolved N (mg N/L)	Total Dissolved P (µg P/L)	Soluble Reactive P (µg P/L)	Particulate P (µg P/L)	NO_2 (mg N/L)	NH_4 (mg N/L)	PO_4 (mg P/L)
Trip 2								
Yukon River at Eagle	8/22/2002	--	--	--	--	--	--	--
Yukon River below Tatonduk River	8/23/2002	--	--	--	--	--	--	--
Nation River	8/23/2002	0.39	--	1.50	27.12	0.004	0.015	< 0.02
Yukon River below Nation River	8/23/2002	--	--	--	--	--	--	--
Kandik River	8/24/2002	0.35	5.46	2.07	11.21	0.003	< 0.007	< 0.02
Yukon River below Kandik River	8/23/2002	--	--	--	--	--	--	--
Charley River	8/24/2002	0.35	3.41	<0.10	--	< 0.002	< 0.007	< 0.02
Yukon River below Charley River	8/23/2002	--	--	--	--	--	--	--
Coal Creek	8/25/2002	--	--	1.54	7.44	0.003	< 0.007	< 0.02
Yukon River below Coal Creek	8/25/2002	--	--	--	--	--	--	--
Woodchopper Creek	8/24/2002	0.53	--	1.13	2.31	0.004	0.011	< 0.02
Yukon River below Woodchopper Creek	8/25/2002	--	--	--	--	--	--	--
Yukon River above Circle	8/26/2002	0.23	4.90	2.15	318.48	0.002	< 0.007	< 0.02
Yukon River above Twentytwo Mile Village	8/27/2002	--	--	--	--	--	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--	--	--	--	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--	--	--	--	--	--
Sheenjek River	8/28/2002	0.11	17.31	<0.10	--	0.003	0.019	< 0.02
Black River	8/28/2002	0.35	19.09	0.66	2.42	0.005	< 0.007	< 0.02
Porcupine River 9.5 miles upstream from mouth	8/28/2002	0.30	--	0.98	10.11	0.002	< 0.007	< 0.02
Chandalar River	8/30/2002	0.13	3.07	<0.10	--	0.002	0.015	< 0.02
Christian River	8/30/2002	0.25	6.69	<0.10	8.45	0.002	< 0.007	< 0.02
Upper Mouth Birch Creek	8/31/2002	0.46	11.60	0.15	14.56	0.002	< 0.007	< 0.02
Lower Mouth Birch Creek	8/31/2002	0.42	1.42	0.38	31.98	0.002	< 0.007	< 0.02
Yukon River below Porcupine River	9/2/2002	--	--	--	--	--	--	--
Hadweenzic River	9/2/2002	0.31	7.87	0.87	1.21	< 0.002	0.017	< 0.02
Yukon River at Joe Devlin Island	9/2/2002	0.20	26.65	1.68	111.14	--	--	--
Beaver Creek	9/3/2002	0.24	7.97	<0.10	8.05	0.003	< 0.007	< 0.02
Hodzana River	9/3/2002	0.09	5.15	0.55	--	< 0.002	< 0.007	< 0.02
Yukon River below Hodzana River	9/4/2002	--	--	--	--	--	--	--
Yukon River at Timber Point	9/4/2002	0.19	--	3.24	100.78	0.003	< 0.007	< 0.02
Yukon River at Adams Island	9/4/2002	--	--	--	--	--	--	--
Dall River	9/4/2002	0.33	7.75	1.90	4.61	0.004	< 0.007	< 0.02
Yukon River near Stevens Village	9/4/2002	--	--	--	--	--	--	--

Table 14. Nutrient concentrations, year 2003

[Site name, refer to Table 2 and Plate 1 for location; N, nitrogen; P, phosphorus; NO_2, nitrite; NH_4, ammonium; PO_4, phosphate; mg N/L, milligrams N per liter; µg P/L, micrograms phosphorus per liter; <, less than; --, not available]

Site	Date	Total Dissolved N (mg N/L)	Total Dissolved P (µg P/L)	Soluble Reactive P (µg P/L)	Particulate P (µg P/L)	NO_2 (mg N/L)	NH_4 (mg N/L)	PO_4 (mg P/L)
Trip 1								
Yukon River near Stevens Village	6/4/2003	--	--	--	--	--	--	--
Ray River	6/4/2003	0.60	10.67	6.01	63.95	0.004	<0.003	<0.004
Yukon River below Ray River	6/4/2003	--	--	--	--	--	--	--
Hess Creek	6/4/2003	0.61	4.28	3.56	--	0.004	<0.003	<0.004
Yukon River below Hess Creek	6/4/2003	--	--	--	--	--	--	--
Tozitna River	6/5/2003	0.44	11.08	2.82	71.07	0.003	<0.003	<0.004
Yukon River below Tozitna River	6/5/2003	--	--	--	--	--	--	--
Nowitna River	6/6/2003	0.67	17.81	3.87	132.72	0.005	0.007	0.005
Yukon River below Nowitna River	6/6/2003	--	--	--	--	--	--	--
Melozitna River	6/6/2003	0.46	10.14	3.91	88.62	0.003	<0.003	<0.004
Yukon River below Melozitna River	6/8/2003	--	--	--	--	--	--	--
Yukon River at Ruby	6/8/2003	0.31	8.19	1.32	348.17	0.002	0.014	<0.004
Yuki River	6/8/2003	0.55	18.77	7.20	19.86	<0.001	0.062	0.027
Yukon River below Yuki River	6/8/2003	--	--	--	--	--	--	--
Koyukuk River	6/9/2003	0.34	4.93	1.23	342.12	0.003	0.012	<0.004
Yukon River below Koyukuk River	6/9/2003	--	--	--	--	--	--	--
Nulato River	6/9/2003	0.31	5.11	1.90	47.98	0.003	0.010	<0.004
Yukon River at Kaltag	6/10/2003	0.30	7.57	1.14	321.81	0.003	0.013	<0.004
Anvik River	6/11/2003	0.20	7.90	3.58	25.72	<0.001	<0.003	<0.004
Yukon River below Anvik River	6/11/2003	--	--	--	--	--	--	--
Bonasila River	6/11/2003	0.18	12.25	3.88	20.86	0.001	<0.003	0.004
Yukon River below Bonasila River	6/11/2003	--	--	--	--	--	--	--
Innoko River	6/12/2003	0.46	27.75	7.95	37.82	0.004	0.004	0.014
Yukon River below Innoko River	6/12/2003	--	--	--	--	--	--	--
Atchuelinguk River	6/13/2003	0.25	7.88	1.51	12.22	0.002	<0.003	0.004
Yukon River at Pilot Station	6/13/2003	--	--	--	--	--	--	--
Andreafsky River	6/13/2003	0.12	14.81	4.29	4.18	<0.001	<0.003	0.004

Table 14. Nutrient concentrations, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; N, nitrogen; P, phosphorus; NO_2, nitrite; NH_4, ammonium; PO_4, phosphate; mg N/L, milligrams N per liter; µg P/L, micrograms phosphorus per liter; <, less than; --, not available]

Site	Date	Total Dissolved N (mg N/L)	Total Dissolved P (µg P/L)	Soluble Reactive P (µg P/L)	Particulate P (µg P/L)	NO_2 (mg N/L)	NH_4 (mg N/L)	PO_4 (mg P/L)
Trip 2								
Yukon River near Stevens Village	8/24/2003	0.30	2.11	4.09	--	0.001	<0.005	<0.004
Ray River	8/25/2003	0.47	3.06	2.05	6.74	<0.001	<0.005	<0.004
Yukon River below Ray River	8/25/2003	--	--	--	--	--	--	--
Hess Creek	8/25/2003	0.83	7.25	3.83	168.36	0.003	<0.005	<0.004
Yukon River below Hess Creek	8/25/2003	--	--	--	--	--	--	--
Tozitna River	8/26/2003	0.50	15.06	4.86	81.11	0.001	<0.005	<0.004
Yukon River below Tozitna River	8/26/2003	--	--	--	--	--	--	--
Nowitna River	8/27/2003	0.57	22.48	6.47	19.39	0.004	<0.005	0.007
Yukon River below Nowitna River	8/27/2003	--	--	--	--	--	--	--
Melozitna River	8/27/2003	0.43	3.83	3.44	10.53	0.001	<0.005	<0.004
Yukon River below Melozitna River	8/28/2003	--	--	--	--	--	--	--
Yukon River at Ruby	8/28/2003	0.33	2.00	1.06	188.46	<0.001	<0.005	<0.004
Yuki River	8/28/2003	0.55	8.68	4.34	62.02	0.003	<0.005	<0.004
Yukon River below Yuki River	8/28/2003	--	--	--	--	--	--	--
Koyukuk River	8/29/2003	0.39	2.11	4.20	92.30	0.002	0.008	<0.004
Yukon River below Koyukuk River	8/29/2003	--	--	--	--	--	--	--
Nulato River	8/30/2002	0.39	2.00	0.73	4.82	0.002	<0.005	<0.004
Yukon River at Kaltag	8/30/2003	0.33	2.68	3.26	154.97	0.002	<0.005	<0.004
Anvik River	9/1/2003	0.28	2.87	3.67	14.46	0.001	<0.005	<0.004
Yukon River below Anvik River	9/1/2003	--	--	--	--	--	--	--
Bonasila River	9/1/2003	0.36	23.05	11.43	27.04	0.003	0.015	0.020
Yukon River below Bonasila River	9/1/2003	--	--	--	--	--	--	--
Innoko River	9/2/2003	0.55	22.10	12.92	69.27	0.006	<0.005	0.018
Yukon River below Innoko River	9/2/2003	--	--	--	--	--	--	--
Atchuelinguk River	9/3/2003	0.35	1.92	3.90	76.75	0.001	<0.005	<0.004
Yukon River at Pilot Station	9/3/2003	0.35	15.06	2.70	--	0.019	0.010	0.006
Andreafsky River	9/3/2003	0.27	0.40	3.36	4.40	<0.001	<0.005	<0.004

Suspended Sediment Concentration

by Timothy P. Brabets

A description for sample processing for sediment concentration can be found in Guy (1969). Sample analysis results for year 2002 are given in table 15, and results for year 2003 are given in table 16.

Table 15. Suspended sediment concentrations, year 2002

[Site name, refer to Table 1 and Plate 1 for location; mg/L, milligrams per liter; mm, millimeter; %, percent; <, less than; --, not available]

Site	Date	Suspended Sediment (mg/L)	Sediment, Susp. (Sieve diam. % < 0.063 mm)
Trip 1			
Yukon River at Eagle	6/11/2002	286	61
Nation River	6/13/2002	54	84
Kandik River	6/15/2002	12	81
Coal Creek	6/15/2002	6	96
Charley River	6/16/2002	8	57
Woodchopper Creek	6/16/2002	6	71
Yukon River above Circle	6/17/2002	271	52
Sheenjek River	6/20/2002	52	84
Black River	6/20/2002	15	84
Upper Mouth Birch Creek	6/21/2002	63	31
Chandalar River	6/22/2002	28	81
Christian River	6/22/2002	20	93
Lower Mouth Birch Creek	6/23/2002	--	--
Yukon River at Timber Point	6/24/2002	--	--
Hodzana River	6/25/2002	8	77
Yukon River near Stevens Village	6/24/2002	226	60

Table 15. Suspended sediment concentrations, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; mg/L, milligrams per liter; mm, millimeter; --, not available]

Site	Date	Suspended Sediment (mg/L)	Sediment, Susp. (Sieve diam. % < 0.063 mm)
Trip 2			
Yukon River at Eagle	8/22/2002	--	--
Yukon River below Tatonduk River	8/23/2002	--	--
Nation River	8/23/2002	38	82
Yukon River below Nation River	8/23/2002	--	--
Kandik River	8/24/2002	19	83
Yukon River below Kandik River	8/23/2002	--	--
Charley River	8/24/2002	14	62
Yukon River below Charley River	8/23/2002	--	--
Coal Creek	8/25/2002	23	87
Yukon River below Coal Creek	8/25/2002	--	--
Woodchopper Creek	8/24/2002	17	77
Yukon River below Woodchopper Creek	8/25/2002	--	--
Yukon River above Circle	8/26/2002	478	71
Yukon River above Twentytwo Mile Village	8/27/2002	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--
Sheenjek River	8/28/2002	6	75
Black River	8/28/2002	7	76
Porcupine River 9.5 miles upstream from mouth	8/28/2002	22	75
Chandalar River	8/30/2002	3	36
Christian River	8/30/2002	10	93
Upper Mouth Birch Creek	8/31/2002	24	91
Lower Mouth Birch Creek	8/31/2002	58	89
Yukon River below Porcupine River	9/2/2002	--	--
Hadweenzic River	9/2/2002	6	82
Yukon River at Joe Devlin Island	9/2/2002	212	85
Beaver Creek	9/3/2002	15	92
Hodzana River	9/3/2002	3	66
Yukon River below Hodzana River	9/4/2002	--	--
Yukon River at Timber Point	9/4/2002	172	76
Yukon River at Adams Island	9/4/2002	--	--
Dall River	9/4/2002	8	70
Yukon River near Stevens Village	9/4/2002	245	74

Table 16. Suspended sediment concentrations, year 2003

[Site name, refer to Table 2 and Plate 1 for location; mg/L, milligrams per liter; mm, millimeter; --, not available]

Site	Date	Suspended Sediment (mg/L)	Sediment, Susp. (Sieve diam. % < 0.063 mm)
Trip 1			
Yukon River near Stevens Village	6/4/2003	--	--
Ray River	6/4/2003	81	98
Yukon River below Ray River	6/4/2003	--	--
Hess Creek	6/4/2003	10	94
Yukon River below Hess Creek	6/4/2003	--	--
Tozitna River	6/5/2003	132	89
Yukon River below Tozitna River	6/5/2003	--	--
Nowitna River	6/6/2003	195	96
Yukon River below Nowitna River	6/6/2003	--	--
Melozitna River	6/6/2003	188	88
Yukon River below Melozitna River	6/8/2003	--	--
Yukon River at Ruby	6/8/2003	717	68
Yuki River	6/8/2003	18	76
Yukon River below Yuki River	6/8/2003	--	--
Koyukuk River	6/9/2003	735	80
Yukon River below Koyukuk River	6/9/2003	--	--
Nulato River	6/9/2003	73	87
Yukon River at Kaltag	6/10/2003	669	75
Anvik River	6/11/2003	28	92
Yukon River below Anvik River	6/11/2003	--	--
Bonasila River	6/11/2003	7	79
Yukon River below Bonasila River	6/11/2003	--	--
Innoko River	6/12/2003	22	92
Yukon River below Innoko River	6/12/2003	--	--
Atchuelinguk River	6/13/2003	9	88
Yukon River at Pilot Station	6/13/2003	--	--
Andreafsky River	6/13/2003	4	73

Table 16. Suspended sediment concentrations, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; mg/L, milligrams per liter; mm, millimeter; --, not available]

Site	Date	Suspended Sediment (mg/L)	Sediment, Susp. (Sieve diam. % < 0.063 mm)
Trip 2			
Yukon River near Stevens Village	8/24/2003	--	--
Ray River	8/25/2003	7	66
Yukon River below Ray River	8/25/2003	--	--
Hess Creek	8/25/2003	363	98
Yukon River below Hess Creek	8/25/2003	--	--
Tozitna River	8/26/2003	152	92
Yukon River below Tozitna River	8/26/2003	--	--
Nowitna River	8/27/2003	17	83
Yukon River below Nowitna River	8/27/2003	--	--
Melozitna River	8/27/2003	14	93
Yukon River below Melozitna River	8/28/2003	--	--
Yukon River at Ruby	8/28/2003	347	86
Yuki River	8/28/2003	66	97
Yukon River below Yuki River	8/28/2003	--	--
Koyukuk River	8/29/2003	191	88
Yukon River below Koyukuk River	8/29/2003	--	--
Nulato River	8/30/2002	7	71
Yukon River at Kaltag	8/30/2003	318	82
Anvik River	9/1/2003	11	55
Yukon River below Anvik River	9/1/2003	--	--
Bonasila River	9/1/2003	4	91
Yukon River below Bonasila River	9/1/2003	--	--
Innoko River	9/2/2003	45	95
Yukon River below Innoko River	9/2/2003	--	--
Atchuelinguk River	9/3/2003	73	98
Yukon River at Pilot Station	9/3/2003	--	--
Andreafsky River	9/3/2003	6	74

Particulate Carbon and Particulate Nitrogen

by Paul F. Schuster and Michael M. Reddy

A description of sample collection and processing of samples for particulate carbon (PC) and particulate nitrogen (PN) concentrations is given in Schuster (2003). Sample analysis results for year 2002 are given in table 17, and results for year 2003 are given in table 18.

Table 17. Particulate carbon and particulate nitrogen concentrations, year 2002

[Site name, refer to Table 1 and Plate 1 for location; PC, particulate carbon; PN, particulate nitrogen; mg/L, milligrams per liter; <, less than; --, not available; concentrations averaged from duplicate samples]

Site	Date	PC (mg/L)	PN (mg/L)
Trip 1			
Yukon River at Eagle	6/11/2002	--	--
Nation River	6/13/2002	2.01	0.17
Kandik River	6/15/2002	--	--
Coal Creek	6/15/2002	--	--
Charley River	6/16/2002	--	--
Woodchopper Creek	6/16/2002	--	--
Yukon River above Circle	6/17/2002	3.43	0.16
Sheenjek River	6/20/2002	--	--
Black River	6/20/2002	0.51	<0.01
Upper Mouth Birch Creek	6/21/2002	0.81	0.07
Chandalar River	6/22/2002	0.76	0.04
Christian River	6/22/2002	0.59	0.06
Lower Mouth Birch Creek	6/23/2002	--	--
Yukon River at Timber Point	6/24/2002	2.93	0.13
Hodzana River	6/25/2002	0.19	0.02
Yukon River near Stevens Village	6/24/2002	7.04	0.16

Table 17. Particulate carbon and particulate nitrogen concentrations, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; PC, particulate carbon; PN, particulate nitrogen; mg/L, milligrams per liter; <, less than; --, not available; concentrations averaged from duplicate samples]

Site	Date	PC (mg/L)	PN (mg/L)
Trip 2			
Yukon River at Eagle	8/22/2002	--	--
Yukon River below Tatonduk River	8/23/2002	--	--
Nation River	8/23/2002	2.06	0.13
Yukon River below Nation River	8/23/2002	--	--
Kandik River	8/24/2002	0.68	0.04
Yukon River below Kandik River	8/23/2002	--	--
Charley River	8/24/2002	0.70	0.05
Yukon River below Charley River	8/23/2002	--	--
Coal Creek	8/25/2002	0.71	0.04
Yukon River below Coal Creek	8/25/2002	--	--
Woodchopper Creek	8/24/2002	0.77	0.04
Yukon River below Woodchopper Creek	8/25/2002	--	--
Yukon River above Circle	8/26/2002	9.78	0.34
Yukon River above Twentytwo Mile Village	8/27/2002	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--
Sheenjek River	8/28/2002	0.13	<.01
Black River	8/28/2002	0.28	0.03
Porcupine River 9.5 miles upstream from mouth	8/28/2002	0.94	0.07
Chandalar River	8/30/2002	0.13	<.01
Christian River	8/30/2002	0.40	0.04
Upper Mouth Birch Creek	8/31/2002	0.95	0.08
Lower Mouth Birch Creek	8/31/2002	2.52	0.19
Yukon River below Porcupine River	9/2/2002	--	--
Hadweenzic River	9/2/2002	0.22	0.02
Yukon River at Joe Devlin Island	9/2/2002	4.40	0.18
Beaver Creek	9/3/2002	0.44	0.04
Hodzana River	9/3/2002	0.17	0.02
Yukon River below Hodzana River	9/4/2002	--	--
Yukon River at Timber Point	9/4/2002	3.71	0.16
Yukon River at Adams Island	9/4/2002	--	--
Dall River	9/4/2002	0.28	0.04
Yukon River near Stevens Village	9/4/2002	0.42	0.03

Table 18. Particulate carbon and particulate nitrogen concentrations, year 2003

[Site name, refer to Table 2 and Plate 1 for location; PC, particulate carbon; PN, particulate nitrogen; mg/L, milligrams per liter; <, less than; --, not available; concentrations averaged from duplicate samples]

Site	Date	PC (mg/L)	PN (mg/L)
Trip 1			
Yukon River near Stevens Village	6/4/2003	6.82	0.35
Ray River	6/4/2003	3.66	0.31
Yukon River below Ray River	6/4/2003	--	--
Hess Creek	6/4/2003	<0.06	<0.01
Yukon River below Hess Creek	6/4/2003	--	--
Tozitna River	6/5/2003	3.99	0.30
Yukon River below Tozitna River	6/5/2003	--	--
Nowitna River	6/6/2003	6.89	0.52
Yukon River below Nowitna River	6/6/2003	--	--
Melozitna River	6/6/2003	6.65	0.50
Yukon River below Melozitna River	6/8/2003	--	--
Yukon River at Ruby	6/8/2003	9.40	0.50
Yuki River	6/8/2003	1.03	0.09
Yukon River below Yuki River	6/8/2003	--	--
Koyukuk River	6/9/2003	9.24	0.70
Yukon River below Koyukuk River	6/9/2003	--	--
Nulato River	6/9/2003	1.33	0.12
Yukon River at Kaltag	6/10/2003	8.30	0.49
Anvik River	6/11/2003	0.79	0.07
Yukon River below Anvik River	6/11/2003	--	--
Bonasila River	6/11/2003	0.78	0.11
Yukon River below Bonasila River	6/11/2003	--	--
Innoko River	6/12/2003	0.97	0.08
Yukon River below Innoko River	6/12/2003	--	--
Atchuelinguk River	6/13/2003	0.49	0.06
Yukon River at Pilot Station	6/13/2003	3.81	0.24
Andreafsky River	6/13/2003	0.28	0.04

Table 18. Particulate carbon and particulate nitrogen concentrations, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; PC, particulate carbon; PN, particulate nitrogen; mg/L, milligrams per liter; <, less than; --, not available; concentrations averaged from duplicate samples]

Site	Date	PC (mg/L)	PN (mg/L)
Trip 2			
Yukon River near Stevens Village	8/24/2003	6.22	0.13
Ray River	8/25/2003	0.18	0.02
Yukon River below Ray River	8/25/2003	--	--
Hess Creek	8/25/2003	12.40	0.87
Yukon River below Hess Creek	8/25/2003	--	--
Tozitna River	8/26/2003	4.14	0.30
Yukon River below Tozitna River	8/26/2003	--	--
Nowitna River	8/27/2003	0.67	0.05
Yukon River below Nowitna River	8/27/2003	--	--
Melozitna River	8/27/2003	0.69	0.05
Yukon River below Melozitna River	8/28/2003	--	--
Yukon River at Ruby	8/28/2003	5.20	0.15
Yuki River	8/28/2003	2.40	0.17
Yukon River below Yuki River	8/28/2003	--	--
Koyukuk River	8/29/2003	2.53	0.18
Yukon River below Koyukuk River	8/29/2003	--	--
Nulato River	8/30/2002	0.28	0.02
Yukon River at Kaltag	8/30/2003	4.99	0.17
Anvik River	9/1/2003	0.35	0.03
Yukon River below Anvik River	9/1/2003	--	--
Bonasila River	9/1/2003	0.48	0.04
Yukon River below Bonasila River	9/1/2003	--	--
Innoko River	9/2/2003	1.13	0.08
Yukon River below Innoko River	9/2/2003	--	--
Atchuelinguk River	9/3/2003	0.85	0.06
Yukon River at Pilot Station	9/3/2003	3.71	0.16
Andreafsky River	9/3/2003	0.19	0.02

Suspended Sediment Chemistry

by Arthur J. Horowitz

A description of sample collection and processing of samples for suspended sediment chemistry is given in Schuster (2003). Sample analysis results for year 2002 are given in table 19, and results for year 2003 are given in table 20.

Table 19. Suspended sediment chemistry, year 2002

[Site name, refer to Table 1 and Plate 1 for location; mg/L, milligrams per liter; ppm, parts per million; %, percent; <, less than; NR/IS, not reported/insufficient sample]

Site	Date	Suspended Sediment (mg/L)	Silver (ppm)	Copper (ppm)	Lead (ppm)	Zinc (ppm)	Cadmium (ppm)	Chromium (ppm)	Cobalt (ppm)	Nickel (ppm)
Nation River	6/13/2002	46	0.6	44	29	290	1.8	140	22	83
Yukon River above Circle	6/17/2002	183	<0.5	36	17	140	0.7	97	17	52
Black River	6/20/2002	9	1.4	37	38	240	4.3	210	21	130
Yukon River above Circle	8/26/2002	507	<0.5	34	10	90	0.4	99	16	47
Yukon River at Timber Point	9/2/2002	210	<0.5	38	13	140	0.6	110	16	60
Yukon River at Joe Devlin Island	9/2/2002	233	<0.5	41	16	160	0.9	110	18	63

Site	Date	Barium (ppm)	Vanadium (ppm)	Lithium (ppm)	Beryllium (ppm)	Molybdenum (ppm)	Phosphorus (ppm)	Strontium (ppm)	Arsenic (ppm)	Antimony (ppm)
Nation River	6/13/2002	870	180	44	1.8	6	1200	150	11	1.6
Yukon River above Circle	6/17/2002	1000	140	28	1.5	3	1000	310	12	1.6
Black River	6/20/2002	1000	150	35	1.9	15	1300	210	23	2.8
Yukon River above Circle	8/26/2002	770	130	24	1.4	2	1000	350	11	1.5
Yukon River at Timber Point	9/2/2002	1100	140	31	1.6	3	990	280	14	1.9
Yukon River at Joe Devlin Island	9/2/2002	1200	150	31	1.7	3	1000	300	17	2.0

Site	Date	Selenium (ppm)	Mercury (ppm)	Thallium (ppm)	Uranium (ppm)	Iron (%)	Manganese (ppm)	Aluminum (%)	Titanium (%)
Nation River	6/13/2002	2.1	0.10	<50	<50	3.9	1000	6.6	0.42
Yukon River above Circle	6/17/2002	0.7	0.05	<50	<50	4.1	940	6.8	0.45
Black River	6/20/2002	2.3	NR/IS	<200	<200	4.8	2000	6.1	0.42
Yukon River above Circle	8/26/2002	0.8	0.10	<50	<50	3.9	765	6.5	0.45
Yukon River at Timber Point	9/2/2002	1.1	0.10	<50	<50	3.9	850	6.5	0.41
Yukon River at Joe Devlin Island	9/2/2002	1.1	0.28	<50	<50	4.1	920	6.7	0.45

Site	Date	Total Organic Carbon (%)	Total Carbon (%)	Total Nitrogen (%)
Nation River	6/13/2002	6.4	6.9	0.52
Yukon River above Circle	6/17/2002	1.4	2.4	0.10
Black River	6/20/2002	NR/IS	NR/IS	NR/IS
Yukon River above Circle	8/26/2002	1.0	2.5	<0.1
Yukon River at Timber Point	9/2/2002	1.1	2.1	0.12
Yukon River at Joe Devlin Island	9/2/2002	1.3	2.3	0.15

Table 20. Suspended sediment chemistry, year 2003

[Site name, refer to Table 2 and Plate 1 for location; mg/L, milligrams per liter; ppm, parts per million; %, percent; <, less than; NR/IS, not reported/insufficient sample]

Site	Date	Suspended Sediment (mg/L)	Silver (ppm)	Copper (ppm)	Lead (ppm)	Zinc (ppm)	Cadmium (ppm)	Chromium (ppm)	Cobalt (ppm)	Nickel (ppm)
Koyukuk River	6/9/2003	713	<0.5	29	18	140	0.8	92	16	48
Yukon River at Kaltag	6/10/2003	679	<0.5	26	15	100	0.6	90	12	44
Yukon River at Ruby	8/28/2003	423	<0.5	43	15	110	0.4	110	18	56
Koyukuk River	8/29/2003	201	<0.5	41	21	150	0.4	130	20	67
Yukon River at Kaltag	8/30/2003	374	<0.5	41	15	110	0.3	110	18	55

Site	Date	Barium (ppm)	Vanadium (ppm)	Lithium (ppm)	Beryllium (ppm)	Molybdenum (ppm)	Phosphorus (ppm)	Strontium (ppm)	Arsenic (ppm)	Antimony (ppm)
Koyukuk River	6/9/2003	580	130	33	1.9	1	690	110	16	1.8
Yukon River at Kaltag	6/10/2003	690	110	22	1.5	2	730	200	14	1.5
Yukon River at Ruby	8/28/2003	840	140	29	1.3	3	810	260	14	1.8
Koyukuk River	8/29/2003	680	170	49	1.8	3	760	130	15	1.7
Yukon River at Kaltag	8/30/2003	820	140	32	1.3	2	830	240	14	1.8

Site	Date	Selenium (ppm)	Mercury (ppm)	Thallium (ppm)	Uranium (ppm)	Iron (%)	Manganese (ppm)	Aluminum (%)	Titanium (%)
Koyukuk River	6/9/2003	0.6	0.05	<50	<50	3.7	760	5.9	0.36
Yukon River at Kaltag	6/10/2003	0.5	0.06	<50	<50	3.1	660	5.5	0.32
Yukon River at Ruby	8/28/2003	0.4	0.02	<50	<50	4.2	790	7.3	0.42
Koyukuk River	8/29/2003	0.4	0.07	<50	<50	4.7	860	7.8	0.47
Yukon River at Kaltag	8/30/2003	0.4	0.02	<50	<50	4.3	810	7.3	0.45

Site	Date	Total Organic Carbon (%)	Total Carbon (%)	Total Nitrogen (%)
Koyukuk River	6/9/2003	1.4	1.7	0.16
Yukon River at Kaltag	6/10/2003	1.4	1.8	NR/IS
Yukon River at Ruby	8/28/2003	0.8	1.7	0.06
Koyukuk River	8/29/2003	1.5	1.4	0.14
Yukon River at Kaltag	8/30/2003	1.3	1.6	0.07

Percent Organic Matter

by Paul F. Schuster and Michael M. Reddy

A description of sample collection and processing of samples for percent organic matter (OM) in the sediment is given in Schuster (2003). Sample analysis results for year 2002 are given in table 21, and results for year 2003 are given in table 22.

Table 21. Percent organic matter, year 2002

[Site name, refer to Table 1 and Plate 1 for location; OM, organic matter; --, not available]

Site	Date	Percent OM in Sediment
Trip 1		
Yukon River at Eagle	6/11/2002	--
Nation River	6/13/2002	24
Kandik River	6/15/2002	60
Coal Creek	6/15/2002	--
Charley River	6/16/2002	64
Woodchopper Creek	6/16/2002	--
Yukon River above Circle	6/17/2002	12
Sheenjek River	6/20/2002	16
Black River	6/20/2002	25
Upper Mouth Birch Creek	6/21/2002	25
Chandalar River	6/22/2002	12
Christian River	6/22/2002	15
Lower Mouth Birch Creek	6/23/2002	--
Yukon River at Timber Point	6/24/2002	8
Hodzana River	6/25/2002	51
Yukon River near Stevens Village	6/24/2002	13

Table 21. Percent organic matter, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; OM, organic matter; --, not available]

Site	Date	Percent OM in Sediment
Trip 2		
Yukon River at Eagle	8/22/2002	--
Yukon River below Tatonduk River	8/23/2002	--
Nation River	8/23/2002	23
Yukon River below Nation River	8/23/2002	--
Kandik River	8/24/2002	44
Yukon River below Kandik River	8/23/2002	--
Charley River	8/24/2002	64
Yukon River below Charley River	8/23/2002	--
Coal Creek	8/25/2002	29
Yukon River below Coal Creek	8/25/2002	--
Woodchopper Creek	8/24/2002	31
Yukon River below Woodchopper Creek	8/25/2002	--
Yukon River above Circle	8/26/2002	6
Yukon River above Twentytwo Mile Village	8/27/2002	--
Yukon River near Halfway Whirlpool	8/27/2002	--
Yukon River above Twelvemile Island	8/27/2002	--
Sheenjek River	8/28/2002	100
Black River	8/28/2002	35
Porcupine River 9.5 miles upstream from mouth	8/28/2002	31
Chandalar River	8/30/2002	39
Christian River	8/30/2002	23
Upper Mouth Birch Creek	8/31/2002	17
Lower Mouth Birch Creek	8/31/2002	11
Yukon River below Porcupine River	9/2/2002	--
Hadweenzic River	9/2/2002	100
Yukon River at Joe Devlin Island	9/2/2002	10
Beaver Creek	9/3/2002	18
Hodzana River	9/3/2002	100
Yukon River below Hodzana River	9/4/2002	--
Yukon River at Timber Point	9/4/2002	10
Yukon River at Adams Island	9/4/2002	--
Dall River	9/4/2002	61
Yukon River near Stevens Village	9/4/2002	15

Table 22. Percent organic matter, year 2003

[Site name, refer to Table 2 and Plate 1 for location; OM, organic matter; <, less than; ND, not detected; --, not available]

Site	Date	Percent OM in Sediment
Trip 1		
Yukon River near Stevens Village	6/4/2003	7
Ray River	6/4/2003	15
Yukon River below Ray River	6/4/2003	--
Hess Creek	6/4/2003	ND
Yukon River below Hess Creek	6/4/2003	--
Tozitna River	6/5/2003	11
Yukon River below Tozitna River	6/5/2003	--
Nowitna River	6/6/2003	13
Yukon River below Nowitna River	6/6/2003	--
Melozitna River	6/6/2003	11
Yukon River below Melozitna River	6/8/2003	--
Yukon River at Ruby	6/8/2003	6
Yuki River	6/8/2003	55
Yukon River below Yuki River	6/8/2003	--
Koyukuk River	6/9/2003	7
Yukon River below Koyukuk River	6/9/2003	--
Nulato River	6/9/2003	9
Yukon River at Kaltag	6/10/2003	7
Anvik River	6/11/2003	18
Yukon River below Anvik River	6/11/2003	--
Bonasila River	6/11/2003	67
Yukon River below Bonasila River	6/11/2003	--
Innoko River	6/12/2003	28
Yukon River below Innoko River	6/12/2003	--
Atchuelinguk River	6/13/2003	49
Yukon River at Pilot Station	6/13/2003	7
Andreafsky River	6/13/2003	89

Table 22. Percent organic matter, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; OM, organic matter; <, less than; ND, not detected; --, not available]

Site	Date	Percent OM in Sediment
Trip 2		
Yukon River near Stevens Village	8/24/2003	8
Ray River	8/25/2003	100
Yukon River below Ray River	8/25/2003	--
Hess Creek	8/25/2003	10
Yukon River below Hess Creek	8/25/2003	--
Tozitna River	8/26/2003	12
Yukon River below Tozitna River	8/26/2003	--
Nowitna River	8/27/2003	32
Yukon River below Nowitna River	8/27/2003	--
Melozitna River	8/27/2003	32
Yukon River below Melozitna River	8/28/2003	--
Yukon River at Ruby	8/28/2003	8
Yuki River	8/28/2003	23
Yukon River below Yuki River	8/28/2003	--
Koyukuk River	8/29/2003	10
Yukon River below Koyukuk River	8/29/2003	--
Nulato River	8/30/2002	43
Yukon River at Kaltag	8/30/2003	9
Anvik River	9/1/2003	45
Yukon River below Anvik River	9/1/2003	--
Bonasila River	9/1/2003	100
Yukon River below Bonasila River	9/1/2003	--
Innoko River	9/2/2003	16
Yukon River below Innoko River	9/2/2003	--
Atchuelinguk River	9/3/2003	13
Yukon River at Pilot Station	9/3/2003	7
Andreafsky River	9/3/2003	100

Tritium

by Robert Michel

A description of processing of samples for tritium concentration is given in Thatcher and others (1977). Sample analysis results for year 2002 are given in table 23, and results for year 2003 are given in table 24.

