UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DATA SUPPLEMENT TO:

QUALITY OF COAL MINE DRAINAGE IN WASHINGTON, 1975-77

By L. A. Fuste', F. A. Packard, M.O. Fretwell, and D. P. Garland

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METRIC (SI) CONVERSION FACTORS

Multiply	By	To obtain
inches (in.)----------	25.4	millimeters (mm)
	2.540	centimeters (cm)
	0.0254	meters (m)
feet (ft)----------	0.3048	meters (m)
square feet (ft^2)	0.09290	square meters (m^2)
miles (mi)----------	1.609	kilometers (km)
cubic yards (yd^3)----------	0.7646	cubic meters (m^3)
acre-feet (acre-ft)----------	1233.	cubic meters (m^3)
	0.001233	cubic hectometers (hm^3)
cubic feet per second (ft^3/s)------	0.02832	cubic meters per second (m^3/s)
	28.32	liters per second (L/s)
degree Fahrenheit (^oF)----------	$^oC = 5/9\ (^oF-32)$	degree Celsius (^oC)
microns (u)	0.001	centimeters (cm)
micrograms per liter (ug/L)	0.001	milligrams per liter (mg/L)
milligrams per liter (mg/L)	0.00136	tons per acre-foot (tons/acre-ft)

DATA SUPPLEMENT TO:

COAL MINE DRAINAGE IN WASHINGTON, 1975-77

By L. A. Fuste', F. A. Packard,
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ABSTRACT

From December 1975 to September 1977 the U.S. Geological Survey studied coal-mine drainage in western Washington to 1) characterize the water quality of drainage from abandoned mines in the 11 coal-bearing areas of the State; 2) examine the water-quality effects on a stream receiving drainage from an abandoned coal mine; 3) determine the baseline water-quality conditions at two prospective underground coal-mine areas; and 4) recommend procedures for monitoring stream quality in the baseline areas in the event that mining occurs.

This report presents physical, chemical, and biological data collected during the study period from Gallop Creek (Whatcom County), Loretta Creek (Skagit County), and Wilkeson Creek (Pierce County) and from 100 abandoned coal mines in western Washington, and from a borehole hydraulic-mining test site. Biological information included taxonomic identifications and counts of benthic invertebrates and periphytic algae.

INTRODUCTION

The purpose of this study was fourfold: 1) to characterize the water quality of drainage from abandoned mines in the 11 coal-bearing areas of the State; 2) to examine the water-quality effects on a stream receiving drainage from an abandoned coal mine; 3) to determine the baseline water-quality conditions at two prospective underground areas; and 4) to recommend procedures for monitoring stream quality in the baseline areas in the event that mining occurs.

This report presents physical, chemical, and biological data that were collected by the U.S. Geological Survey in the 11 major coal-bearing areas of Washington State (fig. 1) from December 1975-September 1977. Within these coal-bearing areas, water-quality data were collected at 51 of 137 abandoned coal mines (figs. 2-5, 9) visited, were collected in Gallop Creek (Whatcom County, fig. 6) and Loretta Creek (Skagit County, fig. 7), at two prospective underground coal mining sites, and in Wilkeson Creek (Pierce County, fig. 8), a stream receiving coal mine drainage from the Skookum mines. This mine drainage was considered representative of the coal mine drainage in the State. An interpretive report describing the project results is in preparation.

Sampling sites were located upstream and downstream from the expected tunnel adits at each of the two baseline streams, Gallop and Loretta Creeks. In Wilkeson Creek (fig. 8), four stations were used to determine changes in stream quality as a result of the mine drainage. Station A was located upstream, away from any mine, and was used as the control site. Station B received some seepage from mine tailings and was located on the right bank of the stream directly opposite Station C, the site receiving mine drainage. Station D was located a sufficient distance downstream to allow complete mixing of the effluent.

PRESENTATION OF DATA

Chemical and physical data from analyses of water from three streams and from the mines in the Wilkeson Creek basin are presented in tables 1-8 and 9-12, respectively. Biologic data were collected in the three streams; they include taxonomic identification of benthic invertebrates and periphytic algae, with counts on the former. These data are presented in tables 13-15 and table 16, respectively.

Analyses were also made of physical and chemical constituents of mine-drainage waters from 9 of the 11 coal-bearing areas reported by Beikman, Gower, and Dana (1961) to occur in Washington. Water-quality data are presented for each coal-bearing area (table 17). Mines that were not draining at the time they were visited or reported dry by local residents (table 19) were not sampled. Water-quality data gathered at a borehole-hydraulic mining test site (fig. 10), 1 mile southeast of the Skookum mine-drainage study site, are presented in table 18.

A summary of the water quality of coal mine drainages in Washington is presented in table 20. For comparison purposes, the averages and weighted averages of sulfur content of Washington coals are presented in table 21.

In this report, coal-bearing areas that are geologic outliers and thus are clearly defined are called fields or districts; those that are covered by younger rocks and thus are not clearly defined are called areas. The name assigned to a field or area is generally that of the largest nearby town or city (Beikman, Gower, and Dana, 1961). The term "deposit" will be used in table 5 when there is a need to present data from fields and areas.