Table 23. Tritium concentrations, year 2002

[Site name, refer to Table 1 and Plate 1 for location; TU, tritium units; --, not available]

Site	Date	Tritium (TU) (±1 sigma uncertainty)
Trip 1		
Yukon River at Eagle	6/11/2002	--
Nation River	6/13/2002	12.9±0.7
Kandik River	6/15/2002	13.1±0.8
Coal Creek	6/15/2002	14.5±0.8
Charley River	6/16/2002	13.9±0.8
Woodchopper Creek	6/16/2002	14.0±0.8
Yukon River above Circle	6/17/2002	10.8±0.7
Sheenjek River	6/20/2002	12.8±0.7
Black River	6/20/2002	11.2±0.6
Upper Mouth Birch Creek	6/21/2002	11.4±0.6
Chandalar River	6/22/2002	14.1±0.8
Christian River	6/22/2002	11.2±0.7
Lower Mouth Birch Creek	6/23/2002	--
Yukon River at Timber Point	6/24/2002	10.8±0.7
Hodzana River	6/25/2002	11.5±0.7
Yukon River near Stevens Village	6/24/2002	--

Table 23. Tritium concentrations, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; TU, tritium units; --, not available]

Site	Date	Tritium (TU) (±1 sigma uncertainty)
Trip 2		
Yukon River at Eagle	8/22/2002	--
Yukon River below Tatonduk River	8/23/2002	--
Nation River	8/23/2002	15.1±0.8
Yukon River below Nation River	8/23/2002	--
Kandik River	8/24/2002	13.2±0.7
Yukon River below Kandik River	8/23/2002	--
Charley River	8/24/2002	13.6±0.7
Yukon River below Charley River	8/23/2002	--
Coal Creek	8/25/2002	12.5±0.7
Yukon River below Coal Creek	8/25/2002	--
Woodchopper Creek	8/24/2002	12.9±0.7
Yukon River below Woodchopper Creek	8/25/2002	--
Yukon River above Circle	8/26/2002	11.1±0.7
Yukon River above Twentytwo Mile Village	8/27/2002	--
Yukon River near Halfway Whirlpool	8/27/2002	--
Yukon River above Twelvemile Island	8/27/2002	--
Sheenjek River	8/28/2002	14.7±0.7
Black River	8/28/2002	12.9±0.5
Porcupine River 9.5 miles upstream from mouth	8/28/2002	13.5±0.5
Chandalar River	8/30/2002	12.7±0.5
Christian River	8/30/2002	12.0±0.5
Upper Mouth Birch Creek	8/31/2002	13.0±0.7
Lower Mouth Birch Creek	8/31/2002	12.5±0.7
Yukon River below Porcupine River	9/2/2002	--
Hadweenzic River	9/2/2002	14.0±0.7
Yukon River at Joe Devlin Island	9/2/2002	13.1±0.7
Beaver Creek	9/3/2002	14.0±0.9
Hodzana River	9/3/2002	6.7±0.6
Yukon River below Hodzana River	9/4/2002	--
Yukon River at Timber Point	9/4/2002	11.7±0.8
Yukon River at Adams Island	9/4/2002	--
Dall River	9/4/2002	11.6±0.7
Yukon River near Stevens Village	9/4/2002	--

Table 24. Tritium concentrations, year 2003

[Site name, refer to Table 2 and Plate 1 for location; TU, tritium units; --, not available]

Site	Date	Tritium (TU) (±1 sigma uncertainty)
Trip 1		
Yukon River near Stevens Village	6/4/2003	--
Ray River	6/4/2003	8.8±0.6
Yukon River below Ray River	6/4/2003	--
Hess Creek	6/4/2003	9.0±0.5
Yukon River below Hess Creek	6/4/2003	--
Tozitna River	6/5/2003	10.5±0.6
Yukon River below Tozitna River	6/5/2003	--
Nowitna River	6/6/2003	10.4±0.6
Yukon River below Nowitna River	6/6/2003	--
Melozitna River	6/6/2003	10.4±0.6
Yukon River below Melozitna River	6/8/2003	--
Yukon River at Ruby	6/8/2003	10.7±0.6
Yuki River	6/8/2003	6.7±0.6
Yukon River below Yuki River	6/8/2003	--
Koyukuk River	6/9/2003	8.9±0.6
Yukon River below Koyukuk River	6/9/2003	--
Nulato River	6/9/2003	7.3±0.6
Yukon River at Kaltag	6/10/2003	9.8±0.6
Anvik River	6/11/2003	6.5±0.5
Yukon River below Anvik River	6/11/2003	--
Bonasila River	6/11/2003	7.9±0.6
Yukon River below Bonasila River	6/11/2003	--
Innoko River	6/12/2003	9.0±0.6
Yukon River below Innoko River	6/12/2003	--
Atchuelinguk River	6/13/2003	8.0±0.6
Yukon River at Pilot Station	6/13/2003	--
Andreafsky River	6/13/2003	6.9±0.5

Table 24. Tritium concentrations, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; TU, tritium units; --, not available]

Site	Date	Tritium (TU) (±1 sigma uncertainty)
Trip 2		
Yukon River near Stevens Village	8/24/2003	--
Ray River	8/25/2003	10.6±0.7
Yukon River below Ray River	8/25/2003	--
Hess Creek	8/25/2003	11.4±0.7
Yukon River below Hess Creek	8/25/2003	--
Tozitna River	8/26/2003	12.1±0.7
Yukon River below Tozitna River	8/26/2003	--
Nowitna River	8/27/2003	10.8±0.7
Yukon River below Nowitna River	8/27/2003	--
Melozitna River	8/27/2003	9.0±0.7
Yukon River below Melozitna River	8/28/2003	--
Yukon River at Ruby	8/28/2003	13.0±0.8
Yuki River	8/28/2003	9.0±0.7
Yukon River below Yuki River	8/28/2003	--
Koyukuk River	8/29/2003	11.3±0.8
Yukon River below Koyukuk River	8/29/2003	--
Nulato River	8/30/2002	7.4±0.4
Yukon River at Kaltag	8/30/2003	12.0±0.8
Anvik River	9/1/2003	8.1±0.4
Yukon River below Anvik River	9/1/2003	--
Bonasila River	9/1/2003	8.9±0.4
Yukon River below Bonasila River	9/1/2003	--
Innoko River	9/2/2003	9.1±0.4
Yukon River below Innoko River	9/2/2003	--
Atchuelinguk River	9/3/2003	9.7±0.4
Yukon River at Pilot Station	9/3/2003	--
Andreafsky River	9/3/2003	7.4±0.4

Dissolved Major Cations and Trace Elements

by Howard E. Taylor, David A. Roth, and Ronald C. Antweiler

A description of sample collection and processing of samples for major cations and trace elements using the EDI method (collected from a churn) is given in Schuster (2003). Sample analysis results for year 2002 are given in table 25, and results for year 2003 are given in table 26.

Table 25. Dissolved major cations and trace elements in 0.45-µm filtered water, Equal Discharge Increment sampling from churn, year 2002

[Site name, refer to Table 1 and Plate 1 for location; µg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Aluminum (µg/L)	SD	Arsenic (µg/L)	SD	Boron (µg/L)	SD	Barium (µg/L)	SD	Beryllium (µg/L)	SD	Bismuth (µg/L)	SD	Calcium (mg/L)	SD
Trip 1															
Yukon River at Eagle	6/11/2002	25	0	0.49	0.02	6.5	0.5	36	0	< 0.009	0.004	< 0.001	0.001	25	0
Nation River	6/13/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kandik River	6/15/2002	69	1	0.29	0.00	5	1	19	1	0.02	0.01	0.006	0.001	15	0
Coal Creek	6/15/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Charley River	6/16/2002	68	2	0.37	0.01	1	1	17	0	0.02	0.01	0.006	0.002	11	0
Woodchopper Creek	6/16/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	6/17/2002	35	0	0.47	0.02	5	0	38	0	< 0.01	0.00	< 0.002	0.000	25	0
Sheenjek River	6/20/2002	18	0	0.25	0.01	2	0	28	1	0.01	0.00	< 0.002	0.001	32	0
Black River	6/20/2002	40	1	0.53	0.01	3	0	37	1	0.02	0.01	0.002	0.002	18	0
Upper Mouth Birch Creek	6/21/2002	41	1	0.80	0.01	3	0	45	1	0.02	0.00	0.002	0.001	15	0
Chandalar River	6/22/2002	11	0	0.18	0.01	1	0	16	0	< 0.01	0.00	< 0.002	0.000	40	0
Christian River	6/22/2002	16	1	0.44	0.00	3	0	85	1	0.01	0.01	< 0.002	0.000	15	0
Lower Mouth Birch Creek	6/23/2002	23	2	0.92	0.03	4	0	51	0	0.02	0.00	0.002	0.002	18	0
Yukon River at Timber Point	6/24/2002	29	1	0.47	0.01	6	0	42	0	< 0.01	0.00	< 0.002	0.001	27	0
Hodzana River	6/25/2002	11	0	0.56	0.01	2	0	27	0	< 0.01	0.00	< 0.002	0.000	16	0
Yukon River near Stevens Village	6/24/2002	20	0	0.45	0.02	5.6	0.5	41	1	<0.009	0.005	<0.001	0.000	28	1

Table 25. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Cadmium (μg/L)	SD	Cerium (μg/L)	SD	Cobalt (μg/L)	SD	Chromium (μg/L)	SD	Cesium (μg/L)	SD	Copper (μg/L)	SD	Dysprosium (μg/L)	SD
Trip 1															
Yukon River at Eagle	6/11/2002	0.019	0.001	0.088	0.001	0.035	0.003	<0.03	0.01	< 0.006	0.002	2.2	0.0	0.020	0.000
Nation River	6/13/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kandik River	6/15/2002	< 0.003	0.003	0.16	0.00	0.10	0.01	0.5	0.0	< 0.004	0.001	2.4	0.0	0.053	0.000
Coal Creek	6/15/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Charley River	6/16/2002	0.004	0.002	0.31	0.00	0.080	0.002	0.3	0.1	0.004	0.002	2.0	0.0	0.054	0.002
Woodchopper Creek	6/16/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	6/17/2002	0.006	0.002	0.091	0.003	0.053	0.005	< 0.2	0.1	< 0.004	0.001	2.0	0.0	0.019	0.000
Sheenjek River	6/20/2002	< 0.003	0.001	0.041	0.000	0.053	0.014	< 0.2	0.1	0.004	0.003	1.7	0.0	0.018	0.000
Black River	6/20/2002	< 0.003	0.001	0.15	0.00	0.076	0.008	0.3	0.1	< 0.004	0.001	2.0	0.0	0.038	0.001
Upper Mouth Birch Creek	6/21/2002	< 0.003	0.001	0.43	0.00	0.11	0.00	< 0.2	0.1	< 0.004	0.002	3.4	0.0	0.070	0.000
Chandalar River	6/22/2002	< 0.003	0.002	0.012	0.001	0.050	0.013	< 0.2	0.1	< 0.004	0.001	0.79	0.01	0.0026	0.0004
Christian River	6/22/2002	< 0.003	0.000	0.081	0.000	0.077	0.005	< 0.2	0.0	< 0.004	0.001	3.7	0.0	0.027	0.001
Lower Mouth Birch Creek	6/23/2002	< 0.003	0.001	0.26	0.01	0.062	0.009	0.3	0.1	< 0.004	0.002	3.0	0.1	0.045	0.002
Yukon River at Timber Point	6/24/2002	0.010	0.003	0.042	0.001	0.064	0.008	< 0.2	0.1	0.007	0.003	2.0	0.0	0.013	0.001
Hodzana River	6/25/2002	< 0.003	0.002	0.12	0.00	0.073	0.006	< 0.2	0.0	< 0.004	0.001	1.3	0.0	0.018	0.000
Yukon River near Stevens Village	6/24/2002	0.012	0.002	0.049	0.001	0.023	0.002	0.04	0.02	<0.006	0.005	1.9	0.0	0.015	0.000

Table 25. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Erbium (μg/L)	SD	Europium (μg/L)	SD	Iron (μg/L)	SD	Gadolinium (μg/L)	SD	Holmium (μg/L)	SD	Potassium (mg/L)	SD	Lanthanum (μg/L)	SD
Trip 1															
Yukon River at Eagle	6/11/2002	0.013	0.002	0.0042	0.0009	31	0	0.024	0.000	0.0041	0.0003	0.96	0.02	0.059	0.001
Nation River	6/13/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kandik River	6/15/2002	0.027	0.001	0.014	0.001	220	10	0.062	0.003	0.010	0.000	0.32	0.02	0.097	0.003
Coal Creek	6/15/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Charley River	6/16/2002	0.032	0.001	0.014	0.000	100	0	0.061	0.004	0.011	0.000	0.57	0.03	0.33	0.00
Woodchopper Creek	6/16/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	6/17/2002	0.011	0.000	0.0036	0.0015	37	1	0.020	0.000	0.0043	0.0000	0.89	0.03	0.057	0.001
Sheenjek River	6/20/2002	0.0090	0.0006	0.0040	0.0007	56	1	0.021	0.000	0.0038	0.0002	0.33	0.01	0.024	0.001
Black River	6/20/2002	0.022	0.001	0.0100	0.0009	310	0	0.046	0.002	0.0085	0.0002	0.40	0.02	0.090	0.000
Upper Mouth Birch Creek	6/21/2002	0.037	0.000	0.018	0.001	250	0	0.080	0.002	0.013	0.000	0.76	0.03	0.28	0.00
Chandalar River	6/22/2002	0.0022	0.0010	0.0008	0.0010	5.1	0.2	0.0044	0.0004	0.0010	0.0001	0.49	0.01	0.0095	0.0004
Christian River	6/22/2002	0.016	0.000	0.0071	0.0010	240	0	0.029	0.000	0.0057	0.0001	0.71	0.03	0.051	0.001
Lower Mouth Birch Creek	6/23/2002	0.028	0.002	0.010	0.002	330	0	0.052	0.001	0.0093	0.0000	0.94	0.02	0.18	0.00
Yukon River at Timber Point	6/24/2002	0.0080	0.0007	0.0018	0.0011	34	1	0.011	0.001	0.0026	0.0001	0.96	0.03	0.025	0.001
Hodzana River	6/25/2002	0.0091	0.0010	0.0041	0.0009	260	10	0.021	0.002	0.0036	0.0002	0.81	0.03	0.083	0.001
Yukon River near Stevens Village	6/24/2002	0.0079	0.0009	0.0035	0.0014	35	1	0.014	0.001	0.0031	0.0001	0.86	0.02	0.032	0.000

Table 25. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Lithium (μg/L)	SD	Lutetium (μg/L)	SD	Magnesium (mg/L)	SD	Manganese (μg/L)	SD	Molybdenum (μg/L)	SD	Sodium (mg/L)	SD	Neodymium (μg/L)	SD
Trip 1															
Yukon River at Eagle	6/11/2002	2.2	0.1	0.0017	0.0000	7.2	0.0	1.2	0.0	0.83	0.02	1.9	0.1	0.072	0.002
Nation River	6/13/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kandik River	6/15/2002	3.2	0.3	0.0034	0.0002	3.7	0.1	7.5	0.4	0.14	0.01	1.7	0.1	0.18	0.01
Coal Creek	6/15/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Charley River	6/16/2002	2.6	0.1	0.0046	0.0005	2.4	0.0	4.2	0.1	0.42	0.09	1.6	0.0	0.31	0.00
Woodchopper Creek	6/16/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	6/17/2002	2.3	0.1	0.0018	0.0001	7.2	0.0	3.3	0.0	0.87	0.03	1.8	0.1	0.066	0.002
Sheenjek River	6/20/2002	1.4	0.1	0.0012	0.0001	4.2	0.1	5.0	0.1	0.24	0.05	0.81	0.02	0.042	0.003
Black River	6/20/2002	2.5	0.1	0.0032	0.0002	5.7	0.1	14	1	0.19	0.01	1.7	0.0	0.13	0.01
Upper Mouth Birch Creek	6/21/2002	2.4	0.1	0.0054	0.0001	3.9	0.0	22	0	0.15	0.01	1.3	0.0	0.33	0.00
Chandalar River	6/22/2002	1.6	0.0	0.0003	0.0001	7.4	0.0	5.2	0.2	0.36	0.05	0.99	0.01	0.011	0.001
Christian River	6/22/2002	0.29	0.04	0.0025	0.0002	3.2	0.0	24	1	0.15	0.02	0.92	0.02	0.083	0.002
Lower Mouth Birch Creek	6/23/2002	2.4	0.1	0.0039	0.0003	4.7	0.0	5.4	0.3	0.30	0.09	1.9	0.0	0.22	0.01
Yukon River at Timber Point	6/24/2002	2.5	0.2	0.0007	0.0000	6.9	0.0	7.1	0.3	0.80	0.05	1.9	0.0	0.033	0.002
Hodzana River	6/25/2002	1.5	0.0	0.0015	0.0002	3.6	0.1	28	0	0.43	0.00	2.7	0.0	0.085	0.001
Yukon River near Stevens Village	6/24/2002	2.6	0.2	0.0010	0.0000	7.0	0.1	0.97	0.02	0.69	0.01	1.9	0.1	0.041	0.005

Table 25. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Nickel (μg/L)	SD	Phosphorus (μg/L)	SD	Lead (μg/L)	SD	Praseodymium (μg/L)	SD	Rubidium (μg/L)	SD	Sulfur (mg/L)	SD	Antimony (μg/L)	SD
Trip 1															
Yukon River at Eagle	6/11/2002	1.3	0.0	< 10	10	0.03	0.004	0.016	0.000	0.96	0.00	10	0	0.14	0.00
Nation River	6/13/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kandik River	6/15/2002	2.0	0.2	< 10	10	0.052	0.000	0.036	0.001	0.15	0.00	5.9	0.2	0.057	0.003
Coal Creek	6/15/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Charley River	6/16/2002	2.4	0.1	< 10	10	0.038	0.001	0.083	0.000	0.92	0.02	3.3	0.1	0.078	0.002
Woodchopper Creek	6/16/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	6/17/2002	1.8	0.2	< 10	10	0.027	0.002	0.015	0.000	1.0	0.0	11	0	0.14	0.00
Sheenjek River	6/20/2002	1.6	0.2	< 10	10	0.036	0.001	0.0083	0.0005	0.10	0.00	7.5	0.1	0.081	0.002
Black River	6/20/2002	2.0	0.2	< 10	10	0.077	0.002	0.031	0.000	0.21	0.01	4.8	0.1	0.079	0.004
Upper Mouth Birch Creek	6/21/2002	2.7	0.1	< 10	0	0.10	0.00	0.081	0.002	0.89	0.02	7.0	0.1	0.15	0.00
Chandalar River	6/22/2002	1.1	0.3	< 10	10	0.0050	0.0001	0.0026	0.0002	0.25	0.01	14	0	0.082	0.003
Christian River	6/22/2002	1.4	0.1	< 10	0	0.044	0.001	0.017	0.000	0.21	0.00	1.4	0.0	0.061	0.002
Lower Mouth Birch Creek	6/23/2002	2.3	0.2	< 10	10	0.14	0.00	0.052	0.000	0.98	0.01	7.0	0.1	0.15	0.01
Yukon River at Timber Point	6/24/2002	1.6	0.2	12	1	0.096	0.001	0.0075	0.0003	0.90	0.00	11	0	0.14	0.01
Hodzana River	6/25/2002	1.1	0.1	< 10	0	0.037	0.003	0.021	0.001	0.81	0.00	5.7	0.1	0.11	0.00
Yukon River near Stevens Village	6/24/2002	1.1	0.1	<10	10	0.021	0.001	0.0090	0.0005	0.79	0.01	11	0	0.13	0.00

Table 25. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Selenium (μg/L)	SD	Silica (mg/L)	SD	Samarium (μg/L)	SD	Strontium (μg/L)	SD	Terbium (μg/L)	SD	Tellurium (μg/L)	SD	Thorium (μg/L)	SD
Trip 1															
Yukon River at Eagle	6/11/2002	0.35	0.02	6.1	0.1	0.019	0.002	120	0	0.0031	0.0002	<0.006	0.003	0.015	0.001
Nation River	6/13/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kandik River	6/15/2002	0.1	0.1	3.2	0.0	0.055	0.004	75	2	0.0091	0.0002	< 0.006	0.003	0.051	0.002
Coal Creek	6/15/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Charley River	6/16/2002	< 0.1	0.1	5.9	0.0	0.065	0.002	64	1	0.0088	0.0000	< 0.006	0.001	0.12	0.00
Woodchopper Creek	6/16/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	6/17/2002	0.4	0.1	5.8	0.0	0.017	0.001	120	0	0.0029	0.0002	< 0.006	0.005	0.015	0.000
Sheenjek River	6/20/2002	0.3	0.1	3.1	0.0	0.012	0.000	77	1	0.0031	0.0002	< 0.006	0.003	0.013	0.001
Black River	6/20/2002	0.2	0.1	3.9	0.1	0.040	0.001	61	0	0.0063	0.0001	< 0.006	0.008	0.034	0.002
Upper Mouth Birch Creek	6/21/2002	< 0.1	0.1	4.9	0.0	0.072	0.002	78	0	0.012	0.000	< 0.006	0.001	0.11	0.00
Chandalar River	6/22/2002	0.4	0.1	2.7	0.0	0.0033	0.0014	120	0	0.0004	0.0001	< 0.006	0.002	0.0027	0.0009
Christian River	6/22/2002	0.1	0.0	6.4	0.1	0.026	0.000	40	0	0.0045	0.0003	< 0.006	0.003	0.014	0.001
Lower Mouth Birch Creek	6/23/2002	0.2	0.1	5.1	0.0	0.048	0.000	87	0	0.0075	0.0001	< 0.006	0.002	0.075	0.003
Yukon River at Timber Point	6/24/2002	0.3	0.0	5.0	0.1	0.0099	0.0008	110	0	0.0019	0.0000	< 0.006	0.004	0.0093	0.0013
Hodzana River	6/25/2002	0.1	0.1	6.7	0.1	0.019	0.001	70	1	0.0027	0.0004	< 0.006	0.002	0.026	0.001
Yukon River near Stevens Village	6/24/2002	0.34	0.00	5.2	0.2	0.012	0.000	110	0	0.0026	0.0004	<0.006	0.000	0.008	0.001

Table 25. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Thallium (μg/L)	SD	Thulium (μg/L)	SD	Uranium (μg/L)	SD	Vanadium (μg/L)	SD	Yttrium (μg/L)	SD	Ytterbium (μg/L)	SD	Zinc (μg/L)	SD	Zirconium (μg/L)	SD
Trip 1																	
Yukon River at Eagle	6/11/2002	0.003	0.000	0.0020	0.0001	0.73	0.01	0.35	0.00	0.14	0.00	0.014	0.001	4.0	0.6	0.15	0.00
Nation River	6/13/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kandik River	6/15/2002	< 0.002	0.002	0.0037	0.0003	0.055	0.005	0.37	0.02	0.35	0.00	0.022	0.001	1.7	0.1	0.28	0.02
Coal Creek	6/15/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Charley River	6/16/2002	0.004	0.002	0.0047	0.0004	0.97	0.01	0.28	0.03	0.36	0.00	0.030	0.001	2.4	0.0	0.31	0.00
Woodchopper Creek	6/16/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	6/17/2002	0.003	0.002	0.0015	0.0001	0.69	0.00	0.37	0.05	0.13	0.00	0.012	0.001	1.5	0.1	0.13	0.00
Sheenjek River	6/20/2002	< 0.002	0.001	0.0014	0.0001	0.43	0.00	0.14	0.02	0.12	0.00	0.0078	0.0006	0.99	0.02	0.14	0.00
Black River	6/20/2002	< 0.002	0.002	0.0031	0.0001	0.12	0.00	0.36	0.03	0.25	0.00	0.019	0.000	1.7	0.1	0.28	0.01
Upper Mouth Birch Creek	6/21/2002	< 0.002	0.000	0.0049	0.0001	0.21	0.00	0.30	0.03	0.41	0.00	0.036	0.001	7.3	0.0	0.33	0.01
Chandalar River	6/22/2002	< 0.002	0.001	0.0003	0.0001	0.82	0.00	< 0.08	0.04	0.029	0.000	0.0023	0.0004	0.44	0.02	0.045	0.007
Christian River	6/22/2002	< 0.002	0.001	0.0021	0.0003	0.039	0.001	0.53	0.02	0.17	0.00	0.014	0.001	0.97	0.02	0.24	0.00
Lower Mouth Birch Creek	6/23/2002	< 0.002	0.001	0.0036	0.0002	0.19	0.01	0.31	0.02	0.28	0.00	0.025	0.000	1.2	0.0	0.30	0.01
Yukon River at Timber Point	6/24/2002	0.003	0.001	0.0010	0.0001	0.64	0.01	0.33	0.04	0.081	0.002	0.0072	0.0009	15	0	0.13	0.00
Hodzana River	6/25/2002	< 0.002	0.002	0.0014	0.0002	0.31	0.00	0.29	0.04	0.099	0.002	0.011	0.001	1.6	0.1	0.17	0.00
Yukon River near Stevens Village	6/24/2002	<0.002	0.004	0.0012	0.0002	0.64	0.02	0.29	0.02	0.099	0.002	0.0088	0.0017	2.5	0.3	0.14	0.01

Table 25. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Aluminum (μg/L)	SD	Arsenic (μg/L)	SD	Boron (μg/L)	SD	Barium (μg/L)	SD	Beryllium (μg/L)	SD	Bismuth (μg/L)	SD	Calcium (mg/L)	SD
Trip 2															
Yukon River at Eagle	8/22/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River below Tatonduk River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nation River	8/23/2002	39	1	0.19	0.01	11	1	42	1	0.005	0.003	0.015	0.008	46	1
Yukon River below Nation River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kandik River	8/24/2002	74	0	0.32	0.04	4.3	0.3	23	0	0.012	0.005	0.004	0.004	18	1
Yukon River below Kandik River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Charley River	8/24/2002	64	3	0.36	0.01	1.3	0.2	16	0	0.016	0.001	0.002	0.001	11	0
Yukon River below Charley River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Coal Creek	8/25/2002	120	0	0.32	0.01	9.5	0.7	21	0	0.025	0.006	0.003	0.002	20	1
Yukon River below Coal Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Woodchopper Creek	8/24/2002	93	0	0.64	0.02	26	0	21	0	0.028	0.005	0.002	0.001	15	0
Yukon River below Woodchopper Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	8/26/2002	75	1	0.52	0.01	8.5	0.4	38	1	0.012	0.006	0.002	0.001	27	1
Yukon River above Twentytwo Mile Village	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sheenjek River	8/28/2002	2.8	0.2	0.17	0.00	2.3	0.1	39	0	< 0.004	0.004	0.003	0.001	51	2
Black River	8/28/2002	46	1	0.46	0.01	3.3	0.2	37	1	0.009	0.007	0.003	0.001	20	1
Porcupine River 9.5 miles upstream from mouth	8/28/2002	49	1	0.34	0.01	5.4	0.1	47	0	0.011	0.003	0.003	0.002	29	0
Chandalar River	8/30/2002	7.1	0.5	0.14	0.01	2.1	0.2	21	1	< 0.004	0.004	< 0.001	0.000	53	3
Christian River	8/30/2002	13	0	0.37	0.00	4.6	0.2	95	1	0.013	0.005	0.002	0.001	21	1
Upper Mouth Birch Creek	8/31/2002	55	1	0.65	0.00	2.4	0.2	38	0	0.013	0.006	0.004	0.001	16	1
Lower Mouth Birch Creek	8/31/2002	51	0	0.69	0.01	2.6	0.1	42	1	0.013	0.000	0.003	0.001	16	1
Yukon River below Porcupine River	9/2/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hadweenzic River	9/2/2002	2.7	0.1	0.79	0.02	11	1	94	1	< 0.004	0.003	< 0.001	0.001	39	2
Yukon River at Joe Devlin Island	9/2/2002	57	1	0.51	0.01	6.5	0.1	42	0	0.005	0.001	0.004	0.000	28	1
Beaver Creek	9/3/2002	30	0	0.37	0.00	2.8	0.3	34	1	0.006	0.006	0.001	0.001	18	0
Hodzana River	9/3/2002	4.6	0.0	0.49	0.01	2.5	0.0	35	0	< 0.004	0.003	0.002	0.002	18	1
Yukon River below Hodzana River	9/4/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Timber Point	9/4/2002	42	1	0.51	0.01	7.5	0.6	42	1	< 0.004	0.005	0.003	0.003	28	1
Yukon River at Adams Island	9/4/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dall River	9/4/2002	45	1	1.2	0.0	28	0	26	1	0.026	0.005	0.003	0.001	14	1
Yukon River near Stevens Village	9/4/2002	110	10	0.56	0.02	8.1	0.3	44	0	0.018	0.001	0.006	0.000	29	0

Table 25. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Cadmium (μg/L)	SD	Cerium (μg/L)	SD	Cobalt (μg/L)	SD	Chromium (μg/L)	SD	Cesium (μg/L)	SD	Copper (μg/L)	SD	Dysprosium (μg/L)	SD
Trip 2															
Yukon River at Eagle	8/22/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River below Tatonduk River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nation River	8/23/2002	0.043	0.001	0.039	0.002	0.22	0.00	0.06	0.00	< 0.009	0.001	1.1	0.0	0.018	0.000
Yukon River below Nation River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kandik River	8/24/2002	0.024	0.001	0.18	0.00	0.15	0.00	0.26	0.09	< 0.009	0.012	2.1	0.1	0.064	0.002
Yukon River below Kandik River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Charley River	8/24/2002	0.021	0.001	0.31	0.00	0.080	0.002	0.27	0.03	< 0.009	0.003	1.3	0.0	0.050	0.000
Yukon River below Charley River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Coal Creek	8/25/2002	0.064	0.003	0.23	0.00	0.63	0.00	0.36	0.04	0.015	0.002	6.1	0.0	0.074	0.000
Yukon River below Coal Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Woodchopper Creek	8/24/2002	0.028	0.001	0.23	0.00	0.23	0.00	0.32	0.03	0.016	0.001	2.6	0.0	0.051	0.000
Yukon River below Woodchopper Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	8/26/2002	0.018	0.001	0.20	0.00	0.11	0.00	0.17	0.03	< 0.009	0.002	2.1	0.0	0.033	0.001
Yukon River above Twentytwo Mile Village	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sheenjek River	8/28/2002	0.016	0.002	0.0039	0.0008	0.028	0.005	< 0.04	0.04	< 0.009	0.002	0.46	0.00	0.0015	0.0002
Black River	8/28/2002	0.013	0.003	0.13	0.00	0.092	0.003	0.27	0.01	< 0.009	0.001	1.5	0.0	0.038	0.001
Porcupine River 9.5 miles upstream from mouth	8/28/2002	0.011	0.003	0.097	0.002	0.083	0.002	0.23	0.02	< 0.009	0.001	1.6	0.0	0.043	0.002
Chandalar River	8/30/2002	0.0094	0.0016	0.0051	0.0001	0.041	0.003	0.15	0.01	< 0.009	0.003	0.42	0.01	0.0019	0.0002
Christian River	8/30/2002	0.0073	0.0017	0.037	0.002	0.041	0.000	< 0.04	0.02	< 0.009	0.003	1.7	0.0	0.012	0.001
Upper Mouth Birch Creek	8/31/2002	0.016	0.001	0.41	0.00	0.096	0.003	0.24	0.04	< 0.009	0.001	2.7	0.0	0.064	0.004
Lower Mouth Birch Creek	8/31/2002	0.011	0.002	0.37	0.00	0.10	0.00	0.26	0.02	< 0.009	0.005	2.7	0.0	0.060	0.002
Yukon River below Porcupine River	9/2/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hadweenzic River	9/2/2002	0.020	0.003	0.028	0.002	0.15	0.00	0.04	0.02	< 0.009	0.002	0.68	0.01	0.0075	0.0007
Yukon River at Joe Devlin Island	9/2/2002	0.030	0.002	0.11	0.00	0.076	0.002	0.13	0.02	< 0.009	0.001	2.1	0.0	0.022	0.002
Beaver Creek	9/3/2002	0.026	0.002	0.091	0.003	0.062	0.005	0.07	0.03	< 0.009	0.003	1.6	0.0	0.024	0.000
Hodzana River	9/3/2002	0.019	0.001	0.046	0.002	0.062	0.001	0.06	0.02	< 0.009	0.002	0.68	0.01	0.0071	0.0003
Yukon River below Hodzana River	9/4/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Timber Point	9/4/2002	0.020	0.003	0.068	0.001	0.048	0.003	0.06	0.04	< 0.009	0.004	2.0	0.0	0.015	0.001
Yukon River at Adams Island	9/4/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dall River	9/4/2002	0.012	0.001	0.29	0.01	0.072	0.002	0.26	0.00	< 0.009	0.005	1.9	0.0	0.048	0.000
Yukon River near Stevens Village	9/4/2002	0.019	0.003	0.14	0.00	0.091	0.004	0.23	0.01	0.011	0.003	2.7	0.0	0.028	0.004