METHODS OF ANALYSIS

The methods of water-quality analysis used are outlined by Brown, Skougstad, and Fishman (1974) or by other currently standard methods of the Geological Survey.

Chemical and Physical Methods

Most samples for the determination of dissolved-oxygen concentration were analyzed using the AZIDE modification of the Winkler method (American Public Health Association and others, 1975). Samples for measurement of dissolved oxygen were also taken in the settling tanks used at the borehole-hydraulic test site. For these samples, a calibrated YSI-54 electronic meter was used to measure dissolved oxygen because the presence of colloidal coal particles made Winkler determinations impossible. Miscellaneous chemical measurements were made in Gallop and Wilkeson Creeks. Sulfide was analyzed according to Smith and others (1976). Samples for the determination of an approximate concentration of ferrous iron were made by filtering a sample through a 0.1-micron filter into hydrochloric acid (Garry Erlich, U.S. Geological Survey, oral commun., 1977). The samples were then sent to the U.S. Geological Survey Laboratory, Lakewood, Colo., for analysis.

A crest-stage gage was mounted and rated at the lower station of Gallop and Loretta Creek so that peak flows could be calculated. Water discharges of stream and mine drainages were measured using standard Geological Survey gaging methods.

In order to determine the acid-producing potential of western Washington coal, Soxhlet analyses of three coal samples (Tono coal seam #1, Centralia; Gallop Creek coal seam #2; unnamed coal seam penetrated by Cumberland mine near Loretta Creek) were made using a large extractor (Emrich, 1973) packed with glass wool and 500 grams of coal. The coal had been crushed and sieved to between 1 and 2 millimeters in intermediate diameter. Hot distilled water was passed through each crushed coal sample an average of 50 times.

Biological Methods

Benthic invertebrates were collected using artificial substrate samplers at the two baseline areas and in the stream receiving mine drainage. These samplers consisted of cylindrical wire-mesh baskets, commonly called "barbecue baskets," measuring 7 x 11 inches which contain enough cobble-sized rocks to cover 3.23 ft^2 of streambed surface area.

All barbecue baskets were packed with clean streambank rocks whose intermediate axis measured from 2.5 to 3.5 inches. Standardization of rock surface area and rock size permitted station-to-station comparisons. The baskets were attached to chains that in turn were connected to 3-foot-long steel stakes driven into the streambed. All baskets were placed in riffles and set parallel to the current at depths from 12 to 18 inches and in sections of similar velocity. The samplers were collected after 1 month of benthic invertebrate colonization, and new samplers were set using identical techniques.

Cylindrical nylon-mesh (210 micron) bags were designed to aid in the retrieval of barbecue baskets from the stream. The general consensus regarding mesh size is that a pore size of 300 microns or larger misses over half the fauna by numbers and taxa (Mason, Lewis, and Hudson, 1975), especially if chironomids and blackflies are a large component of the fauna (Zelt and Clifford, 1972). After collection, the baskets and the bags were placed in 19-liter plastic drums filled with 80-percent ethanol and brought back to the laboratory for processing and sorting of invertebrate organisms.

In the laboratory, invertebrates were separated from sediment and detritus using kerosene flotation (Dan Dindal, New York State University, oral commun., 1977) and hand separation before sorting into major groups (aquatic insects and non-insects). During the late fall and early winter season, samples in the three streams contained large numbers of midges, mayflies, and blackflies. These samples were split, and counts of the three groups were estimated using split fractions (Elliot, 1977). All other organisms were counted completely. The final step involved taxonomic identification of the invertebrates to the lowest taxonomic level practical.

Polyethylene strips were placed in Gallop, Loretta, and Wilkeson Creeks for several periods of 3-4 weeks each to obtain information on periphyton growth. The strips were nailed to small (2.5 x 6 inch) plywood boards and these were wired to steel stakes in a vertical position, at fixed depths of 3-5 inches. The stakes and attached boards were placed in the riffle portions of the streams with the polyethylene strip facing downstream to minimize scouring effects. Strips with a month of periphyton growth were retrieved and immersed with a 5-percent FORMALIN solution containing cupric sulfate and some detergent. They were then sent to the USGS Central Laboratory in Atlanta, Ga., for taxonomic identification.

In the Wilkeson Creek area (fig. 8) samples of bottom material were collected below the main portal (sample point no. 1, fig. 9) and the Fanhouse portal (sample point no. 2, fig. 9) of the Skookum mine to determine the presence of sulfur and iron bacteria, respectively. Samples from the main portal were placed in glass jars and hermetically sealed. Samples from the Fanhouse were placed in 250-milliliter polyethylene bottles. Both samples were chilled and sent to Garry Erlich (U.S. Geological Survey, Menlo Park, Calif.), for identification.

DEFINITION OF TERMS

Acre-foot (ac-ft) - The quantity of water required to cover 1 acre to a depth of 1 foot and equal to 325,900 gallons (1,233.5 cubic meters).