Table 25. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Erbium (μg/L)	SD	Europium (μg/L)	SD	Iron (μg/L)	SD	Gadolinium (μg/L)	SD	Holmium (μg/L)	SD	Potassium (mg/L)	SD	Lanthanum (μg/L)	SD
Trip 2															
Yukon River at Eagle	8/22/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River below Tatonduk River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nation River	8/23/2002	0.0099	0.0009	0.0049	0.0003	89	4	0.018	0.002	0.0039	0.0002	0.43	0.02	0.023	0.001
Yukon River below Nation River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kandik River	8/24/2002	0.030	0.001	0.014	0.002	210	0	0.067	0.004	0.012	0.000	0.29	0.03	0.10	0.00
Yukon River below Kandik River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Charley River	8/24/2002	0.027	0.001	0.011	0.000	95	1	0.052	0.003	0.0093	0.0003	0.50	0.02	0.28	0.00
Yukon River below Charley River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Coal Creek	8/25/2002	0.045	0.000	0.016	0.000	420	20	0.082	0.001	0.015	0.000	0.96	0.01	0.15	0.00
Yukon River below Coal Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Woodchopper Creek	8/24/2002	0.032	0.004	0.013	0.000	180	0	0.056	0.001	0.0095	0.0000	1.0	0.0	0.15	0.00
Yukon River below Woodchopper Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	8/26/2002	0.023	0.001	0.0071	0.0005	100	0	0.035	0.000	0.0068	0.0001	0.94	0.01	0.11	0.00
Yukon River above Twentytwo Mile Village	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sheenjek River	8/28/2002	0.0008	0.0002	0.0009	0.0001	4.3	0.2	0.0016	0.0005	0.0002	0.0001	0.39	0.00	0.0033	0.0012
Black River	8/28/2002	0.020	0.002	0.0097	0.0005	270	10	0.041	0.001	0.0069	0.0001	0.32	0.01	0.076	0.001
Porcupine River 9.5 miles upstream from mouth	8/28/2002	0.022	0.002	0.0083	0.0002	190	10	0.043	0.000	0.0079	0.0005	0.39	0.01	0.052	0.001
Chandalar River	8/30/2002	0.0008	0.0006	< 0.0002	0.0007	3.8	0.3	0.0020	0.0002	0.0003	0.0000	0.53	0.01	0.0057	0.0001
Christian River	8/30/2002	0.0074	0.0007	0.0025	0.0005	120	0	0.013	0.000	0.0025	0.0001	0.70	0.02	0.023	0.001
Upper Mouth Birch Creek	8/31/2002	0.032	0.001	0.015	0.001	230	10	0.072	0.001	0.012	0.000	0.60	0.01	0.24	0.00
Lower Mouth Birch Creek	8/31/2002	0.033	0.000	0.015	0.000	210	0	0.063	0.001	0.011	0.000	0.62	0.02	0.22	0.00
Yukon River below Porcupine River	9/2/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hadweenzic River	9/2/2002	0.0052	0.0008	0.0013	0.0005	420	30	0.0085	0.0005	0.0017	0.0002	0.86	0.02	0.018	0.001
Yukon River at Joe Devlin Island	9/2/2002	0.014	0.001	0.0051	0.0005	82	5	0.023	0.004	0.0040	0.0004	0.84	0.01	0.063	0.001
Beaver Creek	9/3/2002	0.014	0.001	0.0053	0.0007	270	10	0.025	0.003	0.0046	0.0001	0.47	0.01	0.057	0.002
Hodzana River	9/3/2002	0.0046	0.0012	0.0021	0.0000	290	0	0.0067	0.0008	0.0012	0.0001	0.92	0.00	0.029	0.001
Yukon River below Hodzana River	9/4/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Timber Point	9/4/2002	0.0097	0.0014	0.0039	0.0008	48	1	0.017	0.001	0.0031	0.0002	0.84	0.01	0.040	0.001
Yukon River at Adams Island	9/4/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dall River	9/4/2002	0.029	0.000	0.012	0.000	390	10	0.050	0.001	0.0098	0.0004	0.62	0.01	0.16	0.01
Yukon River near Stevens Village	9/4/2002	0.015	0.002	0.0075	0.0001	160	0	0.028	0.000	0.0054	0.0002	0.91	0.02	0.083	0.002

Table 25. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Lithium (μg/L)	SD	Lutetium (μg/L)	SD	Magnesium (mg/L)	SD	Manganese (μg/L)	SD	Molybdenum (μg/L)	SD	Sodium (mg/L)	SD	Neodymium (μg/L)	SD
Trip 2															
Yukon River at Eagle	8/22/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River below Tatonduk River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nation River	8/23/2002	5.2	0.0	0.0012	0.0000	9.9	0.4	13	0	0.65	0.07	1.6	0.1	0.037	0.002
Yukon River below Nation River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kandik River	8/24/2002	3.5	0.1	0.0037	0.0006	4.4	0.2	17	1	0.22	0.11	1.7	0.0	0.18	0.00
Yukon River below Kandik River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Charley River	8/24/2002	2.4	0.1	0.0047	0.0001	2.3	0.2	4.1	0.1	0.36	0.05	1.6	0.0	0.28	0.00
Yukon River below Charley River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Coal Creek	8/25/2002	12	0	0.0069	0.0000	14	1	120	0	0.19	0.03	4.5	0.2	0.21	0.00
Yukon River below Coal Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Woodchopper Creek	8/24/2002	37	0	0.0040	0.0002	13	1	15	0	0.16	0.07	8.0	0.3	0.20	0.00
Yukon River below Woodchopper Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	8/26/2002	3.0	0.0	0.0033	0.0001	7.5	0.3	7.3	0.1	0.84	0.01	2.1	0.1	0.13	0.00
Yukon River above Twentytwo Mile Village	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sheenjek River	8/28/2002	1.2	0.0	0.0003	0.0001	5.4	0.1	12	0	0.39	0.03	0.84	0.04	0.0043	0.0003
Black River	8/28/2002	3.3	0.0	0.0034	0.0002	6.4	0.1	12	0	0.20	0.03	1.8	0.1	0.12	0.00
Porcupine River 9.5 miles upstream from mouth	8/28/2002	3.9	0.0	0.0029	0.0003	6.5	0.1	5.9	0.1	0.33	0.02	1.9	0.1	0.099	0.003
Chandalar River	8/30/2002	2.0	0.1	0.0002	0.0000	9.2	0.2	7.5	0.1	0.51	0.06	1.4	0.1	0.0052	0.0011
Christian River	8/30/2002	1.0	0.0	0.0010	0.0001	4.5	0.2	8.9	0.2	0.23	0.02	1.3	0.1	0.031	0.002
Upper Mouth Birch Creek	8/31/2002	2.5	0.1	0.0056	0.0002	3.9	0.2	13	0	0.17	0.03	1.2	0.1	0.29	0.00
Lower Mouth Birch Creek	8/31/2002	2.4	0.1	0.0051	0.0002	3.9	0.0	12	0	0.21	0.03	1.1	0.0	0.28	0.01
Yukon River below Porcupine River	9/2/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hadweenzic River	9/2/2002	2.6	0.0	0.0012	0.0002	5.5	0.1	140	0	0.44	0.07	5.6	0.4	0.022	0.001
Yukon River at Joe Devlin Island	9/2/2002	2.9	0.1	0.0017	0.0002	7.7	0.2	6.4	0.0	0.81	0.02	1.8	0.1	0.076	0.002
Beaver Creek	9/3/2002	1.8	0.1	0.0021	0.0002	6.6	0.2	9.0	0.1	0.20	0.02	1.5	0.1	0.072	0.002
Hodzana River	9/3/2002	1.5	0.0	0.0008	0.0002	3.9	0.1	44	0	0.43	0.01	3.3	0.1	0.031	0.000
Yukon River below Hodzana River	9/4/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Timber Point	9/4/2002	3.1	0.0	0.0014	0.0001	7.9	0.3	4.1	0.0	0.82	0.05	1.8	0.0	0.048	0.000
Yukon River at Adams Island	9/4/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dall River	9/4/2002	4.3	0.0	0.0054	0.0004	2.5	0.1	5.2	0.1	0.35	0.02	2.7	0.1	0.20	0.00
Yukon River near Stevens Village	9/4/2002	3.1	0.0	0.0021	0.0002	8.1	0.1	5.0	0.1	0.76	0.01	1.9	0.1	0.10	0.01

Table 25. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Nickel (μg/L)	SD	Phosphorus (μg/L)	SD	Lead (μg/L)	SD	Praseodymium (μg/L)	SD	Rubidium (μg/L)	SD	Sulfur (mg/L)	SD	Antimony (μg/L)	SD
Trip 2															
Yukon River at Eagle	8/22/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River below Tatonduk River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nation River	8/23/2002	2.2	0.0	< 20	10	0.045	0.002	0.0079	0.0002	0.18	0.01	19	1	0.091	0.005
Yukon River below Nation River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kandik River	8/24/2002	2.5	0.2	< 20	10	0.085	0.025	0.037	0.002	0.13	0.01	7.3	0.2	0.078	0.011
Yukon River below Kandik River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Charley River	8/24/2002	1.4	0.1	< 20	10	0.036	0.001	0.067	0.000	0.71	0.00	3.4	0.1	0.074	0.002
Yukon River below Charley River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Coal Creek	8/25/2002	13	0	< 20	10	0.047	0.002	0.046	0.001	2.0	0.0	22	1	0.27	0.00
Yukon River below Coal Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Woodchopper Creek	8/24/2002	2.8	0.0	< 20	10	0.039	0.002	0.045	0.000	2.1	0.0	20	1	0.32	0.01
Yukon River below Woodchopper Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	8/26/2002	2.7	0.0	< 20	20	0.052	0.003	0.031	0.000	1.1	0.0	12	1	0.17	0.00
Yukon River above Twentytwo Mile Village	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sheenjek River	8/28/2002	0.42	0.07	< 20	10	0.013	0.002	0.0007	0.0001	0.12	0.00	10	0	0.084	0.003
Black River	8/28/2002	1.7	0.0	< 20	20	0.042	0.006	0.025	0.001	0.22	0.00	6.5	0.3	0.100	0.003
Porcupine River 9.5 miles upstream from mouth	8/28/2002	2.3	0.1	< 20	10	0.049	0.002	0.019	0.001	0.19	0.00	11	0	0.093	0.005
Chandalar River	8/30/2002	0.43	0.01	< 20	10	0.026	0.001	0.0012	0.0001	0.32	0.01	18	1	0.10	0.00
Christian River	8/30/2002	1.0	0.0	< 20	10	0.054	0.002	0.0070	0.0003	0.22	0.01	3.9	0.1	0.069	0.007
Upper Mouth Birch Creek	8/31/2002	2.5	0.0	< 20	10	0.10	0.00	0.070	0.001	0.58	0.00	8.2	0.5	0.15	0.00
Lower Mouth Birch Creek	8/31/2002	2.1	0.0	< 20	0	0.11	0.00	0.063	0.003	0.53	0.01	8.0	0.1	0.17	0.01
Yukon River below Porcupine River	9/2/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hadweenzic River	9/2/2002	0.89	0.03	< 20	10	0.014	0.004	0.0045	0.0003	0.44	0.01	3.0	0.2	0.072	0.004
Yukon River at Joe Devlin Island	9/2/2002	1.8	0.0	< 20	10	0.067	0.002	0.017	0.000	0.96	0.00	13	0	0.17	0.00
Beaver Creek	9/3/2002	1.9	0.0	< 20	10	0.049	0.004	0.016	0.001	0.39	0.02	9.7	0.2	0.14	0.01
Hodzana River	9/3/2002	0.68	0.01	< 20	0	0.024	0.001	0.0073	0.0004	0.93	0.01	6.7	0.2	0.089	0.005
Yukon River below Hodzana River	9/4/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Timber Point	9/4/2002	1.5	0.0	< 20	10	0.044	0.000	0.011	0.000	0.94	0.01	13	1	0.16	0.00
Yukon River at Adams Island	9/4/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dall River	9/4/2002	1.1	0.0	< 20	10	0.063	0.004	0.045	0.000	0.72	0.03	2.8	0.1	0.097	0.004
Yukon River near Stevens Village	9/4/2002	1.8	0.0	<10	10	0.098	0.002	0.023	0.000	1.2	0.0	14	0	0.16	0.01

Table 25. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Selenium (μg/L)	SD	Silica (mg/L)	SD	Samarium (μg/L)	SD	Strontium (μg/L)	SD	Terbium (μg/L)	SD	Tellurium (μg/L)	SD	Thorium (μg/L)	SD
Trip 2															
Yukon River at Eagle	8/22/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River below Tatonduk River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nation River	8/23/2002	0.72	0.04	4.0	0.1	0.013	0.001	130	0	0.0030	0.0001	< 0.006	0.002	0.041	0.003
Yukon River below Nation River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kandik River	8/24/2002	0.22	0.06	4.8	0.3	0.054	0.003	85	1	0.010	0.000	< 0.006	0.004	0.033	0.006
Yukon River below Kandik River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Charley River	8/24/2002	0.09	0.02	7.2	0.3	0.055	0.001	64	1	0.0084	0.0002	< 0.006	0.003	0.083	0.005
Yukon River below Charley River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Coal Creek	8/25/2002	0.43	0.04	6.5	0.5	0.060	0.006	86	2	0.013	0.000	< 0.006	0.005	0.062	0.005
Yukon River below Coal Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Woodchopper Creek	8/24/2002	0.20	0.00	7.8	0.3	0.050	0.000	78	1	0.0089	0.0005	0.008	0.005	0.061	0.003
Yukon River below Woodchopper Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	8/26/2002	0.42	0.03	6.9	0.3	0.033	0.001	130	0	0.0052	0.0001	< 0.006	0.000	0.035	0.003
Yukon River above Twentytwo Mile Village	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sheenjek River	8/28/2002	0.31	0.01	3.2	0.2	0.0008	0.0005	110	0	0.0001	0.0000	< 0.006	0.005	0.004	0.000
Black River	8/28/2002	0.12	0.04	5.1	0.4	0.036	0.001	70	1	0.0067	0.0000	< 0.006	0.004	0.033	0.002
Porcupine River 9.5 miles upstream from mouth	8/28/2002	0.30	0.02	4.6	0.1	0.033	0.001	89	0	0.0076	0.0002	< 0.006	0.007	0.034	0.002
Chandalar River	8/30/2002	0.34	0.01	3.2	0.2	0.0014	0.0003	140	0	0.0004	0.0001	< 0.006	0.004	0.001	0.001
Christian River	8/30/2002	0.12	0.04	6.5	0.5	0.011	0.001	60	1	0.0023	0.0002	< 0.006	0.000	0.011	0.005
Upper Mouth Birch Creek	8/31/2002	0.09	0.02	6.7	0.6	0.067	0.000	77	1	0.011	0.000	< 0.006	0.001	0.12	0.00
Lower Mouth Birch Creek	8/31/2002	0.13	0.02	6.5	0.3	0.062	0.004	78	2	0.010	0.000	< 0.006	0.003	0.12	0.00
Yukon River below Porcupine River	9/2/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hadweenzic River	9/2/2002	< 0.06	0.05	5.2	0.2	0.0062	0.0011	87	2	0.0014	0.0001	< 0.006	0.003	0.011	0.002
Yukon River at Joe Devlin Island	9/2/2002	0.45	0.02	6.0	0.3	0.019	0.001	120	0	0.0037	0.0001	< 0.006	0.004	0.034	0.001
Beaver Creek	9/3/2002	0.12	0.00	5.9	0.1	0.019	0.001	84	2	0.0040	0.0003	< 0.006	0.001	0.024	0.001
Hodzana River	9/3/2002	0.09	0.01	5.3	0.3	0.0073	0.0013	77	0	0.0014	0.0002	< 0.006	0.000	0.014	0.001
Yukon River below Hodzana River	9/4/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Timber Point	9/4/2002	0.49	0.00	6.1	0.4	0.013	0.001	130	0	0.0025	0.0001	0.007	0.003	0.017	0.001
Yukon River at Adams Island	9/4/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dall River	9/4/2002	0.12	0.06	9.5	0.8	0.046	0.001	44	1	0.0081	0.0002	< 0.006	0.002	0.11	0.00
Yukon River near Stevens Village	9/4/2002	0.47	0.02	6.3	0.1	0.026	0.001	130	0	0.0049	0.0001	<0.006	0.003	0.025	0.005

Table 25. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Thallium (μg/L)	SD	Thulium (μg/L)	SD	Uranium (μg/L)	SD	Vanadium (μg/L)	SD	Yttrium (μg/L)	SD	Ytterbium (μg/L)	SD	Zinc (μg/L)	SD	Zirconium (μg/L)	SD
Trip 2																	
Yukon River at Eagle	8/22/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River below Tatonduk River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nation River	8/23/2002	0.012	0.002	0.0014	0.0001	0.44	0.00	0.29	0.02	0.13	0.01	0.0088	0.0014	2.6	0.1	0.22	0.03
Yukon River below Nation River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kandik River	8/24/2002	0.002	0.000	0.0040	0.0000	0.075	0.008	0.33	0.00	0.36	0.01	0.024	0.001	1.6	0.3	0.40	0.03
Yukon River below Kandik River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Charley River	8/24/2002	< 0.002	0.001	0.0040	0.0002	0.96	0.05	0.22	0.01	0.32	0.00	0.029	0.002	2.4	0.1	0.38	0.00
Yukon River below Charley River	8/23/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Coal Creek	8/25/2002	0.009	0.002	0.0064	0.0002	0.23	0.00	0.20	0.01	0.52	0.01	0.044	0.004	7.9	0.1	0.64	0.02
Yukon River below Coal Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Woodchopper Creek	8/24/2002	0.011	0.004	0.0039	0.0001	1.3	0.0	0.24	0.01	0.32	0.00	0.027	0.001	2.5	0.1	0.63	0.01
Yukon River below Woodchopper Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	8/26/2002	0.006	0.001	0.0032	0.0003	0.76	0.00	0.55	0.00	0.21	0.00	0.020	0.001	2.3	0.0	0.39	0.03
Yukon River above Twentytwo Mile Village	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sheenjek River	8/28/2002	0.011	0.002	< 0.0001	0.0000	0.70	0.02	0.08	0.02	0.016	0.001	0.0012	0.0005	4.0	0.6	0.044	0.005
Black River	8/28/2002	0.002	0.003	0.0027	0.0001	0.15	0.01	0.30	0.01	0.22	0.00	0.019	0.000	2.6	0.1	0.48	0.01
Porcupine River 9.5 miles upstream from mouth	8/28/2002	0.003	0.002	0.0026	0.0002	0.29	0.00	0.24	0.01	0.25	0.00	0.018	0.001	3.1	0.1	0.41	0.01
Chandalar River	8/30/2002	< 0.002	0.001	< 0.0001	0.0001	1.1	0.0	0.04	0.01	0.018	0.000	0.0016	0.0004	2.0	0.2	0.038	0.002
Christian River	8/30/2002	< 0.002	0.001	0.0010	0.0001	0.12	0.00	0.27	0.01	0.082	0.001	0.0076	0.0002	1.7	0.1	0.17	0.00
Upper Mouth Birch Creek	8/31/2002	< 0.002	0.001	0.0052	0.0004	0.19	0.01	0.28	0.00	0.37	0.01	0.035	0.001	3.1	0.5	0.63	0.01
Lower Mouth Birch Creek	8/31/2002	0.004	0.003	0.0051	0.0002	0.18	0.00	0.34	0.01	0.36	0.00	0.036	0.001	1.9	0.1	0.64	0.00
Yukon River below Porcupine River	9/2/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hadweenzic River	9/2/2002	< 0.002	0.002	0.0009	0.0001	0.26	0.01	0.16	0.02	0.053	0.002	0.0059	0.0002	1.9	0.2	0.27	0.01
Yukon River at Joe Devlin Island	9/2/2002	0.004	0.000	0.0018	0.0002	0.75	0.02	0.45	0.01	0.14	0.00	0.012	0.001	1.8	0.1	0.29	0.03
Beaver Creek	9/3/2002	< 0.002	0.002	0.0019	0.0001	0.27	0.01	0.19	0.01	0.14	0.00	0.012	0.000	1.3	0.0	0.24	0.01
Hodzana River	9/3/2002	< 0.002	0.000	0.0007	0.0001	0.20	0.00	0.16	0.02	0.045	0.001	0.0053	0.0011	3.1	0.6	0.15	0.00
Yukon River below Hodzana River	9/4/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Timber Point	9/4/2002	0.014	0.002	0.0014	0.0001	0.74	0.01	0.40	0.01	0.11	0.00	0.0087	0.0012	1.3	0.2	0.23	0.01
Yukon River at Adams Island	9/4/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dall River	9/4/2002	0.005	0.001	0.0043	0.0002	0.33	0.01	0.43	0.02	0.28	0.00	0.033	0.001	1.1	0.0	0.68	0.01
Yukon River near Stevens Village	9/4/2002	0.008	0.004	0.0021	0.0001	0.76	0.00	0.57	0.02	0.17	0.00	0.014	0.001	3.3	0.0	0.36	0.00

Table 26. Dissolved major cations and trace elements in 0.45-µm filtered water, Equal Discharge Increment sampling from churn, year 2003

[Site name, refer to Table 2 and Plate 1 for location; µg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Arsenic (µg/L)	SD	Boron (µg/L)	SD	Barium (µg/L)	SD	Beryllium (µg/L)	SD	Bismuth (µg/L)	SD	Calcium (mg/L)	SD	Cadmium (µg/L)	SD
Trip 1															
Yukon River near Stevens Village	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ray River	6/4/2003	0.69	0.02	18	1	23	1	0.094	0.004	0.0053	0.0009	8.4	0.2	0.016	0.003
Yukon River below Ray River	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hess Creek	6/4/2003	0.71	0.02	2.3	0.6	55	1	0.024	0.004	0.0028	0.0019	16	0	0.025	0.003
Yukon River below Hess Creek	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tozitna River	6/5/2003	0.56	0.04	2.7	0.2	20	0	0.039	0.000	0.011	0.006	5.9	0.3	0.015	0.002
Yukon River below Tozitna River	6/5/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nowitna River	6/6/2003	1.3	0.0	3.8	0.7	25	0	0.026	0.002	0.0050	0.0021	11	0	0.010	0.001
Yukon River below Nowitna River	6/6/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Melozitna River	6/6/2003	1.3	0.0	4.4	1.7	26	0	0.031	0.002	0.0046	0.0008	5.5	0.2	0.010	0.003
Yukon River below Melozitna River	6/8/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	6/8/2003	0.70	0.05	6.6	0.8	39	0	0.015	0.002	0.0053	0.0016	25	0	0.015	0.001
Yuki River	6/8/2003	0.83	0.04	3.5	0.0	30	0	0.025	0.006	0.0034	0.0006	6.7	0.0	0.007	0.001
Yukon River below Yuki River	6/8/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Koyukuk River	6/9/2003	0.54	0.02	4.5	0.9	16	0	0.011	0.000	0.0057	0.0003	20	0	0.010	0.003
Yukon River below Koyukuk River	6/9/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nulato River	6/9/2003	0.22	0.02	5.5	0.2	12	0	0.003	0.000	0.0012	0.0007	13	0	< 0.006	0.002
Yukon River at Kaltag	6/10/2003	0.65	0.03	7.3	0.8	33	1	0.013	0.004	0.0040	0.0003	23	0	0.012	0.005
Anvik River	6/11/2003	0.27	0.01	11	0	8.7	0.1	< 0.01	0.00	0.004	0.004	7.8	0.2	0.003	0.001
Yukon River below Anvik River	6/11/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bonasila River	6/11/2003	0.52	0.02	6.6	0.6	11	0	< 0.01	0.00	0.015	0.003	5.3	0.3	0.030	0.001
Yukon River below Bonasila River	6/11/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Innoko River	6/12/2003	1.2	0.0	5.9	0.7	35	1	0.03	0.00	0.017	0.001	11	1	0.017	0.001
Yukon River below Innoko River	6/12/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	6/13/2003	0.68	0.01	8.2	0.6	29	1	< 0.01	0.01	0.008	0.000	17	1	0.007	0.001
Yukon River at Pilot Station	6/13/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Andreafsky River	6/13/2003	0.37	0.01	7.5	1.5	11	0	< 0.01	0.01	0.006	0.004	14	0	0.003	0.001

Table 26. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Cerium (μg/L)	SD	Cobalt (μg/L)	SD	Chromium (μg/L)	SD	Cesium (μg/L)	SD	Copper (μg/L)	SD	Dysprosium (μg/L)	SD	Erbium (μg/L)	SD
Trip 1															
Yukon River near Stevens Village	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ray River	6/4/2003	0.82	0.01	0.15	0.01	0.5	0.0	< 0.02	0.00	3.3	0.0	0.11	0.00	0.066	0.000
Yukon River below Ray River	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hess Creek	6/4/2003	0.26	0.00	0.17	0.00	0.6	0.1	< 0.02	0.00	4.6	0.1	0.067	0.001	0.039	0.000
Yukon River below Hess Creek	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tozitna River	6/5/2003	1.1	0.0	0.36	0.00	< 0.3	0.2	< 0.005	0.001	3.1	0.0	0.095	0.001	0.049	0.004
Yukon River below Tozitna River	6/5/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nowitna River	6/6/2003	0.62	0.00	0.17	0.01	0.7	0.1	< 0.02	0.00	4.1	0.0	0.090	0.002	0.048	0.001
Yukon River below Nowitna River	6/6/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Melozitna River	6/6/2003	0.64	0.00	0.18	0.00	0.4	0.2	< 0.02	0.00	4.0	0.0	0.090	0.001	0.052	0.001
Yukon River below Melozitna River	6/8/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	6/8/2003	0.25	0.00	0.095	0.007	< 0.3	0.1	0.008	0.004	3.5	0.1	0.043	0.000	0.024	0.001
Yuki River	6/8/2003	0.59	0.00	0.19	0.01	0.7	0.0	< 0.02	0.00	2.8	0.1	0.079	0.001	0.042	0.003
Yukon River below Yuki River	6/8/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Koyukuk River	6/9/2003	0.34	0.00	0.10	0.00	< 0.3	0.0	< 0.005	0.001	3.9	0.1	0.047	0.000	0.028	0.000
Yukon River below Koyukuk River	6/9/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nulato River	6/9/2003	0.083	0.002	0.080	0.005	0.5	0.0	< 0.005	0.000	0.67	0.03	0.014	0.000	0.0063	0.0013
Yukon River at Kaltag	6/10/2003	0.25	0.01	0.085	0.010	< 0.3	0.0	0.020	0.011	3.7	0.0	0.043	0.002	0.025	0.001
Anvik River	6/11/2003	0.068	0.001	0.045	0.003	< 0.2	0.0	< 0.02	0.00	0.61	0.03	0.012	0.001	0.006	0.000
Yukon River below Anvik River	6/11/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bonasila River	6/11/2003	0.17	0.00	0.39	0.00	0.2	0.1	< 0.02	0.00	1.3	0.0	0.022	0.000	0.010	0.000
Yukon River below Bonasila River	6/11/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Innoko River	6/12/2003	0.59	0.00	0.34	0.00	0.5	0.1	< 0.02	0.00	3.2	0.0	0.080	0.000	0.043	0.000
Yukon River below Innoko River	6/12/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	6/13/2003	0.16	0.00	0.051	0.007	< 0.2	0.1	< 0.02	0.00	2.9	0.0	0.031	0.001	0.017	0.001
Yukon River at Pilot Station	6/13/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Andreafsky River	6/13/2003	0.028	0.000	0.037	0.009	< 0.2	0.0	< 0.02	0.00	0.63	0.02	0.0057	0.0002	0.003	0.000

Table 26. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Europium (μg/L)	SD	Iron (μg/L)	SD	Gallium (μg/L)	SD	Gadolinium (μg/L)	SD	Holmium (μg/L)	SD	Potassium (mg/L)	SD	Lanthanum (μg/L)	SD
Trip 1															
Yukon River near Stevens Village	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ray River	6/4/2003	0.020	0.000	387	6	0.020	0.001	0.13	0.00	0.022	0.000	0.34	0.01	0.38	0.01
Yukon River below Ray River	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hess Creek	6/4/2003	0.016	0.001	364	3	0.0085	0.0006	0.073	0.005	0.014	0.000	0.51	0.01	0.17	0.00
Yukon River below Hess Creek	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tozitna River	6/5/2003	0.022	0.000	534	7	0.017	0.001	0.11	0.01	0.017	0.000	0.39	0.01	0.61	0.01
Yukon River below Tozitna River	6/5/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nowitna River	6/6/2003	0.023	0.000	958	13	0.014	0.001	0.10	0.00	0.018	0.001	0.56	0.01	0.33	0.00
Yukon River below Nowitna River	6/6/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Melozitna River	6/6/2003	0.023	0.001	344	3	0.014	0.002	0.11	0.00	0.018	0.000	0.57	0.02	0.33	0.00
Yukon River below Melozitna River	6/8/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	6/8/2003	0.0099	0.0008	212	2	0.020	0.001	0.046	0.001	0.0079	0.0002	0.94	0.02	0.14	0.00
Yuki River	6/8/2003	0.021	0.001	1150	6	0.013	0.001	0.095	0.004	0.016	0.000	0.34	0.01	0.29	0.00
Yukon River below Yuki River	6/8/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Koyukuk River	6/9/2003	0.013	0.001	268	6	0.016	0.001	0.059	0.001	0.0097	0.0002	0.43	0.01	0.19	0.00
Yukon River below Koyukuk River	6/9/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nulato River	6/9/2003	0.0044	0.0003	83	1	0.0089	0.0004	0.018	0.000	0.0029	0.0001	0.34	0.01	0.041	0.001
Yukon River at Kaltag	6/10/2003	0.0093	0.0002	204	1	0.019	0.001	0.047	0.002	0.0090	0.0001	0.83	0.00	0.14	0.00
Anvik River	6/11/2003	0.0035	0.0003	312	15	0.007	0.001	0.013	0.000	0.0023	0.0000	0.31	0.02	0.039	0.001
Yukon River below Anvik River	6/11/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bonasila River	6/11/2003	0.0062	0.0005	986	11	0.007	0.000	0.027	0.001	0.0041	0.0001	0.45	0.02	0.084	0.001
Yukon River below Bonasila River	6/11/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Innoko River	6/12/2003	0.027	0.001	2250	31	0.021	0.001	0.10	0.00	0.016	0.001	0.61	0.04	0.29	0.01
Yukon River below Innoko River	6/12/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	6/13/2003	0.0076	0.0022	445	1	0.010	0.001	0.034	0.001	0.0056	0.0000	0.78	0.05	0.096	0.000
Yukon River at Pilot Station	6/13/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Andreafsky River	6/13/2003	0.0021	0.0004	201	6	0.004	0.001	0.0062	0.0002	0.0014	0.0000	0.40	0.03	0.018	0.000

Table 26. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Lithium (μg/L)	SD	Lutetium (μg/L)	SD	Magnesium (mg/L)	SD	Manganese (μg/L)	SD	Molybdenum (μg/L)	SD	Sodium (mg/L)	SD	Neodymium (μg/L)	SD
Trip 1															
Yukon River near Stevens Village	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ray River	6/4/2003	3.5	0.0	0.011	0.001	1.8	0.0	7.5	0.1	0.30	0.03	1.6	0.1	0.45	0.02
Yukon River below Ray River	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hess Creek	6/4/2003	0.90	0.01	0.0061	0.0002	6.1	0.2	27	0	0.23	0.01	1.3	0.1	0.23	0.00
Yukon River below Hess Creek	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tozitna River	6/5/2003	0.47	0.06	0.0064	0.0007	1.6	0.1	34	2	0.34	0.16	0.69	0.04	0.57	0.03
Yukon River below Tozitna River	6/5/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nowitna River	6/6/2003	0.62	0.02	0.0078	0.0003	3.2	0.1	8.7	0.1	0.22	0.02	1.2	0.1	0.40	0.01
Yukon River below Nowitna River	6/6/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Melozitna River	6/6/2003	0.65	0.02	0.0075	0.0002	1.7	0.1	2.6	0.1	0.23	0.04	0.96	0.01	0.40	0.00
Yukon River below Melozitna River	6/8/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	6/8/2003	2.3	0.0	0.0036	0.0001	5.4	0.1	4.9	0.2	0.70	0.13	1.6	0.1	0.16	0.00
Yuki River	6/8/2003	0.35	0.01	0.0057	0.0001	3.1	0.0	17	0	0.23	0.01	0.95	0.07	0.38	0.01
Yukon River below Yuki River	6/8/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Koyukuk River	6/9/2003	0.83	0.03	0.0040	0.0000	4.0	0.1	5.6	0.1	0.30	0.04	0.75	0.03	0.21	0.00
Yukon River below Koyukuk River	6/9/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nulato River	6/9/2003	0.58	0.02	0.0010	0.0001	4.1	0.1	7.1	0.1	0.15	0.01	1.5	0.1	0.059	0.001
Yukon River at Kaltag	6/10/2003	2.0	0.1	0.0035	0.0003	5.0	0.1	7.6	0.1	0.53	0.02	1.4	0.0	0.16	0.00
Anvik River	6/11/2003	0.40	0.02	0.0009	0.0002	2.3	0.1	7.9	0.1	0.18	0.04	2.0	0.1	0.054	0.001
Yukon River below Anvik River	6/11/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bonasila River	6/11/2003	0.28	0.01	0.0017	0.0002	1.6	0.1	8.6	0.1	0.22	0.18	1.9	0.1	0.11	0.00
Yukon River below Bonasila River	6/11/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Innoko River	6/12/2003	0.98	0.07	0.0056	0.0001	3.5	0.3	16	0	0.39	0.12	1.5	0.2	0.37	0.01
Yukon River below Innoko River	6/12/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	6/13/2003	1.5	0.2	0.0027	0.0001	3.9	0.2	1.5	0.1	0.47	0.05	1.6	0.1	0.12	0.00
Yukon River at Pilot Station	6/13/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Andreafsky River	6/13/2003	0.58	0.05	0.0006	0.0000	3.0	0.1	0.37	0.05	0.24	0.03	2.0	0.1	0.027	0.002