Benthic invertebrate - An invertebrate of the benthos, the community of organisms living in or on the bottom of an aquatic environment.

Borehole hydraulic mining - Underground mining in which a high-pressure jetting tool is used and where access to the coal seam is by way of a borehole. A cavity is formed as the coal is fractured into fine particles by the high velocity water. The water and coal slurry in the cavity is then pumped to the surface via a second pipe in the jetting tool.

Discharge - The volume of water that passes a given point within a given period of time.

Dissolved - Pertaining to the amount of a substance present in true chemical solution. In practice, however, the term includes all forms of the substance that will pass through a 0.45-micrometer membrane filter, and thus may include some very small colloidal particles.

Drainage basin - The area drained by or contributing to a stream, lake, or other water body.

Hardness - A physical-chemical characteristic that is commonly recognized by the increased quantity of soap required to produce a lather. It is attributable to the presence of alkaline earths (principally calcium and magnesium) and is expressed as an equivalent amount of calcium carbonate ($CaCO_3$).

Invertebrate - An animal without a backbone. Common examples include worms, insects, snails, and crayfish.

Iron bacteria - Bacteria that are capable of metabolizing reduced iron present in the aqueous habitat.

Milligrams per liter (mg/L) and micrograms per liter (ug/L) - Units for expressing the concentration of chemical constituents in solution as the weight of solute per unit volume of water. Concentration of suspended sediment is expressed in milligrams per liter, and is based on the weight of sediment per liter of water-sediment mixture.

Periphyton - A community of microorganisms (algae) attached to or living upon submerged surfaces.

Soxhlet extraction - Extraction procedure using coal and hot water that simulates natural conditions for the formation of acid mine water. This procedure speeds up the natural oxidation of a sample so that years of natural weathering can be reproduced in a matter of a few weeks.

Sulfur bacteria - Bacteria that can oxidize or reduce significant amounts of organic sulfur compounds.

Suspended sediment - The sediment that at any given time is maintained in suspension by the upward components of turbulent currents or that exists in suspension as a colloid.

Suspended-sediment concentration - The velocity-weighted concentration of suspended sediment in the sampled zone (from the water surface to a point approximately 0.3 foot above the bed), expressed as milligrams of dry sediment per liter of water-sediment mixture (mg/L).

Sodium-adsorption ratio (SAR) - An expression of the relative activity of sodium ions in exchange reactions with soil, and an index of sodium or alkali hazard to the soil. Waters range in sodium hazard from those that can be used for irrigation on almost all soils and crops to those that are generally unsatisfactory for irrigation.

Specific conductance - A measure of the ability of a water to conduct an electrical current, and expressed in micromhos per centimeter at 25°C. Because the specific conductance is related to the number and specific chemical types of ions in solution, it can be used for approximating the dissolved-solids contents of the water.

Tons per day - A unit of measurement for the quantity of a substance in solution or suspension that passes a stream section during a 24-hour day.

Total - As used in tables of chemical analyses, refers to the amount of a substance that is present both in solution and in suspension. Analyses are performed on representative samples of water and suspended-sediment mixtures.

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Zelt, K. A., and Clifford, H. F., 1972, Assessment of two mesh sizes for interpreting life cycles, standing crop, and percentage composition of stream insects: Freshwater Biology, vol. 2, no. 3, p. 259-269.

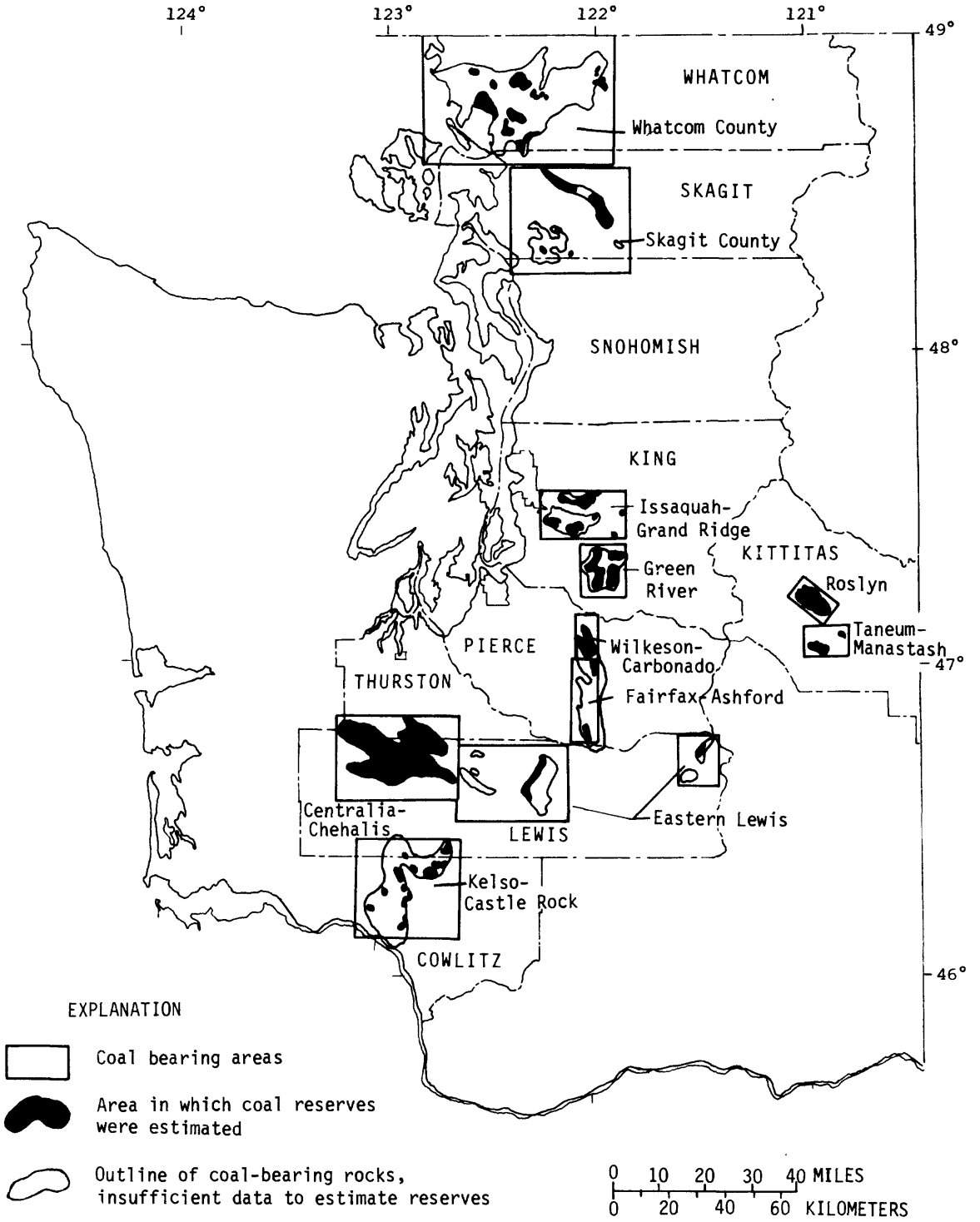


FIGURE 1.--Locations of major coal-bearing areas in Washington.

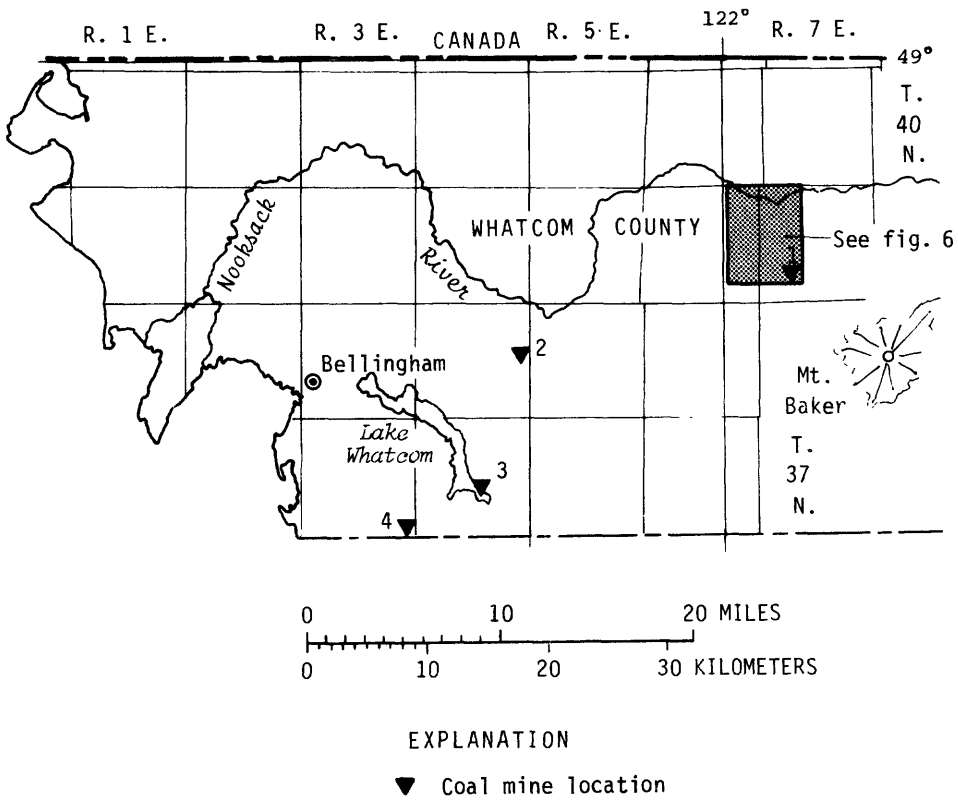


FIGURE 2.--Locations of coal mines sampled in Whatcom County coal deposits.