Table 26. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Nickel (μg/L)	SD	Phosphorus (μg/L)	SD	Lead (μg/L)	SD	Praseodymium (μg/L)	SD	Rubidium (μg/L)	SD	Rhenium (μg/L)	SD	Sulfur (mg/L)	SD
Trip 1															
Yukon River near Stevens Village	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ray River	6/4/2003	2.1	0.1	8	5	0.097	0.001	0.10	0.00	0.26	0.00	0.0005	0.0001	1.5	0.0
Yukon River below Ray River	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hess Creek	6/4/2003	3.3	0.1	< 7	5	0.055	0.002	0.053	0.000	0.22	0.00	0.0009	0.0000	7.4	0.2
Yukon River below Hess Creek	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tozitna River	6/5/2003	2.0	0.1	< 10	10	0.18	0.00	0.14	0.00	0.43	0.01	0.0007	0.0001	1.3	0.1
Yukon River below Tozitna River	6/5/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nowitna River	6/6/2003	2.1	0.0	20	3	0.15	0.01	0.092	0.000	0.33	0.00	0.0006	0.0001	1.3	0.0
Yukon River below Nowitna River	6/6/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Melozitna River	6/6/2003	2.2	0.1	9	4	0.15	0.00	0.094	0.000	0.34	0.01	0.0008	0.0000	1.6	0.1
Yukon River below Melozitna River	6/8/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	6/8/2003	1.9	0.2	< 10	1	0.15	0.00	0.037	0.000	0.92	0.01	0.0020	0.0002	8.3	0.0
Yuki River	6/8/2003	2.3	0.0	29	6	0.19	0.00	0.087	0.001	0.31	0.01	0.0013	0.0001	1.4	0.0
Yukon River below Yuki River	6/8/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Koyukuk River	6/9/2003	1.6	0.1	< 10	1	0.27	0.00	0.049	0.001	0.25	0.00	0.0011	0.0001	5.6	0.1
Yukon River below Koyukuk River	6/9/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nulato River	6/9/2003	0.38	0.09	< 10	2	0.06	0.00	0.012	0.000	0.13	0.00	0.0002	0.0001	2.4	0.1
Yukon River at Kaltag	6/10/2003	1.7	0.2	< 10	7	0.17	0.01	0.038	0.001	0.81	0.00	0.0023	0.0000	7.3	0.0
Anvik River	6/11/2003	0.39	0.08	9	2	0.029	0.004	0.011	0.000	0.32	0.01	< 0.0005	0.0003	2.0	0.1
Yukon River below Anvik River	6/11/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bonasila River	6/11/2003	0.63	0.07	19	4	0.11	0.00	0.024	0.000	0.77	0.02	< 0.0005	0.0004	0.74	0.06
Yukon River below Bonasila River	6/11/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Innoko River	6/12/2003	1.9	0.2	45	1	0.30	0.00	0.085	0.000	0.59	0.02	0.0009	0.0004	2.8	0.2
Yukon River below Innoko River	6/12/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	6/13/2003	1.5	0.2	< 7	4	0.14	0.00	0.027	0.000	0.80	0.02	0.0014	0.0002	4.8	0.1
Yukon River at Pilot Station	6/13/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Andreafsky River	6/13/2003	0.62	0.18	< 7	8	0.022	0.002	0.0053	0.0006	0.34	0.01	< 0.0005	0.0001	2.5	0.1

Table 26. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Antimony (μg/L)	SD	Selenium (μg/L)	SD	Silica (mg/L)	SD	Samarium (μg/L)	SD	Strontium (μg/L)	SD	Terbium (μg/L)	SD	Tellurium (μg/L)	SD
Trip 1															
Yukon River near Stevens Village	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ray River	6/4/2003	0.11	0.00	< 0.06	0.01	4.8	0.1	0.11	0.01	23	1	0.020	0.000	< 0.006	0.005
Yukon River below Ray River	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hess Creek	6/4/2003	0.21	0.01	0.12	0.04	4.6	0.1	0.063	0.005	61	1	0.011	0.000	< 0.006	0.000
Yukon River below Hess Creek	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tozitna River	6/5/2003	0.091	0.004	< 0.1	0.0	4.1	0.1	0.11	0.01	24	0	0.016	0.000	< 0.002	0.001
Yukon River below Tozitna River	6/5/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nowitna River	6/6/2003	0.15	0.00	< 0.06	0.03	5.8	0.0	0.097	0.000	44	1	0.015	0.000	< 0.006	0.002
Yukon River below Nowitna River	6/6/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Melozitna River	6/6/2003	0.15	0.01	< 0.06	0.05	4.2	0.1	0.097	0.000	45	1	0.016	0.000	< 0.006	0.003
Yukon River below Melozitna River	6/8/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	6/8/2003	0.17	0.00	0.28	0.02	4.7	0.1	0.036	0.000	96	1	0.0077	0.0003	0.006	0.008
Yuki River	6/8/2003	0.11	0.00	0.12	0.01	7.7	0.1	0.087	0.001	35	1	0.014	0.001	< 0.006	0.001
Yukon River below Yuki River	6/8/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Koyukuk River	6/9/2003	0.20	0.01	0.14	0.03	2.6	0.0	0.046	0.001	79	0	0.0083	0.0001	0.002	0.003
Yukon River below Koyukuk River	6/9/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nulato River	6/9/2003	0.053	0.003	0.24	0.13	4.4	0.1	0.016	0.002	124	0	0.0026	0.0000	< 0.002	0.003
Yukon River at Kaltag	6/10/2003	0.18	0.01	0.44	0.01	4.2	0.0	0.038	0.001	93	1	0.0070	0.0004	< 0.002	0.003
Anvik River	6/11/2003	0.049	0.003	0.12	0.03	7.9	0.3	0.012	0.000	50	1	0.0021	0.0002	< 0.005	0.002
Yukon River below Anvik River	6/11/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bonasila River	6/11/2003	0.079	0.002	< 0.1	0.0	11	0	0.024	0.000	33	1	0.0039	0.0001	< 0.005	0.007
Yukon River below Bonasila River	6/11/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Innoko River	6/12/2003	0.16	0.00	0.15	0.00	6.8	0.0	0.088	0.000	52	1	0.014	0.000	0.007	0.006
Yukon River below Innoko River	6/12/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	6/13/2003	0.13	0.00	0.22	0.03	4.9	0.2	0.030	0.001	80	1	0.0052	0.0003	< 0.005	0.002
Yukon River at Pilot Station	6/13/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Andreafsky River	6/13/2003	0.050	0.005	< 0.1	0.0	4.7	0.2	0.006	0.000	109	1	0.0010	0.0001	< 0.005	0.004

Table 26. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Thorium (μg/L)	SD	Thallium (μg/L)	SD	Thulium (μg/L)	SD	Uranium (μg/L)	SD	Vanadium (μg/L)	SD	Tungsten (μg/L)	SD	Yttrium (μg/L)	SD
Trip 1															
Yukon River near Stevens Village	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ray River	6/4/2003	0.28	0.00	< 0.003	0.000	0.0100	0.0006	1.6	0.1	0.46	0.05	0.49	0.00	0.68	0.02
Yukon River below Ray River	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hess Creek	6/4/2003	0.075	0.006	< 0.003	0.002	0.0050	0.0002	0.11	0.01	0.46	0.02	< 0.002	0.001	0.42	0.00
Yukon River below Hess Creek	6/4/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tozitna River	6/5/2003	0.14	0.00	0.029	0.004	0.0067	0.0006	0.30	0.00	0.83	0.10	0.057	0.003	0.53	0.00
Yukon River below Tozitna River	6/5/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nowitna River	6/6/2003	0.093	0.001	< 0.003	0.003	0.0073	0.0004	0.092	0.002	1.0	0.0	0.005	0.000	0.55	0.01
Yukon River below Nowitna River	6/6/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Melozitna River	6/6/2003	0.099	0.000	< 0.003	0.001	0.0077	0.0000	0.093	0.003	1.0	0.1	0.006	0.001	0.54	0.01
Yukon River below Melozitna River	6/8/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	6/8/2003	0.053	0.004	0.012	0.008	0.0033	0.0003	0.58	0.00	0.66	0.05	0.012	0.002	0.27	0.00
Yuki River	6/8/2003	0.066	0.000	< 0.003	0.001	0.0058	0.0002	0.047	0.001	1.8	0.1	0.002	0.000	0.44	0.00
Yukon River below Yuki River	6/8/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Koyukuk River	6/9/2003	0.062	0.001	< 0.003	0.001	0.0039	0.0003	0.35	0.00	0.35	0.03	0.010	0.000	0.30	0.00
Yukon River below Koyukuk River	6/9/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nulato River	6/9/2003	0.012	0.003	< 0.003	0.001	0.0010	0.0001	0.056	0.002	0.25	0.05	< 0.002	0.001	0.078	0.001
Yukon River at Kaltag	6/10/2003	0.051	0.001	< 0.003	0.002	0.0035	0.0001	0.53	0.00	0.59	0.01	0.012	0.001	0.27	0.00
Anvik River	6/11/2003	0.020	0.007	< 0.005	0.007	0.0007	0.0001	0.018	0.002	0.41	0.01	< 0.002	0.001	0.067	0.002
Yukon River below Anvik River	6/11/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bonasila River	6/11/2003	0.042	0.010	0.011	0.015	0.0016	0.0002	0.022	0.009	0.95	0.01	0.004	0.004	0.12	0.00
Yukon River below Bonasila River	6/11/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Innoko River	6/12/2003	0.16	0.01	0.011	0.009	0.0061	0.0002	0.15	0.01	1.9	0.1	0.009	0.002	0.49	0.00
Yukon River below Innoko River	6/12/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	6/13/2003	0.067	0.002	0.008	0.003	0.0025	0.0002	0.28	0.01	0.61	0.01	0.007	0.002	0.19	0.00
Yukon River at Pilot Station	6/13/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Andreafsky River	6/13/2003	0.023	0.007	< 0.005	0.004	0.0004	0.0002	0.042	0.001	0.20	0.01	< 0.002	0.001	0.035	0.002

Table 26. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Ytterbium (μg/L)	SD	Zirconium (μg/L)	SD
Trip 1					
Yukon River near Stevens Village	6/4/2003	--	--	--	--
Ray River	6/4/2003	0.069	0.002	0.86	0.03
Yukon River below Ray River	6/4/2003	--	--	--	--
Hess Creek	6/4/2003	0.035	0.001	0.63	0.02
Yukon River below Hess Creek	6/4/2003	--	--	--	--
Tozitna River	6/5/2003	0.042	0.001	0.37	0.00
Yukon River below Tozitna River	6/5/2003	--	--	--	--
Nowitna River	6/6/2003	0.048	0.000	0.77	0.01
Yukon River below Nowitna River	6/6/2003	--	--	--	--
Melozitna River	6/6/2003	0.048	0.002	0.77	0.01
Yukon River below Melozitna River	6/8/2003	--	--	--	--
Yukon River at Ruby	6/8/2003	0.022	0.002	0.27	0.02
Yuki River	6/8/2003	0.036	0.002	0.58	0.01
Yukon River below Yuki River	6/8/2003	--	--	--	--
Koyukuk River	6/9/2003	0.025	0.001	0.29	0.00
Yukon River below Koyukuk River	6/9/2003	--	--	--	--
Nulato River	6/9/2003	0.0050	0.0008	0.070	0.004
Yukon River at Kaltag	6/10/2003	0.023	0.000	0.25	0.00
Anvik River	6/11/2003	0.006	0.001	0.11	0.03
Yukon River below Anvik River	6/11/2003	--	--	--	--
Bonasila River	6/11/2003	0.010	0.001	0.22	0.02
Yukon River below Bonasila River	6/11/2003	--	--	--	--
Innoko River	6/12/2003	0.039	0.002	0.75	0.01
Yukon River below Innoko River	6/12/2003	--	--	--	--
Atchuelinguk River	6/13/2003	0.016	0.000	0.29	0.01
Yukon River at Pilot Station	6/13/2003	--	--	--	--
Andreafsky River	6/13/2003	0.003	0.000	0.091	0.020

Table 26. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Arsenic (μg/L)	SD	Boron (μg/L)	SD	Barium (μg/L)	SD	Beryllium (μg/L)	SD	Bismuth (μg/L)	SD	Calcium (mg/L)	SD	Cadmium (μg/L)	SD
Trip 2															
Yukon River near Stevens Village	8/24/2003	0.45	0.04	11	1	36	1	0.005	0.002	0.0026	0.0021	28	0	0.039	0.002
Ray River	8/25/2003	1.2	0.0	66	0	35	0	0.046	0.002	0.0067	0.0008	16	0	0.011	0.002
Yukon River below Ray River	8/25/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hess Creek	8/25/2003	0.84	0.01	2.9	0.6	66	4	0.026	0.006	0.0058	0.0028	20	0	0.015	0.005
Yukon River below Hess Creek	8/25/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tozitna River	8/26/2003	0.48	0.03	3.4	1.2	22	1	0.024	0.006	0.0036	0.0006	8.2	0.1	0.006	0.001
Yukon River below Tozitna River	8/26/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nowitna River	8/27/2003	1.5	0.1	4.4	0.2	33	2	0.016	0.001	0.0079	0.0061	21	0	< 0.006	0.001
Yukon River below Nowitna River	8/27/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Melozitna River	8/27/2003	0.30	0.01	5.2	0.6	17	0	0.013	0.002	0.0041	0.0029	9.0	0.1	< 0.006	0.001
Yukon River below Melozitna River	8/28/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	8/28/2003	0.76	0.02	12	1	41	1	0.005	0.001	0.0051	0.0040	31	0	< 0.006	0.002
Yuki River	8/28/2003	0.72	0.01	2.4	0.6	29	1	0.029	0.001	0.0044	0.0019	6.7	0.1	0.007	0.002
Yukon River below Yuki River	8/28/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Koyukuk River	8/29/2003	0.54	0.03	6.2	1.7	19	1	0.009	0.001	0.0088	0.0002	28	0	0.030	0.002
Yukon River below Koyukuk River	8/29/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nulato River	8/30/2002	0.23	0.01	6.0	1.0	21	1	0.004	0.003	0.0042	0.0037	21	0	0.010	0.005
Yukon River at Kaltag	8/30/2003	0.77	0.03	11	1	40	2	0.010	0.003	0.0031	0.0007	30	0	< 0.006	0.003
Anvik River	9/1/2003	0.42	0.01	16	1	15	1	0.005	0.002	0.0020	0.0009	12	0	< 0.006	0.002
Yukon River below Anvik River	9/1/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bonasila River	9/1/2003	0.90	0.01	6.0	0.7	16	0	0.009	0.003	0.0006	0.0003	9.5	0.3	< 0.006	0.003
Yukon River below Bonasila River	9/1/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Innoko River	9/2/2003	1.2	0.0	7.2	0.8	39	2	0.021	0.001	0.0080	0.0059	12	0	0.010	0.001
Yukon River below Innoko River	9/2/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	9/3/2003	0.75	0.00	7.9	0.5	32	1	0.005	0.004	0.0023	0.0013	21	1	0.008	0.003
Yukon River at Pilot Station	9/3/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Andreafsky River	9/3/2003	0.29	0.02	4.4	0.8	13	0	0.004	0.001	0.0041	0.0027	17	0	< 0.006	0.001

Table 26. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Cerium (μg/L)	SD	Cobalt (μg/L)	SD	Chromium (μg/L)	SD	Cesium (μg/L)	SD	Copper (μg/L)	SD	Dysprosium (μg/L)	SD	Erbium (μg/L)	SD
Trip 2															
Yukon River near Stevens Village	8/24/2003	0.11	0.00	4.5	0.0	< 0.3	0.1	0.016	0.000	1.6	0.0	0.012	0.001	0.0070	0.0006
Ray River	8/25/2003	0.24	0.01	0.21	0.01	0.5	0.1	< 0.005	0.004	1.9	0.1	0.047	0.001	0.030	0.000
Yukon River below Ray River	8/25/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hess Creek	8/25/2003	0.49	0.01	0.30	0.00	0.7	0.1	< 0.02	0.00	4.8	0.0	0.096	0.000	0.054	0.000
Yukon River below Hess Creek	8/25/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tozitna River	8/26/2003	0.73	0.02	0.27	0.00	0.6	0.0	< 0.005	0.002	2.6	0.0	0.077	0.001	0.045	0.000
Yukon River below Tozitna River	8/26/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nowitna River	8/27/2003	0.34	0.00	0.21	0.01	0.6	0.1	< 0.02	0.01	2.2	0.0	0.060	0.001	0.036	0.000
Yukon River below Nowitna River	8/27/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Melozitna River	8/27/2003	0.26	0.00	0.089	0.002	< 0.2	0.1	< 0.02	0.02	1.3	0.1	0.041	0.002	0.023	0.000
Yukon River below Melozitna River	8/28/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	8/28/2003	0.080	0.001	0.17	0.00	0.2	0.1	< 0.02	0.00	1.8	0.0	0.012	0.001	0.0065	0.0009
Yuki River	8/28/2003	0.76	0.02	0.41	0.01	1.2	0.1	<0.02	0.01	3.7	0.0	0.12	0.00	0.072	0.001
Yukon River below Yuki River	8/28/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Koyukuk River	8/29/2003	0.16	0.01	0.21	0.00	0.3	0.0	< 0.02	0.01	2.3	0.0	0.026	0.001	0.013	0.001
Yukon River below Koyukuk River	8/29/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nulato River	8/30/2002	0.033	0.002	0.058	0.006	0.3	0.0	< 0.02	0.01	0.54	0.11	0.0078	0.0008	0.0046	0.0005
Yukon River at Kaltag	8/30/2003	0.10	0.00	0.085	0.002	0.3	0.1	< 0.02	0.00	2.2	0.1	0.015	0.001	0.0083	0.0005
Anvik River	9/1/2003	0.063	0.001	0.11	0.01	< 0.2	0.1	< 0.02	0.01	0.64	0.00	0.015	0.001	0.0091	0.0009
Yukon River below Anvik River	9/1/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bonasila River	9/1/2003	0.13	0.00	0.16	0.00	< 0.2	0.0	< 0.02	0.01	0.98	0.01	0.022	0.001	0.015	0.000
Yukon River below Bonasila River	9/1/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Innoko River	9/2/2003	0.45	0.02	0.15	0.01	0.7	0.1	< 0.02	0.00	2.6	0.0	0.079	0.002	0.045	0.002
Yukon River below Innoko River	9/2/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	9/3/2003	0.13	0.00	0.085	0.003	< 0.2	0.2	< 0.02	0.00	1.8	0.1	0.019	0.000	0.011	0.001
Yukon River at Pilot Station	9/3/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Andreafsky River	9/3/2003	0.025	0.004	0.053	0.005	< 0.2	0.0	< 0.02	0.01	0.48	0.01	0.0056	0.0003	0.0032	0.0002

Table 26. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Europium (μg/L)	SD	Iron (μg/L)	SD	Gallium (μg/L)	SD	Gadolinium (μg/L)	SD	Holmium (μg/L)	SD	Potassium (mg/L)	SD	Lanthanum (μg/L)	SD
Trip 2															
Yukon River near Stevens Village	8/24/2003	0.0029	0.0004	108	3	0.039	0.001	0.013	0.001	0.0025	0.0000	1.0	0.0	0.057	0.001
Ray River	8/25/2003	0.0077	0.0013	488	6	0.016	0.001	0.047	0.002	0.010	0.000	0.48	0.01	0.12	0.00
Yukon River below Ray River	8/25/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hess Creek	8/25/2003	0.023	0.000	525	2	0.019	0.001	0.10	0.00	0.020	0.000	0.43	0.01	0.25	0.01
Yukon River below Hess Creek	8/25/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tozitna River	8/26/2003	0.017	0.000	339	9	0.015	0.001	0.085	0.002	0.015	0.000	0.30	0.04	0.40	0.00
Yukon River below Tozitna River	8/26/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nowitna River	8/27/2003	0.014	0.001	1060	3	0.013	0.000	0.065	0.002	0.012	0.000	0.51	0.00	0.18	0.01
Yukon River below Nowitna River	8/27/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Melozitna River	8/27/2003	0.0088	0.0008	254	5	0.0084	0.0007	0.047	0.003	0.0081	0.0002	0.33	0.01	0.18	0.00
Yukon River below Melozitna River	8/28/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	8/28/2003	0.0033	0.0002	87	1	0.036	0.001	0.013	0.000	0.0025	0.0002	1.3	0.1	0.044	0.001
Yuki River	8/28/2003	0.031	0.001	778	6	0.016	0.001	0.15	0.00	0.025	0.000	0.19	0.01	0.37	0.01
Yukon River below Yuki River	8/28/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Koyukuk River	8/29/2003	0.0062	0.0004	226	11	0.019	0.000	0.031	0.002	0.0050	0.0003	0.41	0.01	0.087	0.004
Yukon River below Koyukuk River	8/29/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nulato River	8/30/2002	0.0022	0.0003	73	0	0.0051	0.0009	0.0097	0.0008	0.0016	0.0001	0.41	0.04	0.020	0.001
Yukon River at Kaltag	8/30/2003	0.0032	0.0003	107	3	0.033	0.003	0.015	0.001	0.0031	0.0005	1.2	0.1	0.058	0.002
Anvik River	9/1/2003	0.0038	0.0005	394	10	0.0057	0.0006	0.016	0.001	0.0032	0.0003	0.37	0.01	0.038	0.002
Yukon River below Anvik River	9/1/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bonasila River	9/1/2003	0.0056	0.0004	1530	54	0.0065	0.0014	0.026	0.000	0.0047	0.0004	0.51	0.02	0.069	0.000
Yukon River below Bonasila River	9/1/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Innoko River	9/2/2003	0.018	0.000	1290	5	0.015	0.001	0.090	0.003	0.016	0.001	0.53	0.03	0.23	0.00
Yukon River below Innoko River	9/2/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	9/3/2003	0.0051	0.0005	310	11	0.021	0.000	0.019	0.001	0.0037	0.0006	0.90	0.01	0.071	0.002
Yukon River at Pilot Station	9/3/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Andreafsky River	9/3/2003	0.0008	0.0003	112	5	0.0043	0.0005	0.0058	0.0010	0.0011	0.0002	0.33	0.01	0.012	0.001

Table 26. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Lithium (μg/L)	SD	Lutetium (μg/L)	SD	Magnesium (mg/L)	SD	Manganese (μg/L)	SD	Molybdenum (μg/L)	SD	Sodium (mg/L)	SD	Neodymium (μg/L)	SD
Trip 2															
Yukon River near Stevens Village	8/24/2003	3.3	0.1	0.0010	0.0001	6.9	0.1	11	0	0.96	0.00	2.1	0.0	0.061	0.002
Ray River	8/25/2003	11	0	0.0057	0.0001	3.8	0.1	65	0	0.87	0.08	5.7	0.1	0.16	0.01
Yukon River below Ray River	8/25/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hess Creek	8/25/2003	0.92	0.04	0.0084	0.0002	6.5	0.1	27	0	0.38	0.04	1.4	0.0	0.34	0.01
Yukon River below Hess Creek	8/25/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tozitna River	8/26/2003	0.39	0.03	0.0062	0.0002	2.1	0.0	29	0	0.23	0.03	0.90	0.00	0.42	0.00
Yukon River below Tozitna River	8/26/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nowitna River	8/27/2003	0.87	0.02	0.0052	0.0002	6.3	0.0	16	0	0.46	0.14	1.9	0.0	0.24	0.01
Yukon River below Nowitna River	8/27/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Melozitna River	8/27/2003	0.69	0.02	0.0038	0.0002	2.9	0.0	7.7	0.1	0.34	0.01	1.6	0.0	0.20	0.00
Yukon River below Melozitna River	8/28/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	8/28/2003	3.5	0.0	0.0010	0.0000	7.7	0.0	3.2	0.1	1.1	0.1	2.5	0.1	0.051	0.002
Yuki River	8/28/2003	0.43	0.02	0.010	0.000	3.1	0.0	40	0	0.23	0.03	1.0	0.01	0.50	0.00
Yukon River below Yuki River	8/28/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Koyukuk River	8/29/2003	1.6	0.0	0.0020	0.0002	8.8	0.1	8.6	0.2	0.42	0.05	1.5	0.1	0.10	0.00
Yukon River below Koyukuk River	8/29/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nulato River	8/30/2002	0.92	0.02	0.0006	0.0002	6.4	0.1	15	0	0.26	0.11	2.4	0.0	0.029	0.002
Yukon River at Kaltag	8/30/2003	3.1	0.0	0.0013	0.0001	7.8	0.1	3.0	0.1	0.99	0.06	2.3	0.1	0.060	0.003
Anvik River	9/1/2003	0.71	0.00	0.0013	0.0002	3.6	0.1	19	0	0.25	0.01	3.1	0.1	0.051	0.001
Yukon River below Anvik River	9/1/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bonasila River	9/1/2003	0.44	0.01	0.0022	0.0001	2.9	0.1	56	2	0.15	0.04	3.1	0.1	0.092	0.002
Yukon River below Bonasila River	9/1/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Innoko River	9/2/2003	1.1	0.0	0.0067	0.0001	4.2	0.1	17	0	0.40	0.10	1.8	0.0	0.31	0.00
Yukon River below Innoko River	9/2/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	9/3/2003	1.9	0.0	0.0018	0.0002	5.4	0.2	15	1	0.63	0.04	2.2	0.0	0.083	0.001
Yukon River at Pilot Station	9/3/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Andreafsky River	9/3/2003	0.70	0.01	0.0005	0.0002	3.7	0.0	6.0	0.1	0.31	0.11	2.5	0.0	0.019	0.001

Table 26. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Nickel (μg/L)	SD	Phosphorus (μg/L)	SD	Lead (μg/L)	SD	Praseodymium (μg/L)	SD	Rubidium (μg/L)	SD	Rhenium (μg/L)	SD	Sulfur (mg/L)	SD
Trip 2															
Yukon River near Stevens Village	8/24/2003	1.5	0.2	< 10	6	0.08	0.00	0.015	0.001	1.3	0.0	0.0027	0.0002	12	0
Ray River	8/25/2003	1.9	0.2	< 10	4	0.07	0.01	0.034	0.001	0.55	0.01	0.0010	0.0000	3.7	0.0
Yukon River below Ray River	8/25/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hess Creek	8/25/2003	3.5	0.0	< 8	3	0.14	0.01	0.072	0.001	0.17	0.00	0.0013	0.0001	7.6	0.1
Yukon River below Hess Creek	8/25/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tozitna River	8/26/2003	1.7	0.0	< 10	4	0.09	0.00	0.10	0.00	0.37	0.00	0.0008	0.0002	2.0	0.0
Yukon River below Tozitna River	8/26/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nowitna River	8/27/2003	1.6	0.1	14	1	0.089	0.003	0.055	0.000	0.32	0.02	0.0009	0.0002	2.2	0.1
Yukon River below Nowitna River	8/27/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Melozitna River	8/27/2003	0.98	0.01	< 8	3	0.033	0.006	0.048	0.001	0.40	0.01	0.0005	0.0001	3.2	0.1
Yukon River below Melozitna River	8/28/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	8/28/2003	0.83	0.02	< 8	6	0.064	0.006	0.011	0.001	1.6	0.0	0.0026	0.0001	13	0
Yuki River	8/28/2003	3.2	0.0	15	6	0.078	0.004	0.11	0.00	0.14	0.01	0.0007	0.0001	1.3	0.0
Yukon River below Yuki River	8/28/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Koyukuk River	8/29/2003	1.00	0.01	< 8	5	0.23	0.00	0.025	0.001	0.23	0.01	0.0023	0.0002	15	0
Yukon River below Koyukuk River	8/29/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nulato River	8/30/2002	0.31	0.05	< 8	7	0.019	0.015	0.0055	0.0001	0.15	0.00	< 0.0003	0.0001	4.0	0.0
Yukon River at Kaltag	8/30/2003	0.94	0.05	< 8	3	0.087	0.005	0.015	0.000	1.3	0.1	0.0021	0.0001	13	0
Anvik River	9/1/2003	0.49	0.02	< 8	4	0.008	0.001	0.011	0.001	0.38	0.01	0.0009	0.0001	2.8	0.1
Yukon River below Anvik River	9/1/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bonasila River	9/1/2003	0.49	0.03	52	3	0.014	0.002	0.020	0.001	1.0	0.0	< 0.0003	0.0000	0.80	0.04
Yukon River below Bonasila River	9/1/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Innoko River	9/2/2003	1.8	0.0	36	2	0.16	0.01	0.071	0.002	0.52	0.03	0.0008	0.0003	2.9	0.1
Yukon River below Innoko River	9/2/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	9/3/2003	0.73	0.01	< 8	1	0.14	0.00	0.019	0.001	1.0	0.0	0.0016	0.0001	7.8	0.3
Yukon River at Pilot Station	9/3/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Andreafsky River	9/3/2003	0.31	0.02	< 8	4	0.021	0.005	0.0038	0.0004	0.25	0.00	< 0.0003	0.0001	3.1	0.0

Table 26. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Antimony (μg/L)	SD	Selenium (μg/L)	SD	Silica (mg/L)	SD	Samarium (μg/L)	SD	Strontium (μg/L)	SD	Terbium (μg/L)	SD	Tellurium (μg/L)	SD
Trip 2															
Yukon River near Stevens Village	8/24/2003	0.22	0.01	0.29	0.10	4.6	0.0	0.012	0.001	117	1	0.0021	0.0001	< 0.002	0.001
Ray River	8/25/2003	0.12	0.00	0.17	0.08	9.3	0.1	0.039	0.002	47	0	0.0078	0.0000	0.003	0.005
Yukon River below Ray River	8/25/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hess Creek	8/25/2003	0.20	0.01	0.15	0.04	7.9	0.0	0.093	0.000	72	5	0.016	0.000	< 0.006	0.000
Yukon River below Hess Creek	8/25/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tozitna River	8/26/2003	0.087	0.003	0.14	0.05	6.4	0.0	0.084	0.001	35	0	0.013	0.000	< 0.002	0.004
Yukon River below Tozitna River	8/26/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nowitna River	8/27/2003	0.11	0.00	0.08	0.01	8.6	0.0	0.060	0.001	84	5	0.010	0.000	< 0.006	0.004
Yukon River below Nowitna River	8/27/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Melozitna River	8/27/2003	0.053	0.007	< 0.06	0.05	6.7	0.1	0.046	0.003	42	1	0.0071	0.0001	< 0.006	0.001
Yukon River below Melozitna River	8/28/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	8/28/2003	0.25	0.00	0.27	0.04	6.0	0.1	0.012	0.001	130	4	0.0022	0.0001	< 0.006	0.000
Yuki River	8/28/2003	0.11	0.01	<0.06	0.07	9.2	0.1	0.13	0.01	35	1	0.022	0.000	< 0.006	0.002
Yukon River below Yuki River	8/28/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Koyukuk River	8/29/2003	0.15	0.01	0.24	0.09	4.2	0.1	0.027	0.001	122	8	0.0044	0.0000	< 0.006	0.005
Yukon River below Koyukuk River	8/29/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nulato River	8/30/2002	0.082	0.006	0.10	0.01	5.2	0.1	0.0088	0.0007	210	2	0.0016	0.0001	< 0.006	0.003
Yukon River at Kaltag	8/30/2003	0.23	0.01	0.36	0.05	5.9	0.0	0.015	0.001	131	1	0.0026	0.0002	< 0.006	0.001
Anvik River	9/1/2003	0.049	0.006	0.06	0.03	11	0	0.013	0.001	81	0	0.0020	0.0000	< 0.006	0.002
Yukon River below Anvik River	9/1/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bonasila River	9/1/2003	0.048	0.008	< 0.06	0.01	20	0	0.023	0.002	55	1	0.0040	0.0002	< 0.006	0.002
Yukon River below Bonasila River	9/1/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Innoko River	9/2/2003	0.15	0.01	0.14	0.05	9.2	0.3	0.080	0.001	62	3	0.014	0.000	< 0.006	0.005
Yukon River below Innoko River	9/2/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	9/3/2003	0.19	0.01	0.24	0.06	7.4	0.2	0.020	0.001	100	2	0.0032	0.0001	< 0.006	0.001
Yukon River at Pilot Station	9/3/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Andreafsky River	9/3/2003	0.061	0.004	< 0.06	0.02	6.6	0.1	0.0049	0.0002	132	3	0.0010	0.0001	< 0.006	0.001

Table 26. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Thorium (μg/L)	SD	Thallium (μg/L)	SD	Thulium (μg/L)	SD	Uranium (μg/L)	SD	Vanadium (μg/L)	SD	Tungsten (μg/L)	SD	Yttrium (μg/L)	SD
Trip 2															
Yukon River near Stevens Village	8/24/2003	0.027	0.006	< 0.003	0.000	0.0010	0.0001	0.64	0.00	0.61	0.08	0.009	0.001	0.071	0.001
Ray River	8/25/2003	0.13	0.00	< 0.003	0.003	0.0049	0.0002	1.0	0.0	0.61	0.02	1.2	0.0	0.31	0.00
Yukon River below Ray River	8/25/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hess Creek	8/25/2003	0.12	0.00	0.011	0.011	0.0075	0.0007	0.14	0.00	0.89	0.01	0.003	0.003	0.55	0.03
Yukon River below Hess Creek	8/25/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tozitna River	8/26/2003	0.13	0.01	< 0.003	0.002	0.0056	0.0002	0.20	0.01	0.75	0.09	0.066	0.002	0.44	0.00
Yukon River below Tozitna River	8/26/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nowitna River	8/27/2003	0.067	0.001	0.022	0.002	0.0050	0.0001	0.20	0.00	0.98	0.03	0.007	0.002	0.34	0.02
Yukon River below Nowitna River	8/27/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Melozitna River	8/27/2003	0.086	0.000	0.004	0.005	0.0033	0.0002	0.20	0.00	0.36	0.07	0.014	0.002	0.25	0.00
Yukon River below Melozitna River	8/28/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	8/28/2003	0.023	0.005	0.007	0.001	0.0009	0.0002	0.73	0.01	0.58	0.04	0.013	0.002	0.070	0.002
Yuki River	8/28/2003	0.12	0.01	0.006	0.005	0.0098	0.0001	0.053	0.002	1.1	0.1	0.004	0.002	0.73	0.02
Yukon River below Yuki River	8/28/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Koyukuk River	8/29/2003	0.054	0.001	0.004	0.001	0.0022	0.0001	0.80	0.02	0.39	0.04	0.010	0.002	0.14	0.01
Yukon River below Koyukuk River	8/29/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nulato River	8/30/2002	0.0085	0.0016	0.005	0.004	0.0007	0.0001	0.11	0.00	0.19	0.06	< 0.002	0.001	0.048	0.002
Yukon River at Kaltag	8/30/2003	0.029	0.001	0.005	0.001	0.0014	0.0001	0.75	0.00	0.54	0.03	0.015	0.001	0.091	0.005
Anvik River	9/1/2003	0.010	0.000	0.005	0.002	0.0013	0.0002	0.033	0.001	0.44	0.03	< 0.002	0.001	0.090	0.003
Yukon River below Anvik River	9/1/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bonasila River	9/1/2003	0.013	0.002	< 0.003	0.003	0.0022	0.0000	0.018	0.001	0.89	0.03	< 0.002	0.000	0.14	0.00
Yukon River below Bonasila River	9/1/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Innoko River	9/2/2003	0.073	0.003	0.011	0.009	0.0064	0.0002	0.14	0.00	1.1	0.1	0.006	0.001	0.47	0.02
Yukon River below Innoko River	9/2/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	9/3/2003	0.022	0.001	< 0.003	0.002	0.0014	0.0001	0.46	0.00	0.58	0.02	0.007	0.001	0.11	0.00
Yukon River at Pilot Station	9/3/2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Andreafsky River	9/3/2003	0.0091	0.0020	< 0.003	0.002	0.0004	0.0001	0.049	0.002	0.23	0.09	0.002	0.001	0.031	0.001

Table 26. Dissolved major cations and trace elements in 0.45-μm filtered water, Equal Discharge Increment sampling from churn, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; μg/L, micrograms per liter; mg/L, milligrams per liter; SD, standard deviation; <, less than; --, not available]

Site	Date	Ytterbium (μg/L)	SD	Zirconium (μg/L)	SD
Trip 2					
Yukon River near Stevens Village	8/24/2003	0.0061	0.0008	0.11	0.00
Ray River	8/25/2003	0.034	0.001	0.70	0.00
Yukon River below Ray River	8/25/2003	--	--	--	--
Hess Creek	8/25/2003	0.050	0.001	0.97	0.01
Yukon River below Hess Creek	8/25/2003	--	--	--	--
Tozitna River	8/26/2003	0.038	0.001	0.38	0.01
Yukon River below Tozitna River	8/26/2003	--	--	--	--
Nowitna River	8/27/2003	0.032	0.002	0.67	0.01
Yukon River below Nowitna River	8/27/2003	--	--	--	--
Melozitna River	8/27/2003	0.023	0.001	0.29	0.01
Yukon River below Melozitna River	8/28/2003	--	--	--	--
Yukon River at Ruby	8/28/2003	0.0073	0.0003	0.14	0.04
Yuki River	8/28/2003	0.068	0.002	1.1	0.0
Yukon River below Yuki River	8/28/2003	--	--	--	--
Koyukuk River	8/29/2003	0.013	0.000	0.28	0.01
Yukon River below Koyukuk River	8/29/2003	--	--	--	--
Nulato River	8/30/2002	0.0036	0.0004	0.084	0.024
Yukon River at Kaltag	8/30/2003	0.0088	0.0002	0.16	0.01
Anvik River	9/1/2003	0.0087	0.0001	0.15	0.00
Yukon River below Anvik River	9/1/2003	--	--	--	--
Bonasila River	9/1/2003	0.013	0.001	0.24	0.00
Yukon River below Bonasila River	9/1/2003	--	--	--	--
Innoko River	9/2/2003	0.040	0.001	0.68	0.03
Yukon River below Innoko River	9/2/2003	--	--	--	--
Atchuelinguk River	9/3/2003	0.010	0.001	0.15	0.01
Yukon River at Pilot Station	9/3/2003	--	--	--	--
Andreafsky River	9/3/2003	0.0028	0.0005	0.079	0.005

Major Anions

by Paul F. Schuster and Michael M. Reddy

A description of processing of samples for chloride (Cl), sulfate (SO_4), and nitrate (NO_3) can be found in Fishman and Friedman (1989). For a description of laboratory alkalinity analyses see USGS (1997-99). Sample analysis results for year 2002 are given in table 27, and results for year 2003 are given in table 28.

Table 27. Anion concentrations and laboratory alkalinity, year 2002

[Site name, refer to Table 1 and Plate 1 for location; mg/L, milligrams per liter; mg N/L, milligrams nitrogen per liter; E, estimate; --, not available]

Site	Date	Chloride (mg/L)	Sulfate (mg/L)	Nitrate (mg N/L)	Lab Alkalinity (mg/L as $CaCO_3$)
Trip 1					
Yukon River at Eagle	6/11/2002	0.4	26.6	0.057	68
Nation River	6/13/2002	0.9	40.6	0.135	81
Kandik River	6/15/2002	0.8	15.0	0.046	38
Coal Creek	6/15/2002	--	--	--	--
Charley River	6/16/2002	0.3	7.6	0.104	29
Woodchopper Creek	6/16/2002	--	--	--	--
Yukon River above Circle	6/17/2002	0.5	28.1	0.044	67
Sheenjek River	6/20/2002	0.3	18.3	0.053	79
Black River	6/20/2002	1.6	10.3	0.065	54
Upper Mouth Birch Creek	6/21/2002	0.7	16.8	0.039	34
Chandalar River	6/22/2002	0.2	35.7	0.104	97
Christian River	6/22/2002	0.3	2.6	0.059	48
Lower Mouth Birch Creek	6/23/2002	1.1	16.7	0.039	46
Yukon River at Timber Point	6/24/2002	0.6	27.8	0.040	64
Hodzana River	6/25/2002	0.4	13.4	0.097	42
Yukon River near Stevens Village	6/24/2002	0.5	27.3	0.048	68

Table 27. Anion concentrations and laboratory alkalinity, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; mg/L, milligrams per liter; mg N/L, milligrams nitrogen per liter; E, estimate; --, not available]

Site	Date	Chloride (mg/L)	Sulfate (mg/L)	Nitrate (mg N/L)	Lab Alkalinity (mg/L as $CaCO_3$)
Trip 2					
Yukon River at Eagle	8/22/2002	--	--	--	--
Yukon River below Tatonduk River	8/23/2002	0.5	31.8	0.058	69
Nation River	8/23/2002	0.9	55.6	0.235	115
Yukon River below Nation River	8/23/2002	0.5	37.8	0.082	75
Kandik River	8/24/2002	0.8	17.7	0.117	42
Yukon River below Kandik River	8/23/2002	0.6	37.2	0.078	75
Charley River	8/24/2002	0.2	7.4	0.184	28
Yukon River below Charley River	8/23/2002	0.6	34.1	0.062	71
Coal Creek	8/25/2002	3.4	56.5	0.239	49
Yukon River below Coal Creek	8/25/2002	0.6	30.7	0.072	70
Woodchopper Creek	8/24/2002	7.8	52.0	0.258	44
Yukon River below Woodchopper Creek	8/25/2002	0.5	29.9	0.070	68
Yukon River above Circle	8/26/2002	0.5	32.1	0.067	69
Yukon River above Twentytwo Mile Village	8/27/2002	17.3	32.6	0.060	68
Yukon River near Halfway Whirlpool	8/27/2002	0.5	32.4	0.057	70
Yukon River above Twelvemile Island	8/27/2002	0.5	32.2	0.067	69
Sheenjek River	8/28/2002	0.2	26.7	0.050	123
Black River	8/28/2002	1.5	15.2	0.065	59
Porcupine River 9.5 miles upstream from mouth	8/28/2002	0.8	27.0	0.040	65
Chandalar River	8/30/2002	0.2	43.8	0.118	118
Christian River	8/30/2002	0.4	8.5	0.015E	62
Upper Mouth Birch Creek	8/31/2002	0.5	20.0	0.157	32
Lower Mouth Birch Creek	8/31/2002	0.4	20.2	0.154	33
Yukon River below Porcupine River	9/2/2002	--	--	--	--
Hadweenzic River	9/2/2002	1.2	6.1	0.003E	115
Yukon River at Joe Devlin Island	9/2/2002	0.5	34.9	0.053	70
Beaver Creek	9/3/2002	0.7	25.3	0.128	48
Hodzana River	9/3/2002	0.4	17.3	0.003E	49
Yukon River below Hodzana River	9/4/2002	0.6	35.1	0.053	75
Yukon River at Timber Point	9/4/2002	0.6	34.6	0.050	69
Yukon River at Adams Island	9/4/2002	0.6	35.8	0.057	75
Dall River	9/4/2002	0.5	5.7	0.021E	41
Yukon River near Stevens Village	9/4/2002	0.6	35.1	0.056	69

Table 28. Anion concentrations and laboratory alkalinity, year 2003

[Site name, refer to Table 2 and Plate 1 for location; mg/L, milligrams per liter; mg N/L, milligrams nitrogen per liter; --, not available]

Site	Date	Chloride (mg/L)	Sulfate (mg/L)	Nitrate (mg N/L)	Lab Alkalinity (mg/L as $CaCO_3$)
Trip 1					
Yukon River near Stevens Village	6/4/2003	0.6	21.6	0.028	64
Ray River	6/4/2003	0.4	3.2	0.044	21
Yukon River below Ray River	6/4/2003	1.5	21.1	0.071	--
Hess Creek	6/4/2003	0.5	18.1	0.046	41
Yukon River below Hess Creek	6/4/2003	0.9	21.2	0.050	64
Tozitna River	6/5/2003	0.2	3.0	0.078	15
Yukon River below Tozitna River	6/5/2003	0.9	23.4	0.049	67
Nowitna River	6/6/2003	0.3	3.0	0.089	32
Yukon River below Nowitna River	6/6/2003	1.2	22.0	0.060	65
Melozitna River	6/6/2003	0.2	3.6	0.107	15
Yukon River below Melozitna River	6/8/2003	0.9	21.5	0.070	64
Yukon River at Ruby	6/8/2003	0.8	20.5	0.050	62
Yuki River	6/8/2003	0.4	3.3	0.192	24
Yukon River below Yuki River	6/8/2003	0.8	19.8	0.059	61
Koyukuk River	6/9/2003	0.1	13.9	0.064	52
Yukon River below Koyukuk River	6/9/2003	0.7	17.0	0.060	57
Nulato River	6/9/2003	0.4	5.6	0.265	46
Yukon River at Kaltag	6/10/2003	0.6	18.4	0.055	61
Anvik River	6/11/2003	0.6	4.6	0.117	28
Yukon River below Anvik River	6/11/2003	0.9	19.4	0.056	66
Bonasila River	6/11/2003	0.8	1.9	0.028	24
Yukon River below Bonasila River	6/11/2003	1.5	18.3	0.053	62
Innoko River	6/12/2003	0.5	6.2	0.133	33
Yukon River below Innoko River	6/12/2003	0.8	19.2	0.056	65
Atchuelinguk River	6/13/2003	0.9	12.4	0.019	50
Yukon River at Pilot Station	6/13/2003	0.8	18.7	0.060	65
Andreafsky River	6/13/2003	--	--	--	--

Table 28. Anion concentrations and laboratory alkalinity, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; mg/L, milligrams per liter; mg N/L, milligrams nitrogen per liter; <, less than; --, not available]

Site	Date	Chloride (mg/L)	Sulfate (mg/L)	Nitrate (mg N/L)	Lab Alkalinity (mg/L as $CaCO_3$)
Trip 2					
Yukon River near Stevens Village	8/24/2003	0.8	36.5	0.041	81
Ray River	8/25/2003	1.1	8.4	0.004	51
Yukon River below Ray River	8/25/2003	0.9	37.3	0.043	85
Hess Creek	8/25/2003	0.3	18.5	0.099	49
Yukon River below Hess Creek	8/25/2003	1.0	36.8	0.043	94
Tozitna River	8/26/2003	0.2	4.6	0.116	23
Yukon River below Tozitna River	8/26/2003	0.3	37.5	0.070	83
Nowitna River	8/27/2003	0.4	4.8	0.104	75
Yukon River below Nowitna River	8/27/2003	0.3	33.2	0.080	83
Melozitna River	8/27/2003	0.2	7.4	0.144	28
Yukon River below Melozitna River	8/28/2003	0.3	35.5	0.074	83
Yukon River at Ruby	8/28/2003	1.0	34.9	0.077	81
Yuki River	8/28/2003	0.3	2.7	0.048	22
Yukon River below Yuki River	8/28/2003	1.1	34.9	0.069	81
Koyukuk River	8/29/2003	0.2	40.6	0.092	72
Yukon River below Koyukuk River	8/29/2003	0.6	38.0	0.083	76
Nulato River	8/30/2002	0.3	9.7	0.200	76
Yukon River at Kaltag	8/30/2003	0.8	34.7	0.090	79
Anvik River	9/1/2003	0.8	6.5	0.025	45
Yukon River below Anvik River	9/1/2003	1.0	33.8	0.083	79
Bonasila River	9/1/2003	1.1	1.9	0.088	40
Yukon River below Bonasila River	9/1/2003	0.8	32.8	0.076	76
Innoko River	9/2/2003	0.5	6.6	0.119	41
Yukon River below Innoko River	9/2/2003	0.9	33.4	0.078	78
Atchuelinguk River	9/3/2003	0.9	19.8	0.064	60
Yukon River at Pilot Station	9/3/2003	0.8	33.1	0.083	77
Andreafsky River	9/3/2003	1.6	7.8	<0.008	56

Sediment Mineralogy

by Dennis Eberl

A description of sample collection and processing of samples for quantitative X-ray mineralogical analysis is given in Schuster (2003). Sample analysis results for year 2003 are given in table 29. For a more extensive analysis of sediment mineralogy in the Yukon River basin, see Eberl (2004).

Table 29. Sediment mineralogy, year 2003

[Site name, refer to Table 2 and Plate 1 for location; %, percent]

Site	Trip 1	Koyukuk River	Yukon River at Kaltag	Trip 2	Yukon River at Ruby	Koyukuk River	Yukon River at Kaltag
Date		6/9/2003	6/10/2003		8/28/2003	8/29/2003	8/30/2003
Mineral							
Non-Clays:		**Weight %**	**Weight %**		**Weight %**	**Weight %**	**Weight %**
Quartz		37.0	39.1		24.5	37.6	26.5
Ordered Microcline Feldspar		1.7	1.8		1.5	0.4	1.6
Intermed. Microcline Feldspar		0.0	0.1		0.7	0.0	0.0
Sanidine Feldspar		1.3	1.5		1.3	1.9	1.8
Orthoclase Feldspar		0.0	0.0		0.0	0.0	0.0
Anorthoclase Feldspar		10.3	10.6		9.8	6.0	10.4
Albite Feldspar		6.5	6.1		5.3	1.7	4.5
Oligoclase Feldspar		0.0	0.7		1.6	2.5	2.3
Andesine Feldspar		1.2	1.6		3.6	0.0	0.0
Labradorite Feldspar		6.0	4.6		3.3	0.0	5.8
Bytownite Feldspar		0.5	0.8		1.1	0.0	0.0
Anorthite Feldspar		0.0	0.0		0.0	0.0	0.0
Calcite		0.0	0.6		4.9	0.3	3.5
Mg-calcite		0.7	0.7		0.8	0.9	0.9
Dolomite		2.1	2.0		2.2	1.0	2.4
Amphibole		1.3	0.9		1.8	0.0	1.9
Pyroxene		1.0	0.8		0.7	0.3	0.7
Magnetite		0.0	0.0		0.0	0.0	0.0
Hematite		0.2	0.2		0.4	0.1	0.3
Goethite		0.0	0.0		0.0	0.0	0.1
Total non-clays:		69.9	72.1		63.5	52.6	62.8
Clays:							
Disordered Kaolinite		0.1	0.0		0.6	0.0	1.8
Ferruginous Smectite		4.7	2.2		2.8	3.2	5.9
Illite + Smectite		10.6	12.1		13.0	20.0	10.3
Total Chlorite		14.3	13.9		17.4	20.8	13.1
Total Clays:		29.6	28.3		33.8	44.0	31.1
Total Clays + Non-clays:		99.5	100.4		97.3	96.6	93.9

Dissolved and Colloidal Trace Elements

by Alan M. Shiller

A description of sample collection and processing of samples for dissolved and colloidal trace elements filtered through 0.45-μm and 0.02-μm pore size, respectively, 25-mm diameter filters is given in Schuster (2003). Samples in this section were collected by a centroid grab. For operational definitions in this report, the 0.45-μm filtered samples include dissolved and colloidal material, whereas the 0.02-μm filtered samples include dissolved material only. The colloidal fraction of the sample can be determined by subtracting the 0.02-μm fraction from the 0.45-μm fraction. Sample analysis results for 0.45-μm filtered samples for year 2002 are given in table 30, and results for year 2003 are given in table 31. Sample analysis results for 0.02-μm filtered samples for year 2002 are given in table 32, and results for year 2003 are given in table 33.

Table 30. Dissolved trace elements in 0.45-µm filtered water, from surface grabs, year 2002

[Site name, refer to Table 1 and Plate 1 for location; data are in micrograms per liter; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; <, less than; --, not available]

Site	Date	Ba	Cd	Ce	Co	Cr	Cs	Cu	Fe	Li	Mn
Trip 1											
Yukon River at Eagle	6/11/2002	45	0.021	0.267	0.114	0.34	0.011	2.17	178	2.61	6.7
Nation River	6/13/2002	40	0.039	0.119	0.400	0.20	0.004	1.53	197	5.55	21.4
Kandik River	6/15/2002	22	0.008	0.182	0.096	0.32	0.002	2.43	216	3.69	8.0
Coal Creek	6/15/2002	--	--	--	--	--	--	--	--	--	--
Charley River	6/16/2002	20	0.015	0.396	0.073	0.28	0.003	1.83	98	3.04	4.3
Woodchopper Creek	6/16/2002	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	6/17/2002	46	0.022	0.325	0.158	0.38	0.016	2.01	203	3.21	9.2
Sheenjek River	6/20/2002	28	0.009	0.022	0.044	0.10	0.000	1.26	28	1.23	5.9
Black River	6/20/2002	43	0.010	0.182	0.087	0.33	0.001	1.87	329	3.29	14.8
Upper Mouth Birch Creek	6/21/2002	48	0.009	0.526	0.117	0.35	0.004	3.51	332	2.80	25.2
Chandalar River	6/22/2002	16	0.006	0.017	0.041	0.09	0.001	0.69	9	1.82	5.9
Christian River	6/22/2002	83	0.007	0.092	0.086	0.21	0.001	3.53	266	0.34	25.8
Lower Mouth Birch Creek	6/23/2002	--	--	--	--	--	--	--	--	--	--
Yukon River at Timber Point	6/24/2002	47	0.013	0.176	0.101	0.25	0.009	1.77	146	3.18	6.7
Hodzana River	6/25/2002	29	0.008	0.146	0.074	0.11	0.001	1.19	248	1.81	29.6
Yukon River near Stevens Village	6/24/2002	44	0.014	0.143	0.088	0.26	0.006	1.94	115	2.83	6.9

Table 30. Dissolved trace elements in 0.45-μm filtered water, from surface grabs, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; data are in micrograms per liter; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; <, less than; --, not available]

Site	Date	Mo	Ni	Pb	Rb	Re	Sr	Tl	U	V	Zn
Trip 1											
Yukon River at Eagle	6/11/2002	0.71	1.72	0.085	1.09	0.002	119	0.005	0.72	0.76	1.21
Nation River	6/13/2002	0.44	3.25	0.060	0.22	0.003	135	0.005	0.31	0.46	3.03
Kandik River	6/15/2002	0.14	1.68	0.066	0.17	0.001	77	0.002	0.06	0.40	0.75
Coal Creek	6/15/2002	--	--	--	--	--	--	--	--	--	--
Charley River	6/16/2002	0.34	2.20	0.012	0.92	0.001	70	0.003	1.26	0.31	1.37
Woodchopper Creek	6/16/2002	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	6/17/2002	0.77	1.74	0.114	1.11	0.003	124	0.006	0.79	1.01	1.65
Sheenjek River	6/20/2002	0.26	0.86	0.018	0.07	0.003	82	<0.001	0.57	0.18	0.14
Black River	6/20/2002	0.23	1.81	0.073	0.23	0.001	64	0.002	0.14	0.58	0.64
Upper Mouth Birch Creek	6/21/2002	0.18	2.34	0.152	0.93	0.001	73	0.002	0.22	0.50	0.88
Chandalar River	6/22/2002	0.39	0.72	0.012	0.26	0.004	111	0.001	0.90	0.10	0.11
Christian River	6/22/2002	0.14	1.27	0.041	0.21	0.001	44	0.001	0.04	0.69	0.22
Lower Mouth Birch Creek	6/23/2002	--	--	--	--	--	--	--	--	--	--
Yukon River at Timber Point	6/24/2002	0.72	1.51	0.073	0.93	0.003	119	0.005	0.71	0.71	0.85
Hodzana River	6/25/2002	0.47	0.77	0.032	0.80	0.001	72	0.002	0.35	0.41	0.29
Yukon River near Stevens Village	6/24/2002	0.74	1.48	0.070	0.84	0.002	112	0.005	0.66	0.66	2.46

Table 30. Dissolved trace elements in 0.45-μm filtered water, from surface grabs, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; data are in micrograms per liter; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; <, less than; --, not available]

Site	Date	Ba	Cd	Ce	Co	Cr	Cs	Cu	Fe	Li	Mn
Trip 2											
Yukon River at Eagle	8/22/2002	--	--	--	--	--	--	--	--	--	--
Yukon River below Tatonduk River	8/23/2002	--	--	--	--	--	--	--	--	--	--
Nation River	8/23/2002	53	0.036	0.068	0.253	0.17	0.005	1.05	119	5.98	14.0
Yukon River below Nation River	8/23/2002	--	--	--	--	--	--	--	--	--	--
Kandik River	8/24/2002	24	0.008	0.153	0.127	0.35	0.002	2.14	177	3.95	18.6
Yukon River below Kandik River	8/23/2002	--	--	--	--	--	--	--	--	--	--
Charley River	8/24/2002	17	0.010	0.297	0.074	0.24	0.003	1.18	77	2.75	3.6
Yukon River below Charley River	8/23/2002	--	--	--	--	--	--	--	--	--	--
Coal Creek	8/25/2002	23	0.062	0.285	0.712	0.48	0.025	6.32	505	13.23	118.0
Yukon River below Coal Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--
Woodchopper Creek	8/24/2002	25	0.022	0.236	0.249	0.36	0.020	2.87	147	39.20	16.3
Yukon River below Woodchopper Creek	8/25/2002										
Yukon River above Circle	8/26/2002	39	0.018	0.298	0.162	0.40	0.017	2.35	183	3.19	12.0
Yukon River above Twentytwo Mile Village	8/27/2002	--	--	--	--	--	--	--	--	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--	--	--	--	--	--	--	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--	--	--	--	--	--	--	--	--
Sheenjek River	8/28/2002	44	0.006	0.001	0.019	0.05	0.000	0.40	2	1.26	12.1
Black River	8/28/2002	43	0.008	0.132	0.062	0.30	0.000	1.53	253	3.52	12.6
Porcupine River 9.5 miles upstream from mouth	8/28/2002	54	0.011	0.110	0.065	0.22	0.002	1.39	176	4.22	4.8
Chandalar River	8/30/2002	21	0.004	0.004	0.019	0.10	0.001	0.10	1	2.10	7.5
Christian River	8/30/2002	101	0.005	0.035	0.033	0.11	0.001	1.58	98	1.07	8.5
Upper Mouth Birch Creek	8/31/2002	41	0.007	0.450	0.095	0.33	0.003	2.59	215	2.70	12.5
Lower Mouth Birch Creek	8/31/2002	44	0.009	0.389	0.092	0.32	0.002	2.71	224	2.71	12.8
Yukon River below Porcupine River	9/2/2002	--	--	--	--	--	--	--	--	--	--
Hadweenzic River	9/2/2002	94	0.006	0.029	0.144	0.11	0.000	0.60	360	2.39	129.0
Yukon River at Joe Devlin Island	9/2/2002	48	0.022	0.188	0.104	0.23	0.010	2.13	115	3.30	8.5
Beaver Creek	9/3/2002	39	0.011	0.107	0.055	0.16	0.001	1.56	285	1.99	9.7
Hodzana River	9/3/2002	39	0.003	0.040	0.055	0.07	0.001	0.56	229	1.59	44.3
Yukon River below Hodzana River	9/4/2002										
Yukon River at Timber Point	9/4/2002	46	0.016	0.168	0.093	0.22	0.009	1.98	111	3.27	7.5
Yukon River at Adams Island	9/4/2002	--	--	--	--	--	--	--	--	--	--
Dall River	9/4/2002	27	0.007	0.310	0.068	0.37	0.003	1.83	415	4.64	6.3
Yukon River near Stevens Village	9/4/2002	49	0.019	0.192	0.103	0.25	0.011	2.22	123	3.35	6.9

Table 30. Dissolved trace elements in 0.45-μm filtered water, from surface grabs, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; data are in micrograms per liter; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; <, less than; --, not available]

Site	Date	Mo	Ni	Pb	Rb	Re	Sr	Tl	U	V	Zn
Trip 2											
Yukon River at Eagle	8/22/2002	--	--	--	--	--	--	--	--	--	--
Yukon River below Tatonduk River	8/23/2002	--	--	--	--	--	--	--	--	--	--
Nation River	8/23/2002	0.67	2.21	0.053	0.23	0.003	143	0.005	0.45	0.42	2.17
Yukon River below Nation River	8/23/2002	--	--	--	--	--	--	--	--	--	--
Kandik River	8/24/2002	0.17	1.61	0.032	0.14	0.001	90	0.002	0.07	0.42	0.47
Yukon River below Kandik River	8/23/2002	--	--	--	--	--	--	--	--	--	--
Charley River	8/24/2002	0.36	1.28	0.009	0.69	0.001	64	0.002	0.94	0.23	0.98
Yukon River below Charley River	8/23/2002	--	--	--	--	--	--	--	--	--	--
Coal Creek	8/25/2002	0.19	12.72	0.068	2.00	0.005	88	0.006	0.23	0.35	5.40
Yukon River below Coal Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--
Woodchopper Creek	8/24/2002	0.16	3.15	0.033	2.09	0.002	89	0.004	1.18	0.28	1.37
Yukon River below Woodchopper Creek	8/25/2002										
Yukon River above Circle	8/26/2002	0.84	1.94	0.084	1.44	0.003	113	0.007	0.80	0.92	0.96
Yukon River above Twentytwo Mile Village	8/27/2002	--	--	--	--	--	--	--	--	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--	--	--	--	--	--	--	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--	--	--	--	--	--	--	--	--
Sheenjek River	8/28/2002	0.36	0.28	<0.003	0.09	0.004	113	0.000	0.68	0.13	0.14
Black River	8/28/2002	0.21	1.52	0.036	0.18	0.001	78	0.001	0.14	0.38	0.31
Porcupine River 9.5 miles upstream from mouth	8/28/2002	0.34	2.63	0.065	0.19	0.002	101	0.002	0.30	0.32	1.54
Chandalar River	8/30/2002	0.44	0.42	<0.003	0.30	0.005	134	0.001	1.00	0.08	0.95
Christian River	8/30/2002	0.23	0.88	0.019	0.21	0.001	60	0.001	0.11	0.31	0.81
Upper Mouth Birch Creek	8/31/2002	0.14	2.09	0.122	0.60	0.001	74	0.002	0.18	0.34	0.44
Lower Mouth Birch Creek	8/31/2002	0.16	1.93	0.121	0.53	0.001	80	0.002	0.17	0.42	0.44
Yukon River below Porcupine River	9/2/2002	--	--	--	--	--	--	--	--	--	--
Hadweenzic River	9/2/2002	0.35	0.85	0.028	0.38	0.001	86	0.001	0.25	0.19	0.20
Yukon River at Joe Devlin Island	9/2/2002	0.75	1.94	0.109	0.94	0.003	122	0.005	0.67	0.69	1.28
Beaver Creek	9/3/2002	0.23	2.09	0.046	0.38	0.001	90	0.001	0.26	0.27	0.77
Hodzana River	9/3/2002	0.49	0.48	0.007	0.90	0.001	81	0.001	0.20	0.18	0.20
Yukon River below Hodzana River	9/4/2002										
Yukon River at Timber Point	9/4/2002	0.74	1.82	0.100	1.03	0.003	123	0.005	0.71	0.65	1.13
Yukon River at Adams Island	9/4/2002	--	--	--	--	--	--	--	--	--	--
Dall River	9/4/2002	0.36	1.11	0.059	0.69	0.001	44	0.002	0.32	0.51	0.25
Yukon River near Stevens Village	9/4/2002	0.76	1.80	0.114	1.08	0.003	125	0.005	0.71	0.69	1.40

Table 31. Dissolved trace elements in 0.45-µm filtered water, from surface grabs, year 2003

[Site name, refer to Table 2 and Plate 1 for location; data are in micrograms per liter; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; <, less than; --, not available]

Site	Date	Ba	Cd	Ce	Co	Cr	Cs	Cu	Fe	Li	Mn
Trip 1											
Yukon River near Stevens Village	6/4/2003	43	0.021	0.263	0.111	0.19	0.006	3.09	204	2.65	10.6
Ray River	6/4/2003	25	0.018	0.946	0.167	0.45	0.006	3.31	506	3.77	12.9
Yukon River below Ray River	6/4/2003	--	--	--	--	--	--	--	--	--	--
Hess Creek	6/4/2003	57	0.020	0.277	0.173	0.47	0.001	4.44	359	1.07	28.7
Yukon River below Hess Creek	6/4/2003	--	--	--	--	--	--	--	--	--	--
Tozitna River	6/5/2003	21	0.013	1.160	0.350	0.48	0.002	2.93	537	0.49	37.7
Yukon River below Tozitna River	6/5/2003	--	--	--	--	--	--	--	--	--	--
Nowitna River	6/6/2003	28	0.015	0.803	0.329	0.60	0.001	3.96	1422	0.72	46.0
Yukon River below Nowitna River	6/6/2003	--	--	--	--	--	--	--	--	--	--
Melozitna River	6/6/2003	16	0.011	1.138	0.148	0.44	0.004	2.48	488	0.76	16.7
Yukon River below Melozitna River	6/8/2003	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	6/8/2003	43	0.019	0.283	0.102	0.23	0.006	3.53	261	2.80	12.7
Yuki River	6/8/2003	31	0.012	0.651	0.197	0.72	0.001	2.63	1320	0.38	24.2
Yukon River below Yuki River	6/8/2003	--	--	--	--	--	--	--	--	--	--
Koyukuk River	6/9/2003	17	0.014	0.418	0.148	0.18	0.003	3.64	296	0.91	18.2
Yukon River below Koyukuk River	6/9/2003	--	--	--	--	--	--	--	--	--	--
Nulato River	6/9/2003	13	0.003	0.066	0.063	0.08	0.002	0.55	65	0.66	10.5
Yukon River at Kaltag	6/10/2003	37	0.017	0.345	0.108	0.22	0.007	3.64	211	2.32	13.5
Anvik River	6/11/2003	9	0.002	0.073	0.043	0.10	0.001	0.51	208	0.45	11.2
Yukon River below Anvik River	6/11/2003	--	--	--	--	--	--	--	--	--	--
Bonasila River	6/11/2003	12	0.006	0.180	0.056	0.18	0.003	0.64	723	0.31	18.7
Yukon River below Bonasila River	6/11/2003	--	--	--	--	--	--	--	--	--	--
Innoko River	6/12/2003	37	0.014	0.633	0.127	0.52	0.003	3.06	1514	1.05	17.0
Yukon River below Innoko River	6/12/2003	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	6/13/2003	31	0.009	0.203	0.042	0.16	0.003	2.60	338	1.56	6.0
Yukon River at Pilot Station	6/13/2003	42	0.017	0.313	0.101	0.21	0.007	4.10	310	2.32	18.7
Andreafsky River	6/13/2003	11	0.002	0.029	0.016	0.05	0.001	0.55	128	0.64	2.6

Table 31. Dissolved trace elements in 0.45-μm filtered water, from surface grabs, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; data are in micrograms per liter; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; <, less than; --, not available]

Site	Date	Mo	Ni	Pb	Rb	Re	Sr	Tl	U	V	Zn
Trip 1											
Yukon River near Stevens Village	6/4/2003	0.47	2.27	0.173	0.71	0.002	90	0.005	0.65	0.52	0.92
Ray River	6/4/2003	0.24	2.22	0.172	0.32	0.001	22	0.002	1.57	0.55	0.79
Yukon River below Ray River	6/4/2003	--	--	--	--	--	--	--	--	--	--
Hess Creek	6/4/2003	0.17	3.47	0.075	0.23	0.001	57	0.002	0.10	0.47	0.94
Yukon River below Hess Creek	6/4/2003	--	--	--	--	--	--	--	--	--	--
Tozitna River	6/5/2003	0.15	2.15	0.131	0.45	0.001	23	0.002	0.30	0.72	0.82
Yukon River below Tozitna River	6/5/2003	--	--	--	--	--	--	--	--	--	--
Nowitna River	6/6/2003	0.20	2.29	0.284	0.37	0.001	41	0.002	0.10	1.44	0.47
Yukon River below Nowitna River	6/6/2003	--	--	--	--	--	--	--	--	--	--
Melozitna River	6/6/2003	0.13	1.47	0.166	0.53	0.000	25	0.002	0.76	0.62	0.52
Yukon River below Melozitna River	6/8/2003	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	6/8/2003	0.60	2.04	0.207	1.06	0.002	97	0.006	0.63	0.68	0.68
Yuki River	6/8/2003	0.22	2.47	0.218	0.34	0.001	33	0.002	0.05	1.84	0.65
Yukon River below Yuki River	6/8/2003	--	--	--	--	--	--	--	--	--	--
Koyukuk River	6/9/2003	0.18	1.63	0.398	0.26	0.001	73	0.001	0.36	0.42	0.68
Yukon River below Koyukuk River	6/9/2003	--	--	--	--	--	--	--	--	--	--
Nulato River	6/9/2003	0.11	0.34	0.039	0.12	0.000	115	0.001	0.06	0.20	0.09
Yukon River at Kaltag	6/10/2003	0.46	1.84	0.267	0.91	0.002	88	0.005	0.58	0.65	0.74
Anvik River	6/11/2003	0.16	0.35	0.026	0.37	0.001	48	0.001	0.02	0.43	0.12
Yukon River below Anvik River	6/11/2003	--	--	--	--	--	--	--	--	--	--
Bonasila River	6/11/2003	0.10	0.41	0.050	0.85	0.000	33	0.001	0.02	0.87	0.20
Yukon River below Bonasila River	6/11/2003	--	--	--	--	--	--	--	--	--	--
Innoko River	6/12/2003	0.28	1.76	0.333	0.63	0.001	48	0.003	0.15	1.73	0.58
Yukon River below Innoko River	6/12/2003	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	6/13/2003	0.44	1.32	0.162	0.85	0.001	75	0.003	0.30	0.60	0.24
Yukon River at Pilot Station	6/13/2003	0.53	1.79	0.283	1.03	0.002	93	0.005	0.50	0.78	0.49
Andreafsky River	6/13/2003	0.20	0.29	0.013	0.38	0.000	98	0.001	0.04	0.17	0.11

Table 31. Dissolved trace elements in 0.45-μm filtered water, from surface grabs, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; data are in micrograms per liter; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; <, less than; --, not available]