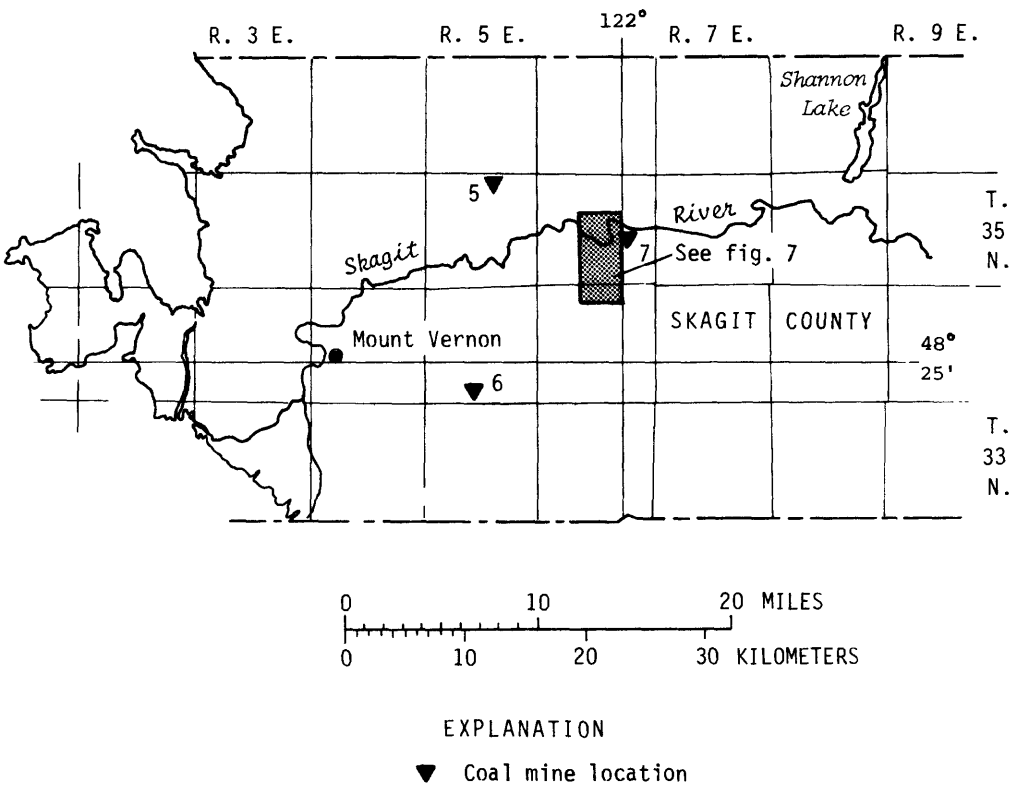


FIGURE 3.--Locations of coal mines sampled in Skagit County coal deposits.

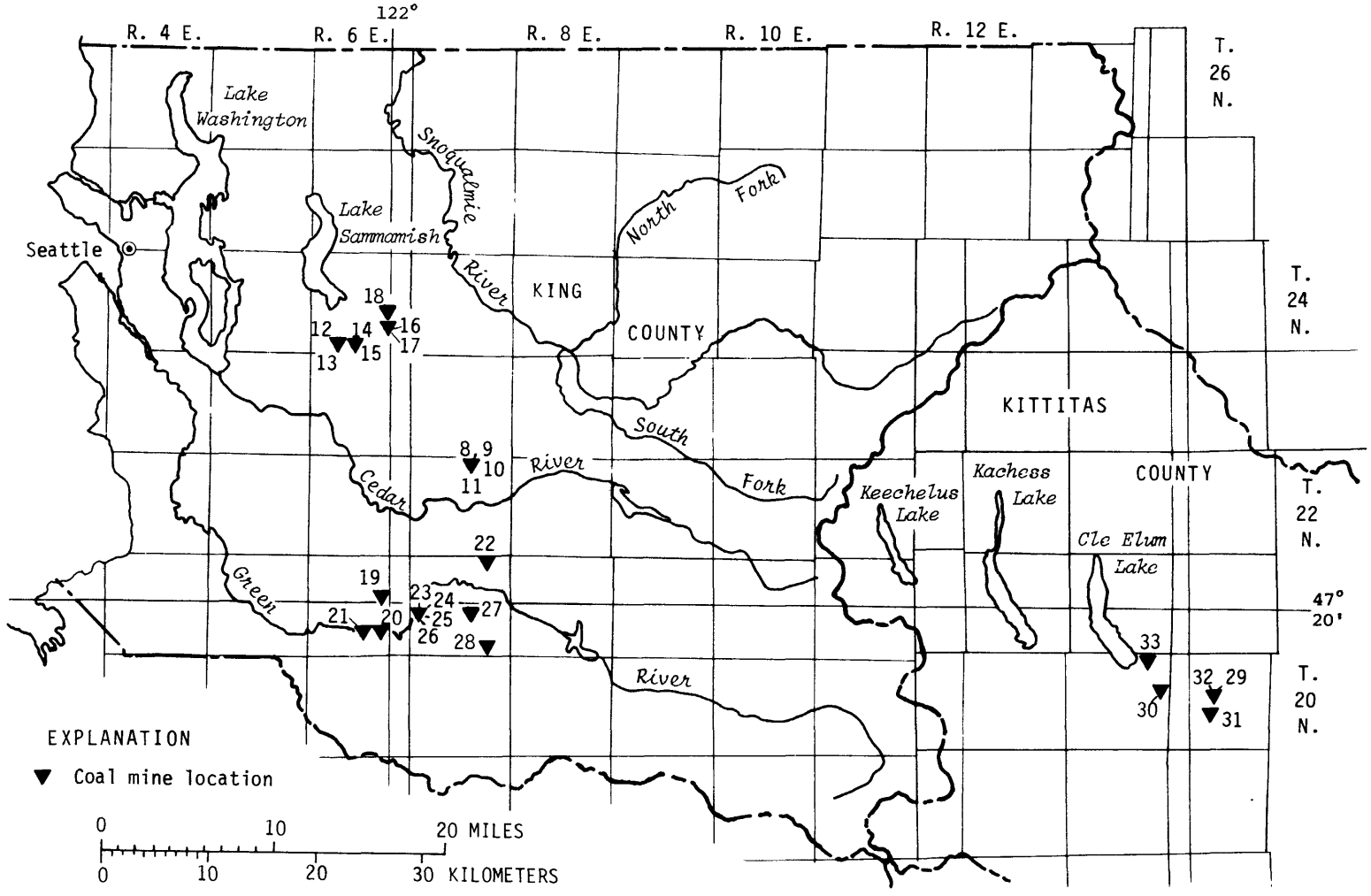


FIGURE 4.--Locations of coal mines sampled in Issaquah-Grand Ridge area, Green River coal district, and Roslyn coal field.

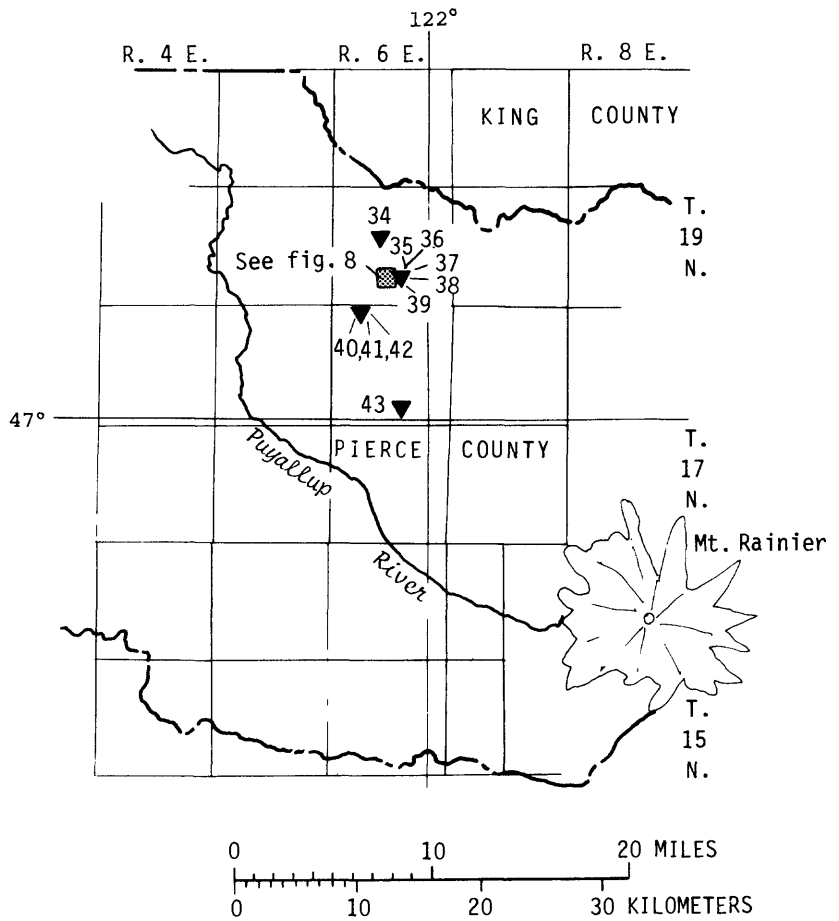


FIGURE 5.--Locations of coal mines sampled in Wilkeson-Carbonado coal field and Fairfax-Ashford coal area.