Site	Date	Ba	Cd	Ce	Co	Cr	Cs	Cu	Fe	Li	Mn
Trip 2											
Yukon River near Stevens Village	8/24/2003	47	0.011	0.294	0.171	0.42	0.027	1.64	263	4.09	6.8
Ray River	8/25/2003	37	0.012	0.238	0.182	0.38	0.003	1.65	417	12.12	66.3
Yukon River below Ray River	8/25/2003	--	--	--	--	--	--	--	--	--	--
Hess Creek	8/25/2003	72	0.025	0.536	0.251	0.73	0.001	4.45	522	1.01	35.9
Yukon River below Hess Creek	8/25/2003	--	--	--	--	--	--	--	--	--	--
Tozitna River	8/26/2003	23	0.010	0.765	0.259	0.51	0.002	2.51	308	0.42	31.0
Yukon River below Tozitna River	8/26/2003	--	--	--	--	--	--	--	--	--	--
Nowitna River	8/27/2003	35	0.011	0.368	0.102	0.49	0.001	1.97	1056	0.93	18.2
Yukon River below Nowitna River	8/27/2003	--	--	--	--	--	--	--	--	--	--
Melozitna River	8/27/2003	18	0.005	0.273	0.071	0.37	0.002	1.23	224	0.75	9.8
Yukon River below Melozitna River	8/28/2003	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	8/28/2003	47	0.010	0.317	0.168	0.42	0.024	2.02	258	4.15	7.4
Yuki River	8/28/2003	31	0.014	0.856	0.376	1.05	0.001	3.57	929	0.46	47.9
Yukon River below Yuki River	8/28/2003	--	--	--	--	--	--	--	--	--	--
Koyukuk River	8/29/2003	20	0.008	0.123	0.071	0.17	0.002	1.98	126	1.82	8.5
Yukon River below Koyukuk River	8/29/2003	--	--	--	--	--	--	--	--	--	--
Nulato River	8/30/2002	22	0.003	0.027	0.037	0.07	0.001	0.42	57	1.02	16.0
Yukon River at Kaltag	8/30/2003	48	0.011	0.286	0.155	0.38	0.021	2.16	238	3.83	8.9
Anvik River	9/1/2003	15	0.002	0.059	0.056	0.14	0.002	0.56	325	0.78	21.9
Yukon River below Anvik River	9/1/2003	--	--	--	--	--	--	--	--	--	--
Bonasila River	9/1/2003	17	0.004	0.150	0.122	0.29	0.006	0.47	1669	0.49	58.5
Yukon River below Bonasila River	9/1/2003	--	--	--	--	--	--	--	--	--	--
Innoko River	9/2/2003	42	0.016	0.566	0.153	0.70	0.004	2.52	1528	1.21	21.3
Yukon River below Innoko River	9/2/2003	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	9/3/2003	34	0.010	0.133	0.077	0.18	0.007	1.64	281	2.05	18.3
Yukon River at Pilot Station	9/3/2003	44	0.008	0.120	0.071	0.21	0.009	2.01	134	3.08	6.2
Andreafsky River	9/3/2003	14	0.002	0.019	0.035	0.05	0.001	0.44	114	0.71	14.5

Table 31. Dissolved trace elements in 0.45-μm filtered water, from surface grabs, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; data are in micrograms per liter; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; <, less than; --, not available]

Site	Date	Mo	Ni	Pb	Rb	Re	Sr	Tl	U	V	Zn
Trip 2											
Yukon River near Stevens Village	8/24/2003	0.96	1.20	0.132	1.59	0.003	128	0.007	0.79	0.79	1.05
Ray River	8/25/2003	0.83	1.74	0.054	0.59	0.001	43	0.001	1.01	0.54	0.36
Yukon River below Ray River	8/25/2003	--	--	--	--	--	--	--	--	--	--
Hess Creek	8/25/2003	0.32	3.52	0.173	0.17	0.002	71	0.001	0.14	0.85	0.62
Yukon River below Hess Creek	8/25/2003	--	--	--	--	--	--	--	--	--	--
Tozitna River	8/26/2003	0.22	1.72	0.096	0.40	0.001	33	0.002	0.21	0.67	0.35
Yukon River below Tozitna River	8/26/2003	--	--	--	--	--	--	--	--	--	--
Nowitna River	8/27/2003	0.29	1.66	0.079	0.35	0.001	81	0.001	0.21	0.91	0.28
Yukon River below Nowitna River	8/27/2003	--	--	--	--	--	--	--	--	--	--
Melozitna River	8/27/2003	0.22	0.97	0.028	0.46	0.001	40	0.001	0.21	0.30	0.16
Yukon River below Melozitna River	8/28/2003	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	8/28/2003	1.00	1.16	0.171	1.80	0.003	130	0.006	0.81	0.85	0.96
Yuki River	8/28/2003	0.19	3.32	0.117	0.17	0.001	33	0.002	0.05	1.23	0.74
Yukon River below Yuki River	8/28/2003	--	--	--	--	--	--	--	--	--	--
Koyukuk River	8/29/2003	0.32	0.98	0.149	0.25	0.002	123	0.001	0.83	0.24	0.43
Yukon River below Koyukuk River	8/29/2003	--	--	--	--	--	--	--	--	--	--
Nulato River	8/30/2002	0.19	0.24	0.007	0.15	0.000	188	0.001	0.11	0.14	0.14
Yukon River at Kaltag	8/30/2003	0.94	1.11	0.166	1.75	0.003	121	0.006	0.76	0.79	0.81
Anvik River	9/1/2003	0.22	0.43	0.010	0.43	0.001	76	0.001	0.03	0.37	0.11
Yukon River below Anvik River	9/1/2003	--	--	--	--	--	--	--	--	--	--
Bonasila River	9/1/2003	0.12	0.49	0.019	1.12	0.000	52	0.001	0.02	0.90	0.21
Yukon River below Bonasila River	9/1/2003	--	--	--	--	--	--	--	--	--	--
Innoko River	9/2/2003	0.29	1.93	0.228	0.60	0.001	59	0.002	0.14	1.25	0.64
Yukon River below Innoko River	9/2/2003	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	9/3/2003	0.60	0.74	0.140	1.17	0.002	98	0.004	0.46	0.52	0.32
Yukon River at Pilot Station	9/3/2003	0.82	0.82	0.108	1.30	0.002	117	0.004	0.71	0.55	0.34
Andreafsky River	9/3/2003	0.17	0.30	0.007	0.29	0.000	109	0.001	0.04	0.11	0.04

Table 32. Dissolved trace elements in 0.02-µm filtered water, from surface grabs, year 2002

[Site name, refer to Table 1 and Plate 1 for location; data are in micrograms per liter; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; <, less than; --, not available]

Site	Date	Ba	Cd	Ce	Co	Cr	Cs	Cu	Fe	Li	Mn
Trip 1											
Yukon River at Eagle	6/11/2002	39	0.005	0.045	0.030	0.17	0.005	1.70	13	3.00	3.0
Nation River	6/13/2002	39	0.016	0.052	0.353	0.14	0.002	1.35	79	5.38	20.0
Kandik River	6/15/2002	22	0.005	0.135	0.093	0.30	0.001	2.26	142	3.78	7.8
Coal Creek	6/15/2002	--	--	--	--	--	--	--	--	--	--
Charley River	6/16/2002	18	0.013	0.283	0.068	0.25	0.003	1.71	72	3.02	4.1
Woodchopper Creek	6/16/2002	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	6/17/2002	44	0.010	0.041	0.046	0.11	0.004	1.65	12	2.99	4.0
Sheenjek River	6/20/2002	24	0.005	0.008	0.034	0.09	0.000	1.12	9	1.11	5.4
Black River	6/20/2002	41	0.009	0.090	0.072	0.22	0.000	1.52	90	3.09	12.2
Upper Mouth Birch Creek	6/21/2002	45	0.007	0.263	0.085	0.25	0.002	3.03	93	2.86	20.0
Chandalar River	6/22/2002	16	0.002	0.004	0.036	0.08	0.001	0.64	1	1.85	5.4
Christian River	6/22/2002	84	0.004	0.035	0.071	0.16	0.000	3.10	51	0.32	24.5
Lower Mouth Birch Creek	6/23/2002	--	--	--	--	--	--	--	--	--	--
Yukon River at Timber Point	6/24/2002	39	0.005	0.017	0.035	0.10	0.003	1.36	8	2.96	3.7
Hodzana River	6/25/2002	29	0.004	0.028	0.071	0.08	0.001	1.18	12	1.81	28.7
Yukon River near Stevens Village	6/24/2002	45	0.005	0.023	0.030	0.10	0.002	1.60	11	3.00	3.0

Table 32. Dissolved trace elements in 0.02-µm filtered water, from surface grabs, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; data are in micrograms per liter; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; <, less than; --, not available]

Site	Date	Mo	Ni	Pb	Rb	Re	Sr	Tl	U	V	Zn
Trip 1											
Yukon River at Eagle	6/11/2002	0.83	1.30	0.003	0.96	0.002	114	0.005	0.72	0.40	BD
Nation River	6/13/2002	0.52	2.90	0.011	0.21	0.003	113	0.005	0.31	0.38	0.42
Kandik River	6/15/2002	0.15	1.62	0.021	0.16	0.001	77	0.002	0.05	0.37	0.20
Coal Creek	6/15/2002	--	--	--	--	--	--	--	--	--	--
Charley River	6/16/2002	0.32	1.93	0.009	0.96	0.001	66	0.003	0.99	0.28	0.49
Woodchopper Creek	6/16/2002	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	6/17/2002	0.92	1.38	<0.003	1.00	0.003	125	0.005	0.74	0.44	0.14
Sheenjek River	6/20/2002	0.27	0.74	<0.003	0.06	0.003	77	<0.001	0.55	0.17	0.11
Black River	6/20/2002	0.21	1.58	0.010	0.19	0.001	62	0.001	0.12	0.31	0.91
Upper Mouth Birch Creek	6/21/2002	0.18	2.25	0.020	0.91	0.001	80	0.002	0.18	0.26	0.63
Chandalar River	6/22/2002	0.39	0.70	<0.003	0.24	0.004	119	0.001	0.93	0.10	<0.08
Christian River	6/22/2002	0.15	1.18	0.004	0.21	0.001	40	0.001	0.03	0.47	<0.08
Lower Mouth Birch Creek	6/23/2002	--	--	--	--	--	--	--	--	--	--
Yukon River at Timber Point	6/24/2002	0.82	1.17	<0.003	0.83	0.003	107	0.004	0.63	0.37	<0.08
Hodzana River	6/25/2002	0.46	0.77	0.004	0.87	0.001	70	0.002	0.24	0.25	0.11
Yukon River near Stevens Village	6/24/2002	0.83	1.30	<0.003	0.81	0.003	110	0.004	0.66	0.40	0.50

Table 32. Dissolved trace elements in 0.02-µm filtered water, from surface grabs, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; data are in micrograms per liter; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; <, less than; --, not available]

Site	Date	Ba	Cd	Ce	Co	Cr	Cs	Cu	Fe	Li	Mn
Trip 2											
Yukon River at Eagle	8/22/2002	--	--	--	--	--	--	--	--	--	--
Yukon River below Tatonduk River	8/23/2002	--	--	--	--	--	--	--	--	--	--
Nation River	8/23/2002	50	0.019	0.018	0.220	0.12	0.002	0.94	23	5.97	13.2
Yukon River below Nation River	8/23/2002	--	--	--	--	--	--	--	--	--	--
Kandik River	8/24/2002	24	0.008	0.141	0.110	0.29	0.001	1.92	122	3.69	15.6
Yukon River below Kandik River	8/23/2002	--	--	--	--	--	--	--	--	--	--
Charley River	8/24/2002	16	0.008	0.201	0.070	0.23	0.003	1.16	58	2.87	3.8
Yukon River below Charley River	8/23/2002	--	--	--	--	--	--	--	--	--	--
Coal Creek	8/25/2002	21	0.043	0.190	0.630	0.32	0.016	5.59	263	13.04	118.5
Yukon River below Coal Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--
Woodchopper Creek	8/24/2002	22	0.018	0.183	0.220	0.30	0.017	2.45	125	39.13	14.9
Yukon River below Woodchopper Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	8/26/2002	40	0.009	0.092	0.070	0.18	0.007	1.95	23	3.12	6.9
Yukon River above Twentytwo Mile Village	8/27/2002	--	--	--	--	--	--	--	--	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--	--	--	--	--	--	--	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--	--	--	--	--	--	--	--	--
Sheenjek River	8/28/2002	41	0.003	<0.001	0.020	0.05	0.000	0.24	0	1.31	11.3
Black River	8/28/2002	40	0.003	0.054	0.050	0.20	0.000	1.21	46	3.27	10.2
Porcupine River 9.5 miles up from mouth	8/28/2002	50	0.004	0.031	0.040	0.16	0.001	1.41	26	4.28	3.3
Chandalar River	8/30/2002	21	0.000	<0.001	0.020	0.09	0.001	0.25	0	2.13	6.7
Christian River	8/30/2002	103	0.001	0.008	0.030	0.09	0.001	1.49	7	1.08	8.1
Upper Mouth Birch Creek	8/31/2002	40	0.006	0.235	0.060	0.28	0.002	2.43	81	2.85	9.3
Lower Mouth Birch Creek	8/31/2002	43	0.005	0.218	0.060	0.29	0.001	2.58	84	2.69	7.4
Yukon River below Porcupine River	9/2/2002	--	--	--	--	--	--	--	--	--	--
Hadweenzic River	9/2/2002	97	0.003	0.010	0.150	0.09	0.000	0.57	5	2.59	135.9
Yukon River at Joe Devlin Island	9/2/2002	48	0.010	0.028	0.040	0.12	0.004	1.93	9	3.25	4.0
Beaver Creek	9/3/2002	37	0.005	0.017	0.040	0.09	0.001	1.25	10	1.96	7.1
Hodzana River	9/3/2002	38	0.002	0.009	0.050	0.04	0.001	0.51	2	1.59	44.4
Yukon River below Hodzana River	9/4/2002	--	--	--	--	--	--	--	--	--	--
Yukon River at Timber Point	9/4/2002	46	0.009	0.023	0.030	0.10	0.003	1.72	7	3.19	2.8
Yukon River at Adams Island	9/4/2002	--	--	--	--	--	--	--	--	--	--
Dall River	9/4/2002	25	0.004	0.170	0.070	0.31	0.003	1.73	102	4.70	5.8
Yukon River near Stevens Village	9/4/2002	42	0.007	0.029	0.030	0.11	0.003	1.90	9	3.00	2.0

Table 32. Dissolved trace elements in 0.02-µm filtered water, from surface grabs, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; data are in micrograms per liter; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; <, less than; --, not available]

Site	Date	Mo	Ni	Pb	Rb	Re	Sr	Tl	U	V	Zn
Trip 2											
Yukon River at Eagle	8/22/2002	--	--	--	--	--	--	--	--	--	--
Yukon River below Tatonduk River	8/23/2002	--	--	--	--	--	--	--	--	--	--
Nation River	8/23/2002	0.73	2.10	0.004	0.21	0.003	146	0.005	0.46	0.33	0.20
Yukon River below Nation River	8/23/2002	--	--	--	--	--	--	--	--	--	--
Kandik River	8/24/2002	0.16	1.50	0.019	0.12	0.001	83	0.002	0.07	0.31	--
Yukon River below Kandik River	8/23/2002	--	--	--	--	--	--	--	--	--	--
Charley River	8/24/2002	0.36	1.30	0.004	0.73	0.001	70	0.002	0.78	0.24	0.27
Yukon River below Charley River	8/23/2002	--	--	--	--	--	--	--	--	--	--
Coal Creek	8/25/2002	0.21	12.10	0.014	1.90	0.005	88	0.006	0.22	0.17	2.83
Yukon River below Coal Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--
Woodchopper Creek	8/24/2002	0.16	2.80	0.013	1.99	0.002	82	0.003	1.08	0.23	0.62
Yukon River below Woodchopper Creek	8/25/2002	--	--	--	--	--	--	--	--	--	--
Yukon River above Circle	8/26/2002	0.96	1.60	0.004	1.23	0.003	124	0.006	0.71	0.54	<0.08
Yukon River above Twentytwo Mile Village	8/27/2002	--	--	--	--	--	--	--	--	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--	--	--	--	--	--	--	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--	--	--	--	--	--	--	--	--
Sheenjek River	8/28/2002	0.35	0.30	<0.003	0.09	0.004	108	0.000	0.65	0.13	<0.08
Black River	8/28/2002	0.21	1.40	0.004	0.18	0.001	69	0.001	0.14	0.22	0.22
Porcupine River 9.5 miles up from mouth	8/28/2002	0.38	2.30	0.003	0.17	0.002	102	0.002	0.31	0.18	0.23
Chandalar River	8/30/2002	0.43	0.40	<0.003	0.27	0.004	137	0.001	0.92	0.10	0.17
Christian River	8/30/2002	0.23	0.80	<0.003	0.21	0.001	63	0.001	0.11	0.23	0.20
Upper Mouth Birch Creek	8/31/2002	0.15	2.00	0.013	0.57	0.001	83	0.001	0.15	0.22	0.15
Lower Mouth Birch Creek	8/31/2002	0.18	2.00	0.013	0.54	0.001	81	0.001	0.14	0.27	0.24
Yukon River below Porcupine River	9/2/2002	--	--	--	--	--	--	--	--	--	--
Hadweenzic River	9/2/2002	0.35	0.90	<0.003	0.40	0.001	99	0.000	0.25	0.10	<0.08
Yukon River at Joe Devlin Island	9/2/2002	0.81	1.80	<0.003	0.91	0.003	131	0.004	0.68	0.43	0.14
Beaver Creek	9/3/2002	0.22	1.80	<0.003	0.37	0.001	85	0.001	0.25	0.15	0.08
Hodzana River	9/3/2002	0.50	0.50	<0.003	0.92	0.001	80	0.001	0.19	0.09	<0.08
Yukon River below Hodzana River	9/4/2002	--	--	--	--	--	--	--	--	--	--
Yukon River at Timber Point	9/4/2002	0.86	1.60	<0.003	0.92	0.003	125	0.004	0.74	0.40	0.14
Yukon River at Adams Island	9/4/2002	--	--	--	--	--	--	--	--	--	--
Dall River	9/4/2002	0.35	1.20	0.009	0.76	0.001	43	0.002	0.27	0.29	0.15
Yukon River near Stevens Village	9/4/2002	0.94	1.60	<0.003	1.03	0.003	116	0.004	0.79	0.42	<0.08

Table 33. Dissolved trace elements in 0.02-µm filtered water, from surface grabs, year 2003

[Site name, refer to Table 2 and Plate 1 for location; data are in micrograms per liter; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; <, less than; --, not available]

Site	Date	Ba	Cd	Ce	Co	Cr	Cs	Cu	Fe	Li	Mn
Trip 1											
Yukon River near Stevens Village	6/4/2003	39	0.009	0.075	0.065	0.10	0.002	2.59	38.5	2.56	7.1
Ray River	6/4/2003	18	0.010	0.437	0.144	0.35	0.003	2.68	196.4	3.68	12.1
Yukon River below Ray River	6/4/2003	--	--	--	--	--	--	--	--	--	--
Hess Creek	6/4/2003	53	0.015	0.186	0.155	0.41	0.001	3.96	210.4	0.97	26.6
Yukon River below Hess Creek	6/4/2003	--	--	--	--	--	--	--	--	--	--
Tozitna River	6/5/2003	17	0.009	0.643	0.291	0.36	0.001	2.37	261.0	0.46	34.2
Yukon River below Tozitna River	6/5/2003	--	--	--	--	--	--	--	--	--	--
Nowitna River	6/6/2003	22	0.008	0.309	0.269	0.44	0.001	3.17	300.0	0.70	40.5
Yukon River below Nowitna River	6/6/2003	--	--	--	--	--	--	--	--	--	--
Melozitna River	6/6/2003	13	0.006	0.538	0.111	0.32	0.002	2.03	147.1	0.73	13.8
Yukon River below Melozitna River	6/8/2003	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	6/8/2003	37	0.008	0.081	0.058	0.14	0.003	2.91	53.9	2.67	8.3
Yuki River	6/8/2003	22	0.005	0.117	0.137	0.41	0.001	1.94	61.3	0.39	20.9
Yukon River below Yuki River	6/8/2003	--	--	--	--	--	--	--	--	--	--
Koyukuk River	6/9/2003	15	0.005	0.105	0.078	0.08	0.001	2.98	41.2	0.84	12.6
Yukon River below Koyukuk River	6/9/2003	--	--	--	--	--	--	--	--	--	--
Nulato River	6/9/2003	12	0.002	0.020	0.048	0.05	0.001	0.45	7.5	0.62	9.5
Yukon River at Kaltag	6/10/2003	32	0.006	0.083	0.053	0.12	0.003	2.88	38.7	2.20	7.9
Anvik River	6/11/2003	9	0.001	0.014	0.036	0.07	0.001	0.41	8.0	0.42	10.3
Yukon River below Anvik River	6/11/2003	--	--	--	--	--	--	--	--	--	--
Bonasila River	6/11/2003	10	0.001	0.013	0.045	0.09	0.003	0.51	8.2	0.30	17.2
Yukon River below Bonasila River	6/11/2003	--	--	--	--	--	--	--	--	--	--
Innoko River	6/12/2003	28	0.005	0.084	0.086	0.27	0.002	2.19	69.2	1.01	14.0
Yukon River below Innoko River	6/12/2003	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	6/13/2003	28	0.004	0.030	0.031	0.10	0.002	2.07	23.2	1.49	4.9
Yukon River at Pilot Station	6/13/2003	38	0.006	0.064	0.058	0.12	0.004	3.29	41.1	2.30	13.3
Andreafsky River	6/13/2003	10	<0.001	0.003	0.013	0.03	0.001	0.44	2.2	0.60	2.2

Table 33. Dissolved trace elements in 0.02-µm filtered water, from surface grabs, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; data are in micrograms per liter; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; <, less than; --, not available]

Site	Date	Mo	Ni	Pb	Rb	Re	Sr	Tl	U	V	Zn
Trip 1											
Yukon River near Stevens Village	6/4/2003	0.55	1.95	0.007	0.69	0.002	89	0.004	0.62	0.32	0.08
Ray River	6/4/2003	0.27	1.98	0.029	0.30	0.001	21	0.001	1.02	0.41	0.46
Yukon River below Ray River	6/4/2003	--	--	--	--	--	--	--	--	--	--
Hess Creek	6/4/2003	0.19	3.25	0.021	0.23	0.001	57	0.002	0.08	0.36	0.44
Yukon River below Hess Creek	6/4/2003	--	--	--	--	--	--	--	--	--	--
Tozitna River	6/5/2003	0.16	1.88	0.030	0.43	0.001	21	0.002	0.21	0.50	0.39
Yukon River below Tozitna River	6/5/2003	--	--	--	--	--	--	--	--	--	--
Nowitna River	6/6/2003	0.19	2.01	0.031	0.36	0.001	39	0.001	0.06	0.61	0.13
Yukon River below Nowitna River	6/6/2003	--	--	--	--	--	--	--	--	--	--
Melozitna River	6/6/2003	0.14	1.28	0.018	0.49	0.000	24	0.001	0.52	0.30	0.13
Yukon River below Melozitna River	6/8/2003	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	6/8/2003	0.61	1.77	0.010	1.01	0.002	96	0.005	0.58	0.39	0.17
Yuki River	6/8/2003	0.20	2.07	0.003	0.33	0.001	31	0.001	0.02	0.47	0.09
Yukon River below Yuki River	6/8/2003	--	--	--	--	--	--	--	--	--	--
Koyukuk River	6/9/2003	0.27	1.36	0.011	0.24	0.001	72	0.001	0.31	0.18	0.14
Yukon River below Koyukuk River	6/9/2003	--	--	--	--	--	--	--	--	--	--
Nulato River	6/9/2003	0.14	0.28	0.001	0.11	0.000	114	0.001	0.05	0.14	<0.04
Yukon River at Kaltag	6/10/2003	0.54	1.56	0.008	0.87	0.002	85	0.004	0.54	0.34	0.07
Anvik River	6/11/2003	0.17	0.30	<0.001	0.36	0.001	47	0.001	0.01	0.23	<0.04
Yukon River below Anvik River	6/11/2003	--	--	--	--	--	--	--	--	--	--
Bonasila River	6/11/2003	0.10	0.35	0.001	0.85	0.000	32	0.001	0.01	0.20	<0.04
Yukon River below Bonasila River	6/11/2003	--	--	--	--	--	--	--	--	--	--
Innoko River	6/12/2003	0.16	1.44	0.004	0.61	0.001	46	0.002	0.07	0.40	0.06
Yukon River below Innoko River	6/12/2003	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	6/13/2003	0.40	1.13	0.002	0.83	0.001	73	0.003	0.24	0.27	<0.04
Yukon River at Pilot Station	6/13/2003	0.55	1.57	0.009	0.98	0.002	91	0.004	0.43	0.45	0.10
Andreafsky River	6/13/2003	0.21	0.26	<0.001	0.38	0.000	97	0.001	0.04	0.10	<0.04

Table 33. Dissolved trace elements in 0.02-µm filtered water, from surface grabs, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; data are in micrograms per liter; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; <, less than; --, not available]

Site	Date	Ba	Cd	Ce	Co	Cr	Cs	Cu	Fe	Li	Mn
Trip 2											
Yukon River near Stevens Village	8/24/2003	43	0.003	0.006	0.019	0.09	0.007	1.17	2.3	3.94	1.0
Ray River	8/25/2003	34	0.008	0.105	0.167	0.28	0.003	1.48	70.0	12.16	66.2
Yukon River below Ray River	8/25/2003	--	--	--	--	--	--	--	--	--	--
Hess Creek	8/25/2003	66	0.016	0.333	0.213	0.64	0.001	4.03	246.6	1.01	32.8
Yukon River below Hess Creek	8/25/2003	--	--	--	--	--	--	--	--	--	--
Tozitna River	8/26/2003	21	0.006	0.436	0.223	0.42	0.001	2.24	153.9	0.43	28.6
Yukon River below Tozitna River	8/26/2003	--	--	--	--	--	--	--	--	--	--
Nowitna River	8/27/2003	32	0.004	0.070	0.083	0.32	0.001	1.68	71.4	0.94	16.1
Yukon River below Nowitna River	8/27/2003	--	--	--	--	--	--	--	--	--	--
Melozitna River	8/27/2003	16	0.003	0.110	0.064	0.28	0.002	1.12	36.5	0.76	9.1
Yukon River below Melozitna River	8/28/2003	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	8/28/2003	42	0.004	0.007	0.023	0.11	0.008	1.40	3.7	3.93	1.5
Yuki River	8/28/2003	25	0.008	0.345	0.315	0.80	0.000	2.88	211.5	0.49	42.8
Yukon River below Yuki River	8/28/2003	--	--	--	--	--	--	--	--	--	--
Koyukuk River	8/29/2003	19	0.005	0.028	0.045	0.12	0.001	1.74	11.8	1.79	6.2
Yukon River below Koyukuk River	8/29/2003	--	--	--	--	--	--	--	--	--	--
Nulato River	8/30/2003	21	0.003	0.008	0.036	0.06	0.001	0.40	4.3	1.02	15.7
Yukon River at Kaltag	8/30/2003	43	0.004	0.010	0.026	0.13	0.007	1.60	4.6	3.66	3.1
Anvik River	9/1/2003	15	0.001	0.013	0.051	0.09	0.001	0.47	15.0	0.79	21.7
Yukon River below Anvik River	9/1/2003	--	--	--	--	--	--	--	--	--	--
Bonasila River	9/1/2003	14	0.002	0.012	0.104	0.15	0.006	0.39	7.4	0.49	58.3
Yukon River below Bonasila River	9/1/2003	--	--	--	--	--	--	--	--	--	--
Innoko River	9/2/2003	34	0.007	0.097	0.105	0.42	0.002	1.93	90.3	1.22	17.7
Yukon River below Innoko River	9/2/2003	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	9/3/2003	31	0.004	0.008	0.050	0.10	0.005	1.36	5.6	1.99	16.3
Yukon River at Pilot Station	9/3/2003	43	0.005	0.009	0.026	0.12	0.005	1.73	5.0	2.98	4.1
Andreafsky River	9/3/2003	13	0.002	0.004	0.032	0.04	0.001	0.39	3.0	0.70	14.0

Table 33. Dissolved trace elements in 0.02-µm filtered water, from surface grabs, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; data are in micrograms per liter; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; <, less than; --, not available]

Site	Date	Mo	Ni	Pb	Rb	Re	Sr	Tl	U	V	Zn
Trip 2											
Yukon River near Stevens Village	8/24/2003	1.12	0.77	0.001	1.42	0.003	124	0.005	0.77	0.32	<0.04
Ray River	8/25/2003	0.81	1.66	0.004	0.59	0.001	44	0.001	0.82	0.35	0.11
Yukon River below Ray River	8/25/2003	--	--	--	--	--	--	--	--	--	--
Hess Creek	8/25/2003	0.36	3.36	0.041	0.16	0.002	70	0.001	0.13	0.56	0.18
Yukon River below Hess Creek	8/25/2003	--	--	--	--	--	--	--	--	--	--
Tozitna River	8/26/2003	0.22	1.62	0.019	0.39	0.001	32	0.002	0.15	0.49	0.18
Yukon River below Tozitna River	8/26/2003	--	--	--	--	--	--	--	--	--	--
Nowitna River	8/27/2003	0.28	1.51	0.002	0.35	0.001	79	0.001	0.18	0.32	<0.04
Yukon River below Nowitna River	8/27/2003	--	--	--	--	--	--	--	--	--	--
Melozitna River	8/27/2003	0.22	0.93	0.003	0.47	0.001	40	0.001	0.14	0.21	0.08
Yukon River below Melozitna River	8/28/2003	--	--	--	--	--	--	--	--	--	--
Yukon River at Ruby	8/28/2003	1.12	0.71	0.001	1.62	0.003	127	0.005	0.75	0.37	<0.04
Yuki River	8/28/2003	0.18	2.93	0.015	0.17	0.001	31	0.002	0.03	0.75	0.28
Yukon River below Yuki River	8/28/2003	--	--	--	--	--	--	--	--	--	--
Koyukuk River	8/29/2003	0.37	0.91	0.002	0.25	0.003	123	0.001	0.77	0.17	0.04
Yukon River below Koyukuk River	8/29/2003	--	--	--	--	--	--	--	--	--	--
Nulato River	8/30/2003	0.19	0.24	0.002	0.15	0.000	182	0.001	0.10	0.14	--
Yukon River at Kaltag	8/30/2003	1.09	0.74	0.003	1.58	0.003	123	0.004	0.73	0.40	0.14
Anvik River	9/1/2003	0.23	0.41	<0.001	0.43	0.001	75	0.001	0.03	0.20	0.12
Yukon River below Anvik River	9/1/2003	--	--	--	--	--	--	--	--	--	--
Bonasila River	9/1/2003	0.11	0.44	0.003	1.09	0.000	50	0.001	0.01	0.15	0.16
Yukon River below Bonasila River	9/1/2003	--	--	--	--	--	--	--	--	--	--
Innoko River	9/2/2003	0.30	1.67	0.006	0.59	0.001	57	0.002	0.08	0.32	0.20
Yukon River below Innoko River	9/2/2003	--	--	--	--	--	--	--	--	--	--
Atchuelinguk River	9/3/2003	0.62	0.61	0.001	1.12	0.002	96	0.003	0.41	0.30	0.06
Yukon River at Pilot Station	9/3/2003	0.84	0.67	0.002	1.26	0.003	117	0.004	0.64	0.37	<0.04
Andreafsky River	9/3/2003	0.17	0.27	0.001	0.29	0.000	109	0.001	0.03	0.08	<0.04

Deuterium and Oxygen Isotopes

by Tyler P. Coplen

A description of sample processing for deuterium (δ^2H) can be found in Coplen and others (1991), and a description of sample processing for oxygen isotope ($\delta^{18}O$) analysis can be found in Epstein and Mayeda (1953). Sample analysis results for year 2002 are given in table 34, and results for year 2003 are given in table 35.

Table 34. Deuterium (δ^2H) and oxygen isotopes ($\delta^{18}O$), year 2002

[Site name, refer to Table 1 and Plate 1 for location; δ^2H, deuterium; $\delta^{18}O$, oxygen isotope; δ, delta; --, not available]

Site	Date	δ^2H (per mil)	$\delta^{18}O$ (per mil)
Trip 1			
Yukon River at Eagle	6/11/2002	--	-20.9
Nation River	6/13/2002	-157.1	-20.1
Kandik River	6/15/2002	-153.6	-19.7
Coal Creek	6/15/2002	-161.7	-20.6
Charley River	6/16/2002	-162.1	-20.6
Woodchopper Creek	6/16/2002	-160.0	-20.3
Yukon River above Circle	6/17/2002	-166.6	-21.4
Sheenjek River	6/20/2002	-169.6	-21.7
Black River	6/20/2002	-155.5	-19.8
Upper Mouth Birch Creek	6/21/2002	-153.1	-19.4
Chandalar River	6/22/2002	-172.6	-22.1
Christian River	6/22/2002	-176.9	-22.5
Lower Mouth Birch Creek	6/23/2002	--	--
Yukon River at Timber Point	6/24/2002	-166.7	-21.2
Hodzana River	6/25/2002	-161.4	-20.4
Yukon River near Stevens Village	6/24/2002	--	-21.2

Table 34. Deuterium (δ^2H) and oxygen isotopes ($\delta^{18}O$), year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; δ^2H, deuterium; $\delta^{18}O$, oxygen isotope; δ, delta; --, not available]

Site	Date	δ^2H (per mil)	$\delta^{18}O$ (per mil)
Trip 2			
Yukon River at Eagle	8/22/2002	--	--
Yukon River below Tatonduk River	8/23/2002	--	--
Nation River	8/23/2002	-149.4	-19.4
Yukon River below Nation River	8/23/2002	--	--
Kandik River	8/24/2002	-146.2	-18.7
Yukon River below Kandik River	8/23/2002	--	--
Charley River	8/24/2002	-155.0	-19.9
Yukon River below Charley River	8/23/2002	--	--
Coal Creek	8/25/2002	-153.5	-19.5
Yukon River below Coal Creek	8/25/2002	--	--
Woodchopper Creek	8/24/2002	--	--
Yukon River below Woodchopper Creek	8/25/2002	--	--
Yukon River above Circle	8/26/2002	-162.5	-20.8
Yukon River above Twentytwo Mile Village	8/27/2002	--	--
Yukon River near Halfway Whirlpool	8/27/2002	--	--
Yukon River above Twelvemile Island	8/27/2002	--	--
Sheenjek River	8/28/2002	-169.2	-21.5
Black River	8/28/2002	-146.7	-18.7
Porcupine River 9.5 miles up from mouth	8/28/2002	-153.1	-19.6
Chandalar River	8/30/2002	-171.9	-21.9
Christian River	8/30/2002	-171.1	-21.7
Upper Mouth Birch Creek	8/31/2002	-147.8	-19.0
Lower Mouth Birch Creek	8/31/2002	-147.2	-18.8
Yukon River below Porcupine River	9/2/2002	--	--
Hadweenzic River	9/2/2002	-164.0	-20.2
Yukon River at Joe Devlin Island	9/2/2002	-161.1	-20.4
Beaver Creek	9/3/2002	-143.3	-18.5
Hodzana River	9/3/2002	-159.4	-20.3
Yukon River below Hodzana River	9/4/2002	--	--
Yukon River at Timber Point	9/4/2002	-159.1	-20.2
Yukon River at Adams Island	9/4/2002	--	--
Dall River	9/4/2002	-144.7	-18.6
Yukon River near Stevens Village	9/4/2002	--	-20.4

Table 35. Deuterium (δ^2H) and oxygen isotopes ($\delta^{18}O$), year 2003

[Site name, refer to Table 2 and Plate 1 for location; δ^2H, deuterium; $\delta^{18}O$, oxygen isotope; δ, delta; --, not available]

Site	Date	δ^2H (per mil)	$\delta^{18}O$ (per mil)
Trip 1			
Yukon River near Stevens Village	6/4/2003	--	--
Ray River	6/4/2003	-156.5	-20.21
Yukon River below Ray River	6/4/2003	--	--
Hess Creek	6/4/2003	-154.8	-20.06
Yukon River below Hess Creek	6/4/2003	--	--
Tozitna River	6/5/2003	-137.5	-17.96
Yukon River below Tozitna River	6/5/2003	--	--
Nowitna River	6/6/2003	-125.3	-16.25
Yukon River below Nowitna River	6/6/2003	--	--
Melozitna River	6/6/2003	-131.1	-17.09
Yukon River below Melozitna River	6/8/2003	--	--
Yukon River at Ruby	6/8/2003	-161.8	-20.56
Yuki River	6/8/2003	-122.5	-16.09
Yukon River below Yuki River	6/8/2003	--	--
Koyukuk River	6/9/2003	-151.1	-19.65
Yukon River below Koyukuk River	6/9/2003	--	--
Nulato River	6/9/2003	-131.3	-17.4
Yukon River at Kaltag	6/10/2003	-157.6	-20.26
Anvik River	6/11/2003	-119.9	-15.98
Yukon River below Anvik River	6/11/2003	--	--
Bonasila River	6/11/2003	-116.6	-15.47
Yukon River below Bonasila River	6/11/2003	--	--
Innoko River	6/12/2003	-126.1	-16.34
Yukon River below Innoko River	6/12/2003	--	--
Atchuelinguk River	6/13/2003	-138.7	-17.85
Yukon River at Pilot Station	6/13/2003	--	--
Andreafsky River	6/13/2003	-110.5	-14.72

Table 35. Deuterium (δ^2H) and oxygen isotopes ($\delta^{18}O$), year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; δ^2H, deuterium; $\delta^{18}O$, oxygen isotope; δ, delta; --, not available]

Site	Date	δ^2H (per mil)	$\delta^{18}O$ (per mil)
Trip 2			
Yukon River near Stevens Village	8/24/2003	--	--
Ray River	8/25/2003	-152.9	-19.61
Yukon River below Ray River	8/25/2003	--	--
Hess Creek	8/25/2003	-141.7	-18.38
Yukon River below Hess Creek	8/25/2003	--	--
Tozitna River	8/26/2003	-125.5	-16.48
Yukon River below Tozitna River	8/26/2003	--	--
Nowitna River	8/27/2003	-125.6	-16.32
Yukon River below Nowitna River	8/27/2003	--	--
Melozitna River	8/27/2003	-126.9	-16.69
Yukon River below Melozitna River	8/28/2003	--	--
Yukon River at Ruby	8/28/2003	-157.8	--
Yuki River	8/28/2003	-117.3	-15.45
Yukon River below Yuki River	8/28/2003	--	--
Koyukuk River	8/29/2003	-143.6	-18.75
Yukon River below Koyukuk River	8/29/2003	--	--
Nulato River	8/30/2003	-130.1	-17.12
Yukon River at Kaltag	8/30/2003	-153.3	-19.79
Anvik River	9/1/2003	-117.5	-15.66
Yukon River below Anvik River	9/1/2003	--	--
Bonasila River	9/1/2003	-116.7	-15.56
Yukon River below Bonasila River	9/1/2003	--	--
Innoko River	9/2/2003	-122.6	-15.92
Yukon River below Innoko River	9/2/2003	--	--
Atchuelinguk River	9/3/2003	-130.8	-16.93
Yukon River at Pilot Station	9/3/2003	--	--
Andreafsky River	9/3/2003	-105.5	-14.32

Chlorophyll *a*

by Jacques Finlay

A description of sample processing for chlorophyll *a* analysis can be found in Welschmeyer (1994). Sample analysis results for year 2002 are given in table 36, and results for year 2003 are given in table 37.

Table 36. Chlorophyll *a* concentrations, year 2002

[Site name, refer to Table 1 and Plate 1 for location; µg/L, micrograms per liter; --, not available; <, less than]

Site	Date	Chlorophyll *a* (µg/L)
Trip 1		
Yukon River at Eagle	6/11/2002	--
Nation River	6/13/2002	0.270
Kandik River	6/15/2002	--
Coal Creek	6/15/2002	--
Charley River	6/16/2002	--
Woodchopper Creek	6/16/2002	--
Yukon River above Circle	6/17/2002	0.800
Sheenjek River	6/20/2002	0.800
Black River	6/20/2002	3.740
Upper Mouth Birch Creek	6/21/2002	4.540
Chandalar River	6/22/2002	<0.04
Christian River	6/22/2002	7.120
Lower Mouth Birch Creek	6/23/2002	--
Yukon River at Timber Point	6/24/2002	1.780
Hodzana River	6/25/2002	0.910
Yukon River near Stevens Village	6/24/2002	--

Table 36. Chlorophyll *a* concentrations, year 2002 – continued

[Site name, refer to Table 1 and Plate 1 for location; µg/L, micrograms per liter; --, not available]

Site	Date	Chlorophyll *a* (µg/L)
Trip 2		
Yukon River at Eagle	8/22/2002	--
Yukon River below Tatonduk River	8/23/2002	--
Nation River	8/23/2002	0.042
Yukon River below Nation River	8/23/2002	--
Kandik River	8/24/2002	0.063
Yukon River below Kandik River	8/23/2002	--
Charley River	8/24/2002	0.640
Yukon River below Charley River	8/23/2002	--
Coal Creek	8/25/2002	0.071
Yukon River below Coal Creek	8/25/2002	--
Woodchopper Creek	8/24/2002	0.087
Yukon River below Woodchopper Creek	8/25/2002	--
Yukon River above Circle	8/26/2002	0.515
Yukon River above Twentytwo Mile Village	8/27/2002	--
Yukon River near Halfway Whirlpool	8/27/2002	--
Yukon River above Twelvemile Island	8/27/2002	--
Sheenjek River	8/28/2002	0.119
Black River	8/28/2002	0.677
Porcupine River 9.5 miles upstream from mouth	8/28/2002	0.752
Chandalar River	8/30/2002	0.042
Christian River	8/30/2002	0.743
Upper Mouth Birch Creek	8/31/2002	0.386
Lower Mouth Birch Creek	8/31/2002	0.617
Yukon River below Porcupine River	9/2/2002	--
Hadweenzic River	9/2/2002	0.398
Yukon River at Joe Devlin Island	9/2/2002	0.492
Beaver Creek	9/3/2002	0.326
Hodzana River	9/3/2002	0.369
Yukon River below Hodzana River	9/4/2002	--
Yukon River at Timber Point	9/4/2002	0.644
Yukon River at Adams Island	9/4/2002	--
Dall River	9/4/2002	4.520
Yukon River near Stevens Village	9/4/2002	--

Table 37. Chlorophyll *a* concentrations, year 2003

[Site name, refer to Table 2 and Plate 1 for location; µg/L, micrograms per liter; --, not available]

Site	Date	Chlorophyll *a* (µg/L)
Trip 1		
Yukon River near Stevens Village	6/4/2003	--
Ray River	6/4/2003	--
Yukon River below Ray River	6/4/2003	--
Hess Creek	6/4/2003	--
Yukon River below Hess Creek	6/4/2003	--
Tozitna River	6/5/2003	--
Yukon River below Tozitna River	6/5/2003	--
Nowitna River	6/6/2003	--
Yukon River below Nowitna River	6/6/2003	--
Melozitna River	6/6/2003	1.668
Yukon River below Melozitna River	6/8/2003	--
Yukon River at Ruby	6/8/2003	0.948
Yuki River	6/8/2003	1.224
Yukon River below Yuki River	6/8/2003	--
Koyukuk River	6/9/2003	0.768
Yukon River below Koyukuk River	6/9/2003	--
Nulato River	6/9/2003	0.138
Yukon River at Kaltag	6/10/2003	0.720
Anvik River	6/11/2003	0.648
Yukon River below Anvik River	6/11/2003	--
Bonasila River	6/11/2003	3.426
Yukon River below Bonasila River	6/11/2003	--
Innoko River	6/12/2003	1.626
Yukon River below Innoko River	6/12/2003	--
Atchuelinguk River	6/13/2003	3.048
Yukon River at Pilot Station	6/13/2003	--
Andreafsky River	6/13/2003	0.348

Table 37. Chlorophyll *a* concentrations, year 2003 – continued

[Site name, refer to Table 2 and Plate 1 for location; µg/L, micrograms per liter; --, not available]

Site	Date	Chlorphyll *a* (µg/L)
Trip 2		
Yukon River near Stevens Village	8/24/2003	--
Ray River	8/25/2003	0.400
Yukon River below Ray River	8/25/2003	--
Hess Creek	8/25/2003	0.498
Yukon River below Hess Creek	8/25/2003	--
Tozitna River	8/26/2003	0.456
Yukon River below Tozitna River	8/26/2003	--
Nowitna River	8/27/2003	0.390
Yukon River below Nowitna River	8/27/2003	--
Melozitna River	8/27/2003	1.109
Yukon River below Melozitna River	8/28/2003	--
Yukon River at Ruby	8/28/2003	0.576
Yuki River	8/28/2003	1.800
Yukon River below Yuki River	8/28/2003	--
Koyukuk River	8/29/2003	0.384
Yukon River below Koyukuk River	8/29/2003	--
Nulato River	8/30/2003	0.532
Yukon River at Kaltag	8/30/2003	0.456
Anvik River	9/1/2003	1.728
Yukon River below Anvik River	9/1/2003	--
Bonasila River	9/1/2003	2.406
Yukon River below Bonasila River	9/1/2003	--
Innoko River	9/2/2003	1.260
Yukon River below Innoko River	9/2/2003	--
Atchuelinguk River	9/3/2003	1.140
Yukon River at Pilot Station	9/3/2003	--
Andreafsky River	9/3/2003	0.296

Chapter 6. Quality Assurance and Quality Control

Quality assurance (QA) and quality control (QC) procedures were an integral part of the study to insure accuracy, precision, and completeness of the data. QA was achieved by adhering to standard USGS protocols (USGS, 1997–99) and detailed protocols for the collection and processing of environmental samples from the Yukon River basin specifically (USGS, 2006a,b). QA also required the collection of QC samples for the testing of field and laboratory methodologies.

QC samples included sequential replicates and process blanks. Sequential replicate samples are used to identify and quantify possible bias and variability introduced from the field equipment preparation, sample collection, and field processing. Process blanks are used to identify and document any systematic contamination induced from cleaning and preparation of the sampling and processing equipment, and the handling of samples by field personnel.

Relative percent differences (RPD) are used to describe variability found in replicate samples (tables 38–54) and were computed with the follow equation:

$$\left[\frac{C1-C2}{(C1+C2)/2}\right]\times 100$$

where

$C1$ is the concentration for aliquot 1, and

$C2$ is the concentration for aliquot 2.

Table 55, statistics for relative percent differences, indicates that the highest RPD of 129.4 occurred in the trace-element grab sample analysis category. An arbitrarily

defined RPD bracket of 0–15 contains 93.4 percent of trace-element grab sample analyses.

Nutrients had the lowest (66.7 percent) of samples within the RPD bracket. All other analysis categories contain a larger percent of samples in the 0–15 RPD bracket with suspended sediment, deuterium/oxygen-18, and tritium at 100 percent. The results indicate that confidence in reported concentrations is highest for suspended sediment, deuterium/oxygen-18, and tritium and somewhat lower for other analyses.

Process blanks (tables 56–61) were obtained by processing a volume similar to an environmental sample, of inorganic and organic free water, with the same procedures and equipment as an environmental sample. Concerns should be raised when the minimum concentration of a constituent is lower than the maximum concentration detected in the field equipment blank. Concentrations of constituents detected in the field equipment blanks, with a few exceptions (tables 56–62), were all at or near detection levels and generally were much lower then the concentrations in the environmental samples.

Table 38. Relative percent differences for replicate samples analyzed for dissolved organic carbon

[Site name, refer to Table 1, Table 2, and Plate 1 for location; DOC, dissolved organic carbon; mg C/L, milligrams carbon per liter; UV (abs @ 254 nm), ultraviolet absorbance at the 254 nanometer wavelength; SUVA, specific UV absorbance; L/mg C/m, liters per milligram carbon per one meter path length; %, percent; RPD, relative percent difference]

Site	Date	Whole Water DOC (mg C/L)	Whole Water UV (abs @ 254 nm)	Whole Water SUVA (L/mg C/m)	Hydrophobic Acid SUVA (L/mg C/m)	Hydrophobic Acid (%)	Hydrophilic Organic Matter SUVA (L/mg C/m)	Hydrophilic Organic Matter (%)	Transphylic Acids SUVA (L/mg C/m)	Transphylic Acids (%)
Yukon River above Circle	8/26/2002	6.9	0.257	3.7	4.2	55	2.2	19	2.9	17
Yukon River above Circle	8/26/2002	7.1	0.247	3.5	3.9	56	1.6	24	3.2	14
RPD		2.9	4.0	5.6	7.4	2	31.6	23	9.8	19
Beaver Creek	9/3/2002	5.7	0.203	3.6	3.7	48	3.6	15	2.6	15
Beaver Creek	9/3/2002	5.6	0.207	3.7	3.6	57	3.2	18	3.1	17
RPD		1.8	1.9	2.7	2.7	17	11.8	18	17.5	13
Nulato River	6/9/2003	3.1	0.091	2.9	4.0	41	1.6	23	2.7	17
Nulato River	6/9/2003	3.2	0.083	2.6	4.0	37	2.2	14	2.8	16
RPD		3.2	9.2	10.9	0.0	10	31.6	49	3.6	6
Yuki River	8/28/2003	20.1	0.871	4.3	4.3	64	3.3	14	3.4	17
Yuki River	8/28/2003	20.7	0.876	4.2	4.5	57	3.1	15	3.5	18
RPD		2.9	0.6	2.3	4.5	12	6.2	7	2.9	6

Table 39. Relative percent differences for replicate samples analyzed for anions

Site name, refer to Table 1, Table 2, and Plate 1 for location; µeq/L, microequivalents per liter; RPD, relative percent difference]

Site	Date	Chloride (µeq/L)	Sulfate (µeq/L)	Nitrate (µeq/L)
Yukon River above Circle	8/26/2002	14.29	669.68	4.87
Yukon River above Circle	8/26/2002	14.77	664.92	4.71
RPD		3.3	0.7	3.3
Beaver Creek	9/3/2002	18.12	524.15	6.76
Beaver Creek	9/3/2002	18.82	527.48	11.55
RPD		3.8	0.6	52.3
Nulato River	6/9/2003	9.95	117.12	18.96
Nulato River	6/9/2003	9.82	116.84	18.85
RPD		1.3	0.2	0.6
Yuki River	8/28/2003	8.17	56.97	3.28
Yuki River	8/28/2003	8.01	56.99	3.37
RPD		2.0	0.0	2.7

Table 40. Relative percent differences for replicate samples analyzed for uranium

[Site name, refer to Table 1 and Plate 1 for location; U, uranium; µg/L, micrograms per liter; RPD, relative percent difference]

Site	Date	U (µg/L)	$^{234}U/^{238}U$ Activity Ratio
Yukon River above Circle	8/26/2002	0.79	1.465
Yukon River above Circle	8/26/2002	0.79	1.435
RPD		0.0	2.1
Beaver Creek	9/3/2002	0.28	1.592
Beaver Creek	9/3/2002	0.28	1.595
RPD		0.0	0.2
Hodzana River	9/3/2002	0.27	1.256
Hodzana River	9/3/2002	0.21	1.423
RPD		25.0	12.5

Table 41. Relative percent differences for replicate samples analyzed for particulate carbon (PC) and particulate nitrogen (PN)

[Site name, refer to Table 1, Table 2, and Plate 1 for location; PC, particulate carbon; PN, particulate nitrogen; mg/L, milligrams per liter; RPD, relative percent difference]

Site	Date	PC (mg/L)	PN (mg/L)
Yukon River above Circle	8/26/2002	9.25	0.325
Yukon River above Circle	8/26/2002	10.3	0.348
RPD		10.7	6.8
Beaver Creek	9/3/2002	0.426	0.034
Beaver Creek	9/3/2002	0.461	0.043
RPD		7.9	23.4
Nulato River	6/9/2003	1.325	0.113
Nulato River	6/9/2003	1.335	0.121
RPD		0.7	6.8
Yuki River	8/28/2003	2.205	0.162
Yuki River	8/28/2003	2.6	0.181
RPD		16.4	2.0

Table 42. Relative percent differences for replicate samples analyzed for percent organic matter

[Site name, refer to Table 1, Table 2, and Plate 1 for location; mg/L, milligrams per liter; OM, organic matter; RPD, relative percent difference]

Site	Date	Percent OM in Sediment
Yukon River above Circle	8/26/2002	5
Yukon River above Circle	8/26/2002	6
RPD		18
Yuki River	8/28/2003	20
Yuki River	8/28/2003	26
RPD		26

Table 43. Relative percent differences for replicate samples analyzed for suspended sediment concentration and sediment chemistry

[Site name, refer to Table 1 and Plate 1 for location; mg/L, milligrams per liter; ppm, parts per million; %, percent; <, less than; nc, not calculated; RPD, relative percent difference]

Site	Date	Suspended Sediment (mg/L)	Silver (ppm)	Copper (ppm)	Lead (ppm)	Zinc (ppm)
Yukon River above Circle	8/26/2002	505	<0.5	35	11	87
Yukon River above Circle	8/26/2002	508	<0.5	32	9	92
RPD		0.6	nc	8.9	20.0	5.6

Site	Date	Cadmium (ppm)	Chromium (ppm)	Cobalt (ppm)	Nickel (ppm)	Barium (ppm)
Yukon River above Circle	8/26/2002	0.4	100	16	48	790
Yukon River above Circle	8/26/2002	0.3	97	16	46	750
RPD		28.6	3.0	0.0	4.2	5.2

Site	Date	Vanadium (ppm)	Lithium (ppm)	Beryllium (ppm)	Molybdenum (ppm)	Phosphorus (ppm)
Yukon River above Circle	8/26/2002	130	24	1.4	2	1000
Yukon River above Circle	8/26/2002	130	23	1.4	2	1000
RPD		0.0	4.2	0.0	0.0	0.0

Site	Date	Strontium (ppm)	Arsenic (ppm)	Antimony (ppm)	Selenium (ppm)	Mercury (ppm)
Yukon River above Circle	8/26/2002	350	11	1.5	0.8	0.12
Yukon River above Circle	8/26/2002	350	10	1.5	0.8	0.08
RPD		0.0	9.5	0.0	0.0	40.0

Site	Date	Thallium (ppm)	Uranium (ppm)	Iron (%)	Manganese (ppm)	Aluminum (%)
Yukon River above Circle	8/26/2002	<50	<50	4.0	770	6.5
Yukon River above Circle	8/26/2002	<50	<50	3.8	760	6.5
RPD		nc	nc	5.1	1.3	0.0

Site	Date	Titanium (%)	Total Organic Carbon (%)	Total Carbon (%)	Total Nitrogen (%)
Yukon River above Circle	8/26/2002	0.45	1.0	2.5	<0.1
Yukon River above Circle	8/26/2002	0.45	0.9	2.5	<0.1
RPD		0.0	10.5	0.0	nc

Table 44. Relative percent differences for replicate samples analyzed for suspended sediment concentration

[Site name, refer to Table 1, Table 2, and Plate 1 for location; mg/L, milligrams per liter; RPD, relative percent difference]

Site	Date	Suspended Sediment (mg/L)
Yukon River above Circle	8/26/2002	506
Yukon River above Circle	8/26/2002	449
RPD		11.9
Nulato River	6/9/2003	73
Nulato River	6/9/2003	68
RPD		7.0
Yuki River	8/28/2003	66
Yuki River	8/28/2003	66
RPD		0.0

Table 45. Relative percent differences for replicate samples analyzed for nutrients

[Site name, refer to Table 1, Table 2, and Plate 1 for location; N, nitrogen; P, phosphorus; mg N/L, milligrams nitrogen per liter; µg P/L, micrograms phosphorus per liter; mg P/L, milligrams phosphorus per liter; nc, not calculated; na, not analyzed; <, less than; RPD, relative percent difference]

Site	Date	Total Dissolved N (mg N/L)	Soluble Reactive P (µg P/L)	NO_2 (mg N/L)	NH_4 (mg N/L)	PO_4 (mg P/L)
Yukon River above Circle	8/26/2002	0.23	2.21	0.002	< 0.007	< 0.02
Yukon River above Circle	8/26/2002	na	2.08	0.003	0.014	< 0.02
RPD		nc	6.1	40.0	nc	nc
Beaver Creek	9/3/2002	0.24	<0.3	na	na	na
Beaver Creek	9/3/2002	na	<0.3	na	na	na
RPD		nc	nc			
Nulato River	6/9/2003	0.323	2.32	0.0033	0.010	< 0.004
Nulato River	6/9/2003	0.294	1.47	< 0.0012	< 0.003	< 0.004
RPD		9.4	44.8	nc	nc	nc
Yuki River	8/28/2003	0.553	4.33	0.003	< 0.005	< 0.004
Yuki River	8/28/2003	0.566	na	0.003	< 0.005	< 0.004
RPD		2.3	nc	0.0	nc	nc

Table 46. Relative percent differences for replicate samples analyzed for dissolved inorganic carbon

[Site name, refer to Table 1, Table 2, and Plate 1 for location; CO_2, carbon dioxide; DIC, dissolved inorganic carbon; µmol/L, micromoles per liter; RPD, relative percent difference]

Site	Date	CO_2 (µmol/L)	DIC (µmol/L)
Yukon River above Circle	8/26/2002	45.1	1,518
Yukon River above Circle	8/26/2002	41.1	1,527
RPD		9.3	0.6
Beaver Creek	9/3/2002	59.0	1,162
Beaver Creek	9/3/2002	50.3	1,193
RPD		15.9	2.6
Dall River	9/4/2002	91.9	1,008
Dall River	9/4/2002	93.9	963
RPD		2.2	4.6
Nulato River	6/9/2003	59.7	1,156
Nulato River	6/9/2003	67.4	1,125
RPD		12.1	2.7
Yuki River	8/28/2003	165.1	552
Yuki River	8/28/2003	103.6	543
RPD		45.8	1.6

Table 47. Relative percent differences for replicate samples analyzed for dissolved trace elements in 0.45-µm filtered samples, EDI sampling from churn

[Site name, refer to Table 1 and Plate 1 for location; Al, aluminum; As, arsenic; B, boron; Ba, barium; Be, beryllium; Bi, bismuth; Ca, calcium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Dy, dysprosium; Er, erbium; Eu, europium; Fe, iron; Gd, gadolinium; Ho, holmium; K, potassium; La, lanthanum; Li, lithium; Mg, magnesium; Mn, manganese; Mo, molybdenum; Na, sodium; Nd, neodymium; Ni, nickel; P, phosphorus; Pb, lead; Pr, praseodymium; Rb, rubidium; S, sulfur; Sb, antimony; Se, selenium; SiO_2, silica; Sm, samarium; Sr, strontium; Tb, terbium; Te, tellurium; Th, thorium; Tl, thallium; Tm, thulium; U, uranium; V, vanadium; Y, yttrium; Yb, ytterbium; Zn, zinc; Zr, zirconium; µg/L, micrograms per liter; mg/L, milligrams per liter; RPD, relative percent difference; <, less than; nc, not calculated]

Site	Date	Al (µg/L)	As (µg/L)	B (µg/L)	Ba (µg/L)	Be (µg/L)	Bi (µg/L)	Ca (mg/L)	Cd (µg/L)	Ce (µg/L)
Yukon River above Circle	8/26/2002	75	0.52	8.5	38	0.012	0.002	27	0.018	0.20
Yukon River above Circle	8/26/2002	54	0.51	8.4	38	0.011	0.003	28	0.018	0.17
RPD		32.6	1.9	1.2	0.0	8.7	40.0	3.6	0.0	16.2

Site	Date	Co (µg/L)	Cr (µg/L)	Cs (µg/L)	Cu (µg/L)	Dy (µg/L)	Er (µg/L)	Eu (µg/L)	Fe (µg/L)	Gd (µg/L)
Yukon River above Circle	8/26/2002	0.110	0.17	< 0.009	2.1	0.033	0.023	0.0071	100	0.035
Yukon River above Circle	8/26/2002	0.089	0.14	< 0.009	2.1	0.032	0.019	0.0070	73	0.031
RPD		21.1	19.3	nc	0.0	3.1	19.0	1.4	31.2	12.1

Site	Date	Ho (µg/L)	K (mg/L)	La (µg/L)	Li (µg/L)	Lu (µg/L)	Mg (mg/L)	Mn (µg/L)	Mo (µg/L)
Yukon River above Circle	8/26/2002	0.0068	0.94	0.112	3.0	0.0033	7.5	7.3	0.84
Yukon River above Circle	8/26/2002	0.0067	0.98	0.093	3.0	0.0034	7.8	6.3	0.89
RPD		1.5	4.2	18.5	0.0	3.0	3.9	14.7	5.8

Site	Date	Na (mg/L)	Nd (µg/L)	Ni (µg/L)	P (µg/L)	Pb (µg/L)	Pr (µg/L)	Rb (µg/L)	S (mg/L)
Yukon River above Circle	8/26/2002	2.1	0.13	2.7	< 20	0.052	0.031	1.1	12
Yukon River above Circle	8/26/2002	2.1	0.11	1.6	< 20	0.037	0.025	1.1	13
RPD		0.0	16.7	51.2	nc	33.7	21.4	0.0	8.0

Site	Date	Sb (µg/L)	Se (µg/L)	SiO_2 (mg/L)	Sm (µg/L)	Sr (µg/L)	Tb (µg/L)	Te (µg/L)	Th (µg/L)
Yukon River above Circle	8/26/2002	0.17	0.42	6.9	0.033	130	0.0052	< 0.006	0.035
Yukon River above Circle	8/26/2002	0.16	0.43	7.0	0.027	130	0.0046	< 0.006	0.038
RPD		6.1	2.3	1.4	20.0	0.0	12.2	nc	8.2

Site	Date	Tl (µg/L)	Tm (µg/L)	U (µg/L)	V (µg/L)	Y (µg/L)	Yb (µg/L)	Zn (µg/L)	Zr (µg/L)
Yukon River above Circle	8/26/2002	0.006	0.0032	0.76	0.55	0.21	0.020	2.3	0.39
Yukon River above Circle	8/26/2002	0.008	0.0029	0.78	0.51	0.20	0.019	2.3	0.41
RPD		28.6	9.8	2.6	7.5	4.9	5.1	0.0	5.0

Table 47. Relative percent differences for replicate samples analyzed for dissolved trace elements in 0.45-μm filtered samples, EDI sampling from churn – continued

[Site name, refer to Table 1 and Plate 1 for location; Al, aluminum; As, arsenic; B, boron; Ba, barium; Be, beryllium; Bi, bismuth; Ca, calcium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Dy, dysprosium; Er, erbium; Eu, europium; Fe, iron; Gd, gadolinium; Ho, holmium; K, potassium; La, lanthanum; Li, lithium; Lu, lutetium; Mg, magnesium; Mn, manganese; Mo, molybdenum; Na, sodium; Nd, neodymium; Ni, nickel; P, phosphorus; Pb, lead; Pr, praseodymium; Rb, rubidium; S, sulfur; Sb, antimony; Se, selenium; SiO_2, silica; Sm, samarium; Sr, strontium; Tb, terbium; Te, tellurium; Th, thorium; Tl, thallium; Tm, thulium; U, uranium; V, vanadium; Y, yttrium; Yb, ytterbium; Zn, zinc; Zr, zirconium; μg/L, micrograms per liter; mg/L, milligrams per liter; RPD, relative percent difference; <, less than; nc, not calculated]

Site	Date	Al (μg/L)	As (μg/L)	B (μg/L)	Ba (μg/L)	Be (μg/L)	Bi (μg/L)	Ca (mg/L)	Cd (μg/L)	Ce (μg/L)
Beaver Creek	9/3/2002	30	0.37	2.8	34	0.006	0.001	18	0.026	0.091
Beaver Creek	9/3/2002	31	0.37	2.9	34	< 0.004	0.001	18	0.020	0.097
RPD		3.3	0.0	3.5	0.0	nc	0.0	0.0	26.1	6.4

Site	Date	Co (μg/L)	Cr (μg/L)	Cs (μg/L)	Cu (μg/L)	Dy (μg/L)	Er (μg/L)	Eu (μg/L)	Fe (μg/L)	Gd (μg/L)
Beaver Creek	9/3/2002	0.062	0.07	< 0.009	1.6	0.024	0.014	0.0053	270	0.025
Beaver Creek	9/3/2002	0.050	0.09	< 0.009	1.5	0.024	0.014	0.0054	290	0.027
RPD		21.4	25.0	nc	6.4	0.0	0.0	1.9	7.1	7.7

Site	Date	Ho (μg/L)	K (mg/L)	La (μg/L)	Li (μg/L)	Lu (μg/L)	Mg (mg/L)	Mn (μg/L)	Mo (μg/L)
Beaver Creek	9/3/2002	0.0046	0.47	0.057	1.8	0.0021	6.6	9.0	0.20
Beaver Creek	9/3/2002	0.0049	0.46	0.059	1.8	0.0021	6.6	9.0	0.23
RPD		6.3	2.1	3.4	0.0	0.0	0.0	0.0	13.9

Site	Date	Na (mg/L)	Nd (μg/L)	Ni (μg/L)	P (μg/L)	Pb (μg/L)	Pr (μg/L)	Rb (μg/L)	S (mg/L)
Beaver Creek	9/3/2002	1.5	0.072	1.9	< 20	0.049	0.016	0.39	9.7
Beaver Creek	9/3/2002	1.5	0.077	1.8	< 20	0.048	0.017	0.36	9.6
RPD		0.0	6.7	5.4	nc	2.1	6.1	8.0	1.0

Site	Date	Sb (μg/L)	Se (μg/L)	SiO_2 (mg/L)	Sm (μg/L)	Sr (μg/L)	Tb (μg/L)	Te (μg/L)	Th (μg/L)
Beaver Creek	9/3/2002	0.14	0.12	5.9	0.019	84	0.0040	< 0.006	0.024
Beaver Creek	9/3/2002	0.14	0.14	5.9	0.023	84	0.0040	< 0.006	0.024
RPD		0.0	15.0	0.0	19.0	0.0	0.0	nc	0.0

Site	Date	Tl (μg/L)	Tm (μg/L)	U (μg/L)	V (μg/L)	Y (μg/L)	Yb (μg/L)	Zn (μg/L)	Zr (μg/L)
Beaver Creek	9/3/2002	< 0.002	0.0019	0.27	0.19	0.14	0.012	1.3	0.24
Beaver Creek	9/3/2002	< 0.002	0.0017	0.26	0.20	0.14	0.015	1.5	0.25
RPD		nc	11.1	3.8	5.1	0.0	22.2	14.3	4.1

Table 47. Relative percent differences for replicate samples analyzed for dissolved trace elements in 0.45-μm filtered samples, EDI sampling from churn – continued

[Site name, refer to Table 2 and Plate 1 for location; As, arsenic; B, boron; Ba, barium; Be, beryllium; Bi, bismuth; Ca, calcium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Dy, dysprosium; Er, erbium; Eu, europium; Fe, iron; Ga, gallium; Gd, gadolinium; Ho, holmium; K, potassium; La, lanthanum; Li, lithium; Lu, Lutetium; Mg, magnesium; Mn, manganese; Mo, molybdenum; Na, sodium; Nd, neodymium; Ni, nickel; P, phosphorus; Pb, lead; Pr, praseodymium; Rb, rubidium; Re, rhenium; S, sulfur; Sb, antimony; Se, selenium; SiO_2, silica; Sm, samarium; Sr, strontium; Tb, terbium; Te, tellurium; Th, thorium; Tl, thallium; Tm, thulium; U, uranium; V, vanadium; W, tungsten; Y, yttrium; Yb, ytterbium; Zr, zirconium; μg/L, micrograms per liter; mg/L, milligrams per liter; RPD, relative percent difference; <, less than; nc, not calculated]

Site	Date	As (μg/L)	B (μg/L)	Ba (μg/L)	Be (μg/L)	Bi (μg/L)	Ca (mg/L)	Cd (μg/L)	Ce (μg/L)	Co (μg/L)
Yuki River	8/28/2003	0.71	2.1	29	0.032	0.0036	6.7	0.007	0.76	0.41
Yuki River	8/28/2003	0.72	2.6	28	0.026	0.0051	6.7	0.007	0.75	0.40
RPD		1.4	21.3	3.5	20.7	34.5	0.0	0.0	1.3	2.5

Site	Date	Cr (μg/L)	Cs (μg/L)	Cu (μg/L)	Dy (μg/L)	Er (μg/L)	Eu (μg/L)	Fe (μg/L)	Ga (μg/L)	Gd (μg/L)
Yuki River	8/28/2003	1.2	< 0.02	3.6	0.12	0.074	0.031	763	0.016	0.15
Yuki River	8/28/2003	1.1	< 0.02	3.7	0.12	0.070	0.031	792	0.016	0.15
RPD		8.7	nc	2.7	0.0	5.6	0.0	3.7	0.0	0.0

Site	Date	Ho (μg/L)	K (mg/L)	La (μg/L)	Li (μg/L)	Lu (μg/L)	Mg (mg/L)	Mn (μg/L)	Mo (μg/L)	Na (mg/L)
Yuki River	8/28/2003	0.024	0.19	0.37	0.43	0.011	3.0	40	0.24	0.99
Yuki River	8/28/2003	0.025	0.19	0.37	0.43	0.0097	3.1	40	0.21	1.0
RPD		4.1	0.0	0.0	0.0	12.6	3.3	0.0	13.3	1.0