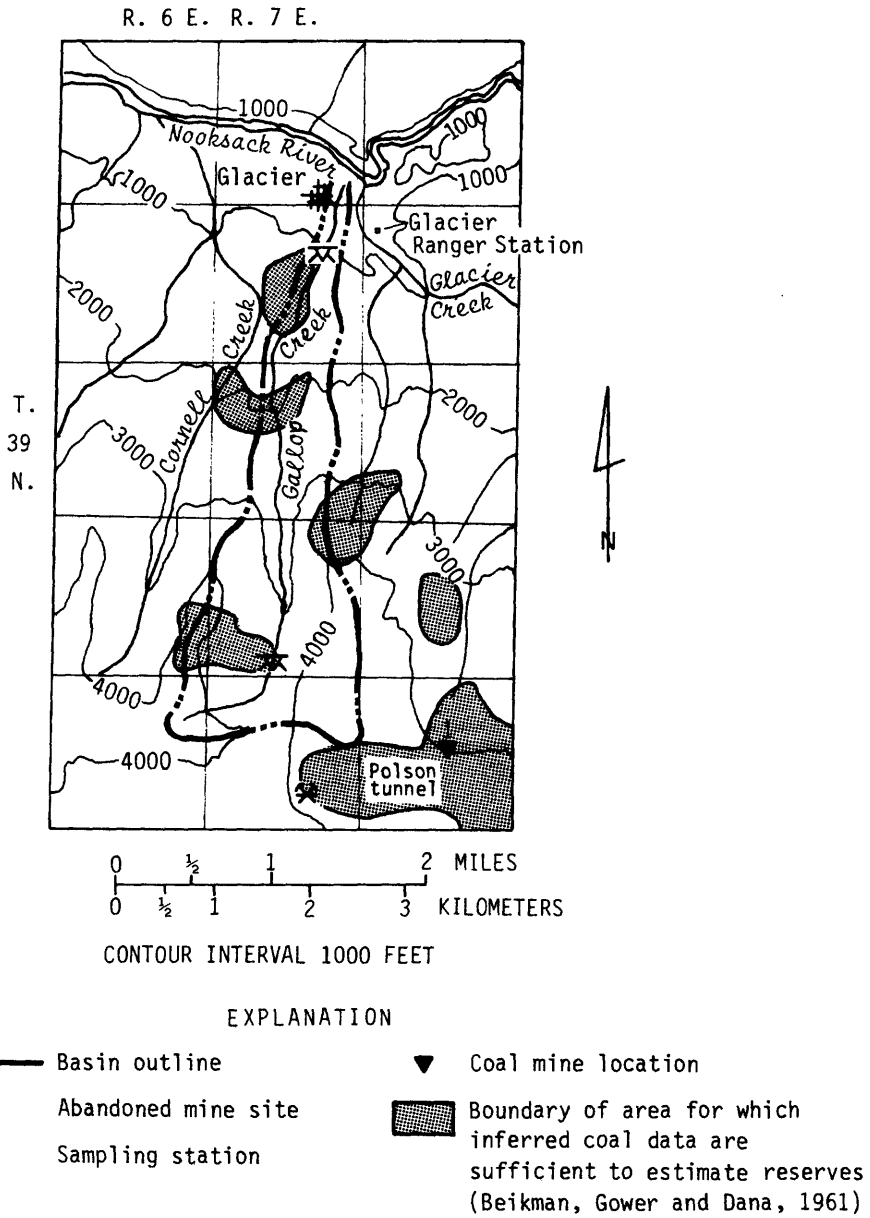


FIGURE 6.--Locations of sampling stations in the Gallop Creek basin.