Site	Date	Nd (μg/L)	Ni (μg/L)	P (μg/L)	Pb (μg/L)	Pr (μg/L)	Rb (μg/L)	Re (μg/L)	S (mg/L)
Yuki River	8/28/2003	0.51	3.1	14	0.078	0.11	0.14	0.0006	1.3
Yuki River	8/28/2003	0.49	3.2	16	0.077	0.11	0.14	0.0008	1.3
RPD		4.0	3.2	13.3	1.3	0.0	0.0	28.6	0.0

Site	Date	Sb (μg/L)	Se (μg/L)	SiO_2 (mg/L)	Sm (μg/L)	Sr (μg/L)	Tb (μg/L)	Te (μg/L)	Th (μg/L)
Yuki River	8/28/2003	0.11	< 0.06	9.2	0.13	35	0.022	< 0.006	0.11
Yuki River	8/28/2003	0.10	< 0.06	9.1	0.12	34	0.021	< 0.006	0.12
RPD		9.5	nc	1.1	8.0	2.9	4.6	nc	8.7

Site	Date	Tl (μg/L)	Tm (μg/L)	U (μg/L)	V (μg/L)	W (μg/L)	Y (μg/L)	Yb (μg/L)	Zr (μg/L)
Yuki River	8/28/2003	0.005	0.010	0.053	1.1	0.004	0.74	0.070	1.0
Yuki River	8/28/2003	0.006	0.0096	0.052	1.1	0.004	0.72	0.066	1.1
RPD		18.2	4.1	1.9	0.0	0.0	2.7	5.9	9.5

Table 48. Relative percent differences for replicate samples analyzed for dissolved trace elements in 0.45-µm filtered samples, from surface grabs, year 2002

[Site name, refer to Table 1 and Plate 1 for location; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; µg/L, micrograms per liter; RPD, relative percent difference]

Site	Date	Ba (µg/L)	Cd (µg/L)	Ce (µg/L)	Co (µg/L)	Cr (µg/L)	Cs (µg/L)	Cu (µg/L)	Fe (µg/L)	Li (µg/L)	Mn (µg/L)
Yukon River above Circle	8/26/2002	38	0.019	0.304	0.152	0.40	0.017	2.34	191	3.37	12.1
Yukon River above Circle	8/26/2002	39	0.018	0.293	0.171	0.39	0.016	2.37	175	3.27	12.0
RPD		2.6	5.4	3.7	11.8	2.5	6.1	1.3	8.7	3.0	0.8

Site	Date	Mo (µg/L)	Ni (µg/L)	Pb (µg/L)	Rb (µg/L)	Re (µg/L)	Sr (µg/L)	Tl (µg/L)	U (µg/L)	V (µg/L)	Zn (µg/L)
Yukon River above Circle	8/26/2002	0.82	1.91	0.088	1.39	0.003	106	0.007	0.79	0.92	0.99
Yukon River above Circle	8/26/2002	0.87	1.97	0.081	1.48	0.003	120	0.007	0.80	0.91	0.93
RPD		5.9	3.1	8.2	6.3	0.0	12.4	0.0	1.3	1.1	6.3

Site	Date	Ba (µg/L)	Cd (µg/L)	Ce (µg/L)	Co (µg/L)	Cr (µg/L)	Cs (µg/L)	Cu (µg/L)	Fe (µg/L)	Li (µg/L)	Mn (µg/L)
Beaver Creek	9/3/2002	39	0.011	0.108	0.053	0.16	0.001	1.51	284	1.98	10.1
Beaver Creek	9/3/2002	37	0.010	0.106	0.053	0.15	0.001	1.54	273	1.94	8.5
RPD		5.3	9.5	1.9	0.0	6.4	0.0	2	3.9	2	17.2

Site	Date	Mo (µg/L)	Ni (µg/L)	Pb (µg/L)	Rb (µg/L)	Re (µg/L)	Sr (µg/L)	Tl (µg/L)	U (µg/L)	V (µg/L)	Zn (µg/L)
Beaver Creek	9/3/2002	0.23	2.18	0.049	0.39	0.001	92	0.001	0.26	0.28	0.85
Beaver Creek	9/3/2002	0.22	2.00	0.046	0.35	0.001	87	0.001	0.26	0.24	0.62
RPD		4.4	8.6	6.3	10.8	0	5.6	0.0	0.0	15.4	31.3

Table 49. Relative percent differences for replicate samples analyzed for dissolved trace elements in 0.45-µm filtered samples, from surface grabs, year 2003

[Site name, refer to Table 2 and Plate 1 for location; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; La, lanthanum; Li, lithium; Mn, manganese; Mo, molybdenum; Nd, neodymium; Ni, nickel; Pb, lead; Pr, praseodymium; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; µg/L, micrograms per liter; RPD, relative percent difference]

Site	Date	Ba (µg/L)	Cd (µg/L)	Ce (µg/L)	Co (µg/L)	Cr (µg/L)	Cs (µg/L)	Cu (µg/L)	Fe (µg/L)	La (µg/L)	Li (µg/L)	Mn (µg/L)
Nulato River	6/9/2003	13	0.004	0.067	0.071	0.08	0.002	0.55	66	0.035	0.67	10.6
Nulato River	6/9/2003	13	0.003	0.064	0.065	0.08	0.002	0.55	63	0.034	0.64	10.4
RPD		0.0	28.6	4.6	8.8	0.0	0.0	0.0	4.6	2.9	4.6	1.9

Site	Date	Mo (µg/L)	Nd (µg/L)	Ni (µg/L)	Pb (µg/L)	Pr (µg/L)	Rb (µg/L)	Re (µg/L)	Sr (µg/L)	Tl (µg/L)	U (µg/L)	V (µg/L)	Zn (µg/L)
Nulato River	6/9/2003	0.11	0.054	0.35	0.038	0.011	0.12	0.0002	132	0.001	0.06	0.22	0.11
Nulato River	6/9/2003	0.11	0.049	0.33	0.033	0.011	0.12	0.0002	125	0.001	0.06	0.24	0.07
RPD		0.0	9.7	5.9	14.1	0.0	0.0	0.0	5.4	0.0	0.0	8.7	44.4

Site	Date	Ba (µg/L)	Cd (µg/L)	Ce (µg/L)	Co (µg/L)	Cr (µg/L)	Cs (µg/L)	Cu (µg/L)	Fe (µg/L)	La (µg/L)	Li (µg/L)	Mn (µg/L)
Yuki River	8/28/2003	31	0.015	0.840	0.407	1.06	0.001	3.53	948	0.409	0.46	47.7
Yuki River	8/28/2003	31	0.014	0.871	0.405	1.05	0.001	3.60	910	0.422	0.45	48.1
RPD		0.0	6.9	3.6	0.5	9.5	0.0	2.0	4.1	3.1	2.2	0.8

Site	Date	Mo (µg/L)	Nd (µg/L)	Ni (µg/L)	Pb (µg/L)	Pr (µg/L)	Rb (µg/L)	Re (µg/L)	Sr (µg/L)	Tl (µg/L)	U (µg/L)	V (µg/L)	Zn (µg/L)
Yuki River	8/28/2003	0.19	0.537	3.29	0.106	0.120	0.16	0.001	37	0.002	0.05	1.41	0.69
Yuki River	8/28/2003	0.19	0.546	3.35	0.104	0.120	0.17	0.001	37	0.002	0.05	1.44	0.78
RPD		0.0	1.7	1.8	1.9	0.0	6.1	0.0	0.0	0.0	0.0	2.1	12.2

Table 50. Relative percent differences for replicate samples analyzed for dissolved trace elements in 0.02-µm filtered samples, from surface grabs, year 2002

[Site name, refer to Table 1 and Plate 1 for location; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; Pb, lead; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; µg/L, micrograms per liter; RPD, relative percent difference]

Site	Date	Ba (µg/L)	Cd (µg/L)	Ce (µg/L)	Co (µg/L)	Cr (µg/L)	Cs (µg/L)	Cu (µg/L)	Fe (µg/L)	Li (µg/L)	Mn (µg/L)
Yukon River above Circle	8/26/2002	41	0.008	0.091	0.075	0.17	0.007	1.96	23	3.15	7.1
Yukon River above Circle	8/26/2002	40	0.010	0.093	0.067	0.19	0.007	1.95	23	2.99	6.6
RPD		2.5	22.2	2.2	11.3	11.1	0.0	0.5	0.0	5.2	7.3

Site	Date	Mo (µg/L)	Ni (µg/L)	Pb (µg/L)	Rb (µg/L)	Re (µg/L)	Sr (µg/L)	Tl (µg/L)	U (µg/L)	V (µg/L)	Zn (µg/L)
Yukon River above Circle	8/26/2002	0.99	1.72	0.004	1.28	0.003	123	0.006	0.68	0.57	0.06
Yukon River above Circle	8/26/2002	0.93	1.57	0.004	1.19	0.003	126	0.005	0.74	0.52	0.07
RPD		6.3	9.1	0.0	7.3	0.0	2.4	18.2	8.4	9.2	15.4

Site	Date	Ba (µg/L)	Cd (µg/L)	Ce (µg/L)	Co (µg/L)	Cr (µg/L)	Cs (µg/L)	Cu (µg/L)	Fe (µg/L)	Li (µg/L)	Mn (µg/L)
Beaver Creek	9/3/2002	37	0.004	0.017	0.037	0.09	0.001	1.19	10	1.95	7.0
Beaver Creek	9/3/2002	37	0.005	0.017	0.036	0.09	0.001	1.30	10	1.99	7.1
RPD		0.0	22.2	0.0	2.7	0.0	0.0	8.8	0.0	2.0	1.4

Site	Date	Mo (µg/L)	Ni (µg/L)	Pb (µg/L)	Rb (µg/L)	Re (µg/L)	Sr (µg/L)	Tl (µg/L)	U (µg/L)	V (µg/L)	Zn (µg/L)
Beaver Creek	9/3/2002	0.23	1.79	0.001	0.37	0.001	84	0.001	0.25	0.15	0.04
Beaver Creek	9/3/2002	0.22	1.83	0.002	0.37	0.001	85	0.001	0.25	0.14	0.12
RPD		4.4	2.2	66.7	0.0	0.0	1.2	0.0	0.0	6.9	100.0

Table 51. Relative percent differences for replicate samples analyzed for dissolved trace elements in 0.02-µm filtered samples, from surface grabs, year 2003

[Site name, refer to Table 2 and Plate 1 for location; Ba, barium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Fe, iron; La, lanthanum; Li, lithium; Mn, manganese; Mo, molybdenum; Nd, neodymium; Ni, nickel; Pb, lead; Pr, praseodymium; Rb, rubidium; Re, rhenium; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; µg/L, micrograms per liter; RPD, relative percent difference; --, not available; nc, not calculated]

Site	Date	Ba (µg/L)	Cd (µg/L)	Ce (µg/L)	Co (µg/L)	Cr (µg/L)	Cs (µg/L)	Cu (µg/L)	Fe (µg/L)	La (µg/L)	Li (µg/L)	Mn (µg/L)
Nulato River	6/9/2003	12	0.002	0.021	0.052	0.05	0.001	0.45	8	0.012	0.61	9.5
Nulato River	6/9/2003	12	0.002	0.019	0.052	0.05	0.001	0.46	7	0.011	0.62	9.5
RPD		0.0	0.0	2.0	0.0	0.0	0.0	2.2	13.3	8.7	1.6	0.0

Site	Date	Mo (µg/L)	Nd (µg/L)	Ni (µg/L)	Pb (µg/L)	Pr (µg/L)	Rb (µg/L)	Re (µg/L)	Sr (µg/L)	Tl (µg/L)	U (µg/L)	V (µg/L)	Zn (µg/L)
Nulato River	6/9/2003	0.15	0.021	0.28	0.001	0.004	0.11	0.0002	127	0.001	0.06	0.16	0.014
Nulato River	6/9/2003	0.14	0.021	0.28	0.001	0.004	0.11	0.0002	126	0.001	0.05	0.16	0.003
RPD		6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	18.2	0.0	129.4

Site	Date	Ba (µg/L)	Cd (µg/L)	Ce (µg/L)	Co (µg/L)	Cr (µg/L)	Cs (µg/L)	Cu (µg/L)	Fe (µg/L)	La (µg/L)	Li (µg/L)	Mn (µg/L)
Yuki River	8/28/2003	na	0.008	0.328	0.347	0.80	na	2.88	198	0.162	0.50	43.1
Yuki River	8/28/2003	25	0.009	0.362	0.333	0.80	0.0005	2.88	225	0.178	0.48	42.4
RPD		nc	11.8	9.8	4.1	0.0	nc	0.0	12.8	9.4	4.1	1.6

Site	Date	Mo (µg/L)	Nd (µg/L)	Ni (µg/L)	Pb (µg/L)	Pr (µg/L)	Rb (µg/L)	Re (µg/L)	Sr (µg/L)	Tl (µg/L)	U (µg/L)	V (µg/L)	Zn (µg/L)
Yuki River	8/28/2003	0.18	0.232	2.94	0.016	0.050	na	0.001	33	--	0.03	0.88	--
Yuki River	8/28/2003	0.17	0.247	2.93	0.011	0.053	0.17	0.001	36	0.002	0.03	0.85	0.28
RPD		5.7	6.3	0.3	37.0	5.8	nc	0.0	8.7	nc	0.0	3.5	nc

Table 52. Relative percent differences for replicate samples analyzed for mercury

[Site name, refer to Table 1, Table 2, and Plate 1 for location; Hg, mercury; ng/L, nanograms per liter; RPD, relative percent difference; na, not available]

Site	Date	Filtered Methyl-Hg (ng/L)	Filtered Total-Hg (ng/L)	Particulate Methyl-Hg (ng/L)	Particulate Total-Hg (ng/L)
Yukon River above Circle	8/26/2002	0.04	2.21	0.0667	na
Yukon River above Circle	8/26/2002	0.04	2.27	0.0666	na
RPD		0.0	2.7	0.2	na
Beaver Creek	9/3/2002	0.06	2.15	0.0694	1.7112
Beaver Creek	9/3/2002	0.06	2.2	0.0658	1.8139
RPD		0.0	2.3	5.3	5.8
Nulato River	6/9/2003	0.04	2.65	na	6.2992
Nulato River	6/9/2003	0.04	2.23	na	6.571
RPD		0.0	17.2	na	4.2
Yuki River	8/28/2003	0.06	7.09	0.0233	3.9179
Yuki River	8/28/2003	0.06	3.53	0.0212	3.9492
RPD		0.0	67.0	9.4	0.8

Table 53. Relative percent differences for replicate samples analyzed for deuterium and oxygen isotopes

[Site name, refer to Table 1, Table 2, and Plate 1 for location; δ^2H, deuterium; $\delta^{18}O$, oxygen-18 isotope; RPD, relative percent difference]

Site	Date	δ^2H (per mil)	$\delta^{18}O$ (per mil)
Yukon River above Circle	8/26/2002	-162.4	-20.70
Yukon River above Circle	8/26/2002	-162.5	-20.79
RPD		0.1	0.4
Beaver Creek	9/3/2002	-143.3	-18.46
Beaver Creek	9/3/2002	-143.2	-18.43
RPD		0.1	0.2
Dall River	9/4/2002	-145.5	-18.69
Dall River	9/4/2002	-143.9	-18.59
RPD		1.1	0.5
Nulato River	6/9/2003	-131.3	-17.42
Nulato River	6/9/2003	-131.2	-17.38
RPD		0.1	0.2
Yuki River	8/28/2003	-117.1	-15.42
Yuki River	8/28/2003	-117.5	-15.48
RPD		0.3	0.4

Table 54. Relative percent differences for replicate samples analyzed for tritium

[Site name, refer to Table 2 and Plate 1 for location; TU, tritium units; RPD, relative percent difference]

Site	Date	Tritium (TU)
Nulato River	6/9/2003	7.5
Nulato River	6/9/2003	7.0
RPD		6.9
Yuki River	8/28/2003	9.3
Yuki River	8/28/2003	8.6
RPD		7.8

Table 55. Statistics for relative percent difference in replicate samples

[Q25, 25th percentile; Q75, 75th percentile; Bracket, percentage of samples • 0.0 and • 15 relative percent difference; N, number of samples]

Analysis category	Mean	Q25	Q75	Minimum	Maximum	Bracket	N
Disolved Organic Carbon	10.0	2.9	12.0	0.0	48.6	77.8	36
Anions	5.9	0.6	3.3	0.0	52.3	91.7	12
Uranium Isotope	0.6	0.1	9.9	0.0	25.0	83.3	6
Particulate Carbon	8.9	6.1	12.1	0.7	16.4	75.0	4
Particulate Nitrogen	9.8	5.6	11.0	2.0	23.4	75.0	4
Suspended Sediment Concentration	4.8	1.5	6.5	0.0	11.9	100.0	6
Nutrients	17.1	3.3	32.4	0.0	44.8	66.7	6
Dissolved Inorganic Carbon	9.7	2.3	11.4	1.6	45.8	80.0	10
Mercury	8.2	0.1	5.7	0.0	67.0	85.7	14
Deuterium and Oxygen-18	0.3	0.1	0.4	0.1	1.1	100.0	10
Tritium	7.4	7.1	7.6	6.9	7.8	100.0	2
Dissolved trace elements (Grab sample)	6.0	0.0	6.9	0.0	129.4	93.4	136
Dissolved trace elements (Churn sample)	7.4	0.0	9.6	0.0	51.2	82.9	140

Table 56. Process blanks analyzed for nutrients

[ID#, identification number; N, nitrogen; P, phosphorus; NO_2, nitrite; NH_4, ammonium; PO_4, phosphate; mg N/L, milligrams nitrogen per liter; µg P/L, micrograms phosphorus per liter; mg P/L, milligrams phosphorus per liter; mg/L, milligrams per liter; MDL, method detection limit; <, less than; na, not analyzed]

Blank ID#	Date	Total Dissolved N (mg N/L)	MDL (mg/L)	Soluble Reactive P (µg P/L)	MDL (µg/L)	NO_2 (mg N/L)	MDL (mg/L)	NH_4 (mg N/L)	MDL (mg/L)	PO_4 (mg P/L)	MDL (mg/L)
4119	6/19/2002	<0.06	0.06	na	4.03	<0.001	0.001	<0.008	0.008	< 0.008	0.008
4016	8/24/2002	<0.06	0.06	na	4.03	<0.002	0.002	< 0.007	0.007	< 0.02	0.02
4027	8/30/2002	<0.06	0.06	na	4.03	<0.002	0.002	< 0.007	0.007	< 0.02	0.02
4047	9/3/2002	0.13	0.06	na	4.03	<0.002	0.002	<0.007	0.007	< 0.02	0.02
4619	6/2/2003	<0.06	0.06	<4.03	4.03	<0.001	0.001	<0.003	0.003	< 0.004	0.004
4784	8/23/2003	<0.06	0.06	<4.03	4.03	<0.001	0.001	0.005	0.005	< 0.004	0.004

Table 57. Process blanks analyzed for dissolved organic carbon

[ID#, identification number; DOC, dissolved organic carbon; mg C/L, milligrams carbon per liter; UV (abs @ 254 nm), ultraviolet absorbance at the 254 nanometer wavelength; MDL, method detection limit; na, not analyzed]

Blank ID#	Date	Whole Water DOC (mg C/L)	MDL (mg C/L)	Whole Water UV (abs @ 254 nm)	MDL (abs @ 254 nm)
4119	6/19/2002	0.7	0.2	0.002	0.002
4016	8/24/2002	0.7	0.2	0.000	0.002
4027	8/30/2002	0.5	0.2	0.001	0.002
4619	6/2/2003	0.6	0.2	0.003	0.002
4784	8/23/2003	0.3	0.2	na	0.002

Table 58. Process blanks analyzed for dissolved trace elements in 0.45-µm filtered samples, Equal Discharge Increment sampling from churn

[ID#, identification number; Al, aluminum; As, arsenic; B, boron; Ba, barium; Be, beryllium; Bi, bismuth; Ca, calcium; Cd, cadmium; Ce, cerium; Co, cobalt; Cr, chromium; Cs, cesium; Cu, copper; Dy, dysprosium; Er, erbium; Eu, europium; Fe, iron; Gd, gadolinium; Ho, holmium; K, potassium; La, lanthanum; Li, lithium; Lu, Lutetium; Mg, magnesium; Mn, manganese; Mo, molybdenum; Na, sodium; Nd, neodymium; µg/L, micrograms per liter; mg /L, milligrams per liter; MDL, method detection limit; <, less than; na, not analyzed]

Blank ID#	Date	Al (µg/L)	MDL(µg/L)	As (µg/L)	MDL(µg/L)	B (µg/L)	MDL(µg/L)	Ba (µg/L)	MDL(µg/L)	Be (µg/L)	MDL(µg/L)	Bi (µg/L)	MDL(µg/L)	Ca (mg/L)	MDL (mg/L)
4119	6/19/2002	0.69	0.05	<0.02	0.02	<1.2	1.2	0.096	0.002	< 0.01	0.010	<0.0015	0.0015	0.019	0.004
4016	8/24/2002	1.85	0.08	< 0.009	0.009	< 0.6	0.6	0.029	0.004	< 0.004	0.004	<0.001	0.0010	0.009	0.005
4027	8/30/2002	1.40	0.08	< 0.009	0.009	< 0.6	0.6	0.057	0.004	< 0.004	0.004	0.002	0.0010	0.029	0.005
4047	9/3/2002	1.99	0.08	< 0.009	0.009	< 0.6	0.6	0.044	0.004	< 0.004	0.004	0.001	0.0010	0.016	0.005
4619	6/2/2003	na	0.07	<0.02	0.02	2.5	1.4	0.080	0.006	<0.004	0.004	0.001	0.0004	0.005	0.003
4784	8/23/2003	na	0.03	<0.03	0.03	4.4	0.6	0.006	0.004	<0.002	0.002	<0.0009	0.0009	<0.004	0.004

Blank ID#	Date	Cd (µg/L)	MDL(µg/L)	Ce (µg/L)	MDL(µg/L)	Co (µg/L)	MDL(µg/L)	Cr (µg/L)	MDL(µg/L)	Cs (µg/L)	MDL(µg/L)	Cu (µg/L)	MDL(µg/L)	Dy (µg/L)	MDL(µg/L)
4119	6/19/2002	<0.003	0.003	0.0009	0.0002	< 0.001	0.001	<0.24	0.24	< 0.004	0.004	0.023	0.009	< 0.0003	0.0003
4016	8/24/2002	0.005	0.001	0.0010	0.0003	0.038	0.002	< 0.04	0.04	< 0.009	0.009	0.052	0.006	< 0.0004	0.0004
4027	8/30/2002	0.002	0.001	0.0016	0.0003	0.008	0.002	< 0.04	0.04	< 0.009	0.009	0.055	0.006	< 0.0004	0.0004
4047	9/3/2002	0.003	0.001	0.0022	0.0003	0.007	0.002	< 0.04	0.04	< 0.009	0.009	0.036	0.006	< 0.0004	0.0004
4619	6/2/2003	<0.006	0.006	0.0028	0.0001	0.110	0.003	<0.30	0.30	< 0.02	0.02	0.088	0.003	0.0004	0.0004
4784	8/23/2003	<0.006	0.006	0.0008	0.0002	0.112	0.002	<0.30	0.30	<0.005	0.005	0.056	0.010	<0.0007	0.0007

Blank ID#	Date	Er (µg/L)	MDL(µg/L)	Eu (µg/L)	MDL(µg/L)	Fe (µg/L)	MDL(µg/L)	Gd (µg/L)	MDL(µg/L)	Ho (µg/L)	MDL(µg/L)	K (mg/L)	MDL (mg/L)	La (µg/L)	MDL(µg/L)
4119	6/19/2002	< 0.0008	0.0008	< 0.0003	0.0003	1.18	0.36	< 0.0004	0.0004	0.0001	0.0001	<0.015	0.015	0.0005	0.0001
4016	8/24/2002	< 0.0007	0.0007	< 0.0002	0.0002	3.79	0.73	< 0.0004	0.0004	< 0.0001	0.0001	< 0.006	0.006	0.0005	0.0002
4027	8/30/2002	< 0.0007	0.0007	< 0.0002	0.0002	1.27	0.73	< 0.0004	0.0004	< 0.0001	0.0001	< 0.006	0.006	0.0010	0.0002
4047	9/3/2002	< 0.0007	0.0007	< 0.0002	0.0002	2.32	0.73	< 0.0004	0.0004	< 0.0001	0.0001	< 0.006	0.006	0.0012	0.0002
4619	6/2/2003	<0.0005	0.0005	<0.0002	0.0002	1.46	0.74	< 0.0004	0.0003	<0.0001	0.0001	<0.008	0.008	0.0015	0.0001
4784	8/23/2003	<0.0006	0.0006	<0.0006	0.0006	1.30	0.33	< 0.0004	0.0004	<0.0001	0.0001	<0.018	0.018	0.0003	0.0001

Blank ID#	Date	Li (µg/L)	MDL(µg/L)	Lu (µg/L)	MDL(µg/L)	Mg (mg/L)	MDL(mg/L)	Mn (µg/L)	MDL(µg/L)	Mo (µg/L)	MDL(µg/L)	Na (mg/L)	MDL(mg/L)	Nd (µg/L)	MDL(µg/L)
4119	6/19/2002	< 0.02	0.02	< 0.0001	0.0001	0.003	0.001	0.102	0.006	< 0.05	0.05	<0.015	0.015	< 0.0005	0.0005
4016	8/24/2002	< 0.02	0.02	< 0.0001	0.0001	< 0.002	0.002	0.262	0.005	0.07	0.04	< 0.007	0.007	< 0.0004	0.0004
4027	8/30/2002	< 0.02	0.02	0.0001	0.0001	0.004	0.002	0.089	0.005	< 0.04	0.04	0.013	0.007	0.0006	0.0004
4047	9/3/2002	0.02	0.02	< 0.0001	0.0001	< 0.002	0.002	0.143	0.005	< 0.04	0.04	< 0.007	0.007	0.0005	0.0004
4619	6/2/2003	<0.01	0.01	<0.0001	0.0001	0.002	0.001	0.233	0.008	<0.03	0.03	<0.005	0.005	0.0016	0.0005
4784	8/23/2003	<0.01	0.01	<0.0001	0.0001	<0.001	0.001	0.243	0.021	<0.05	0.05	0.008	0.007	<0.0007	0.0007

Table 58. Process blanks analyzed for dissolved trace elements in 0.45-μm filtered samples, Equal Discharge Increment sampling from churn – continued

[ID#, identification number; Ni, nickel; P, phosphorus; Pb, lead; Pr, praseodymium; Rb, rubidium; S, sulfur; Sb, antimony; Se, selenium; SiO_2, silica; Sm, samarium; Sr, strontium; Tb, terbium; Te, tellurium; Th, thorium; Tl, thallium; Tm, thulium; U, uranium; V, vanadium; Y, yttrium; Yb, ytterbium; Zn, zinc; Zr, zirconium; μg/L, micrograms per liter; mg /L, milligrams per liter; MDL, method detection limit; <, less than; na, not analyzed]

Blank ID#	Date	Ni (μg/L)	MDL(μg/L)	P (μg/L)	MDL(μg/L)	Pb (μg/L)	MDL(μg/L)	Pr (μg/L)	MDL(μg/L)	Rb (μg/L)	MDL(μg/L)	S (mg/L)	MDL(mg/L)	Sb (μg/L)	MDL(μg/L)
4119	6/19/2002	0.034	0.009	< 10	10	0.008	0.001	< 0.0002	0.0002	0.004	0.0002	0.01	0.01	< 0.003	0.003
4016	8/24/2002	1.752	0.009	< 22	22	0.010	0.004	< 0.0001	0.0001	0.002	0.0011	< 0.02	0.02	0.011	0.003
4027	8/30/2002	0.114	0.009	< 22	22	0.136	0.004	0.0002	0.0001	0.004	0.0011	< 0.02	0.02	0.006	0.003
4047	9/3/2002	0.056	0.009	< 22	22	0.006	0.004	0.0001	0.0001	0.004	0.0011	< 0.02	0.02	0.009	0.003
4619	6/2/2003	<0.049	0.049	<7	7	<0.003	0.003	0.0004	0.0001	0.005	0.0004	<0.02	0.02	0.010	0.002
4784	8/23/2003	<0.049	0.049	<10	10	<0.011	0.011	<0.0003	0.0003	0.006	0.0012	<0.02	0.02	0.015	0.003

Blank ID#	Date	Se (μg/L)	MDL(μg/L)	SiO_2 (mg/L)	MDL(mg/L)	Sm (μg/L)	MDL(μg/L)	Sr (μg/L)	MDL(μg/L)	Tb (μg/L)	MDL(μg/L)	Te (μg/L)	MDL(μg/L)	Th (μg/L)	MDL(μg/L)
4119	6/19/2002	<0.12	0.12	<0.018	0.018	< 0.0007	0.0007	0.08	0.03	< 0.0001	0.0001	< 0.006	0.006	< 0.0005	0.0005
4016	8/24/2002	< 0.06	0.06	0.013	0.009	< 0.0008	0.0008	0.02	0.01	< 0.0001	0.0001	< 0.006	0.006	< 0.001	0.001
4027	8/30/2002	< 0.06	0.06	0.015	0.009	< 0.0008	0.0008	0.08	0.01	< 0.0001	0.0001	< 0.006	0.006	< 0.001	0.001
4047	9/3/2002	< 0.06	0.06	0.012	0.009	< 0.0008	0.0008	0.04	0.01	< 0.0001	0.0001	< 0.006	0.006	0.006	0.001
4619	6/2/2003	< 0.06	0.06	0.014	0.003	<0.0007	0.0007	0.10	0.01	<0.0001	0.0001	< 0.006	0.006	0.001	0.001
4784	8/23/2003	<0.10	0.10	0.022	0.008	<0.0010	0.0010	<0.05	0.05	<0.0001	0.0001	< 0.002	0.002	0.003	0.001

Blank ID#	Date	Tl (μg/L)	MDL(μg/L)	Tm (μg/L)	MDL(μg/L)	U (μg/L)	MDL(μg/L)	V (μg/L)	MDL(μg/L)	Y (μg/L)	MDL(μg/L)	Yb (μg/L)	MDL(μg/L)	Zn (μg/L)	MDL(μg/L)
4119	6/19/2002	< 0.002	0.002	< 0.0001	0.0001	<0.0012	0.0012	< 0.08	0.08	0.0004	0.0002	< 0.0002	0.0002	0.69	0.02
4016	8/24/2002	0.003	0.002	< 0.0001	0.0001	< 0.0008	0.0008	< 0.02	0.02	0.0002	0.0001	< 0.0003	0.0003	0.87	0.04
4027	8/30/2002	< 0.002	0.002	< 0.0001	0.0001	< 0.0008	0.0008	< 0.02	0.02	0.0007	0.0001	< 0.0003	0.0003	1.54	0.04
4047	9/3/2002	< 0.002	0.002	< 0.0001	0.0001	< 0.0008	0.0008	< 0.02	0.02	0.0003	0.0001	< 0.0003	0.0003	1.43	0.04
4619	6/2/2003	< 0.003	0.003	<0.0001	0.0001	<0.0003	0.0003	<0.08	0.08	0.0012	0.0002	<0.0002	0.0002	na	0.08
4784	8/23/2003	<0.003	0.003	<0.0001	0.0001	<0.0043	0.0043	<0.10	0.10	<0.0003	0.0003	<0.0003	0.0003	na	0.26

Blank ID#	Date	Zr (μg/L)	MDL(μg/L)
4119	6/19/2002	0.007	0.001
4016	8/24/2002	0.007	0.003
4027	8/30/2002	0.007	0.003
4047	9/3/2002	0.018	0.003
4619	6/2/2003	0.007	0.002
4784	8/23/2003	0.003	0.001

Table 59. Process blanks analyzed for major anions

[ID#, identification number; mg/L, milligrams per liter; mg N/L, milligrams nitrogen per liter; MDL, method detection limit; <, less than]

Blank ID#	Date	Chloride (mg/L)	MDL (mg/L)	Sulfate (mg/L)	MDL (mg/L)	Nitrate (mg N/L)	MDL (mg/L)
4119	6/19/2002	<0.03	0.03	<0.03	0.03	<0.003	0.003
4016	8/24/2002	<0.03	0.03	<0.03	0.03	<0.003	0.003
4027	8/30/2002	<0.04	0.03	<0.03	0.03	0.003	0.003
4047	9/3/2002	<0.03	0.03	<0.03	0.03	<0.003	0.003
4619	6/2/2003	<0.05	0.03	<0.03	0.03	<0.003	0.003
4784	8/23/2003	<0.03	0.03	<0.03	0.03	<0.003	0.003

Table 60. Process blanks analyzed for particulate carbon (PC) and particulate nitrogen (PN)

[ID#, identification number; PC, particulate carbon; PN, particulate nitrogen; mg/L, milligrams per liter; MDL, method detection limit; <, less than]

Blank ID #	Date	PC (mg/L)	MDL (mg/L)	PN (mg/L)	MDL (mg/L)
4016	8/24/2002	<0.064	0.064	< 0.014	0.014
4027	8/30/2002	0.072	0.064	< 0.014	0.014
4047	9/3/2002	0.071	0.064	< 0.014	0.014
4619	6/2/2003	0.085	0.064	< 0.014	0.014
4784	8/23/2003	<0.064	0.064	<0.014	0.014

Table 61. Process blanks analyzed for mercury

[Hg, mercury; ng/L, nanograms per liter; MDL, method detection limit; na, not analyzed]

Blank ID #	Date	Filtered Methyl-Hg (ng/L)	MDL (ng/L)	Filtered Total-Hg (ng/L)	MDL (ng/L)	Particulate Total-Hg (ng/L)	MDL (ng/L)
4139	6/13/2002	na	0.04	0.07	0.04	0.0834	0.04
4140	6/19/2002	0.04	0.04	0.33	0.04	na	0.04
4141	6/25/2002	0.04	0.04	1.35	0.04	0.2138	0.04
4142	6/25/2002	0.04	0.04	0.38	0.04	0.3233	0.04
4143	8/23/2002	0.04	0.04	0.09	0.04	0.2010	0.04
4144	8/24/2002	0.04	0.04	0.37	0.04	0.2241	0.04
4145	9/5/2002	0.04	0.04	0.09	0.04	0.1524	0.04
8018	6/8/2003	0.04	0.04	0.07	0.04	0.1345	0.04
8019	6/14/2003	0.04	0.04	0.1	0.04	0.1194	0.04
4784	8/23/2003	0.04	0.04	0.05	0.04	0.1269	0.04
4814	9/3/2003	0.04	0.04	0.04	0.04	0.1153	0.04

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