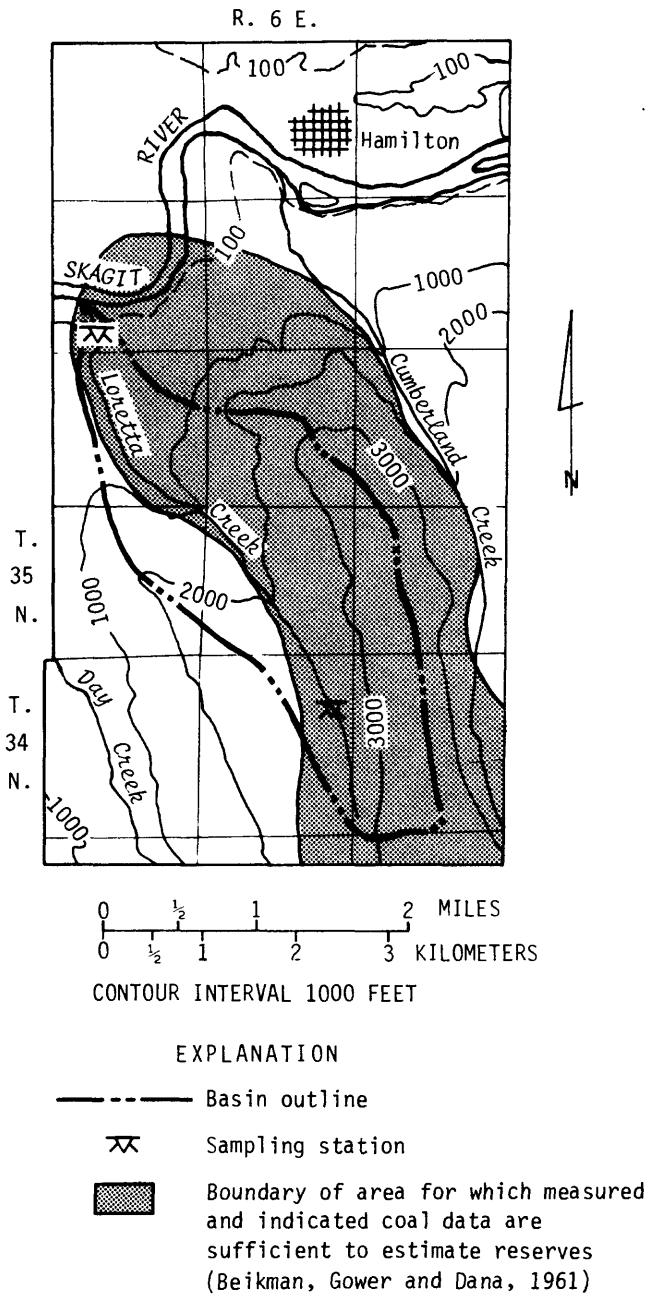
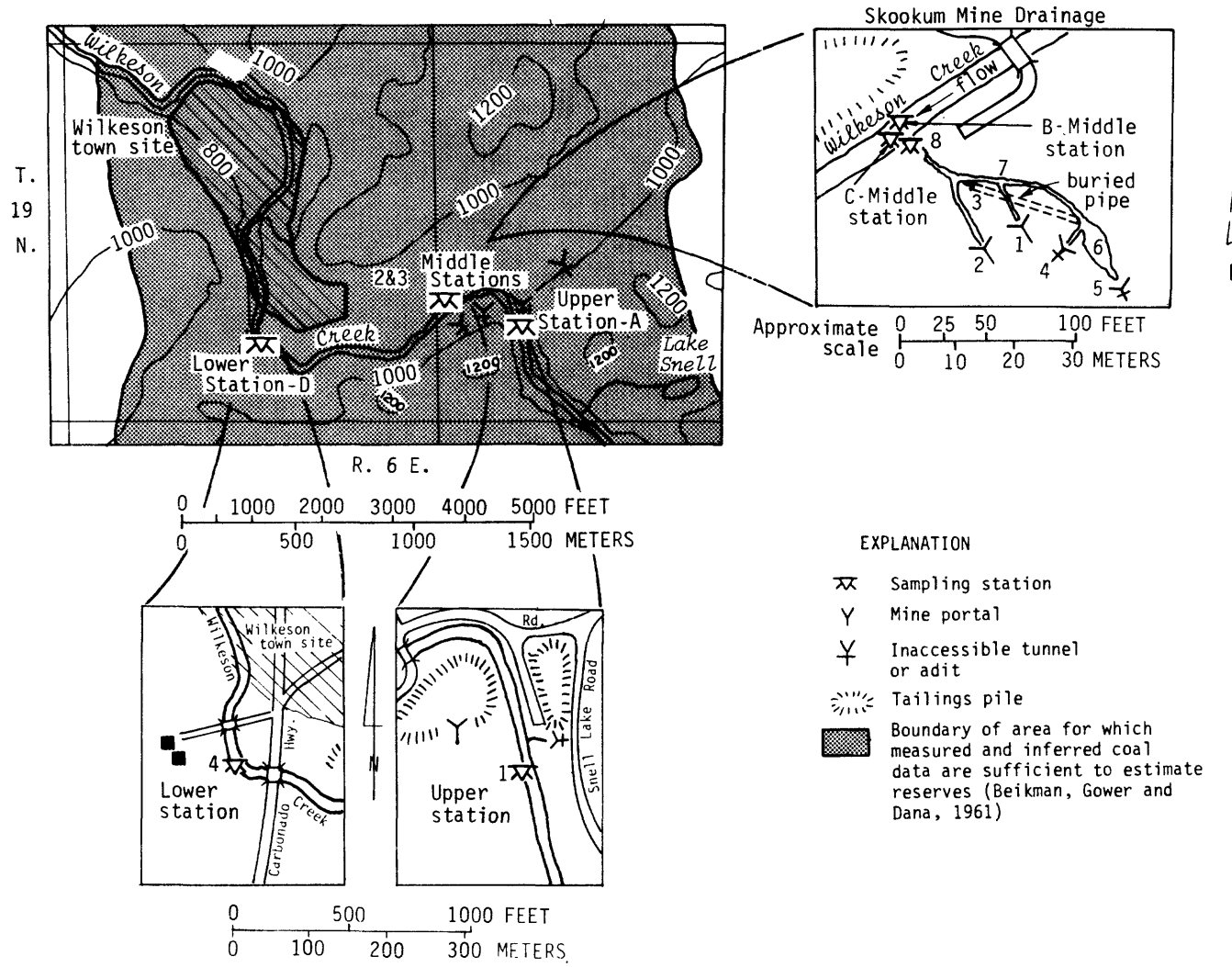


FIGURE 7.--Locations of sampling stations in the Loretta Creek basin.



Index to Skookum Mine Drainage and Wilkeson Creek Sampling Stations

1. Skookum slope (main portal)
2. Fanhouse
3. Lower end of buried pipe
4. Collapsed tunnel
5. Collapsed tunnel
6. Drainage pool at head of buried pipe
7. Small pool along Skookum drainage
8. Combined effluent (sample point #8)

A. Wilkeson Creek, upper station
B. Wilkeson Creek, middle station, right bank
C. Wilkeson Creek, middle station, left bank
D. Wilkeson Creek, lower station

FIGURE 8.--Locations of sampling stations in the Skookum mine drainage system and in Wilkeson Creek.

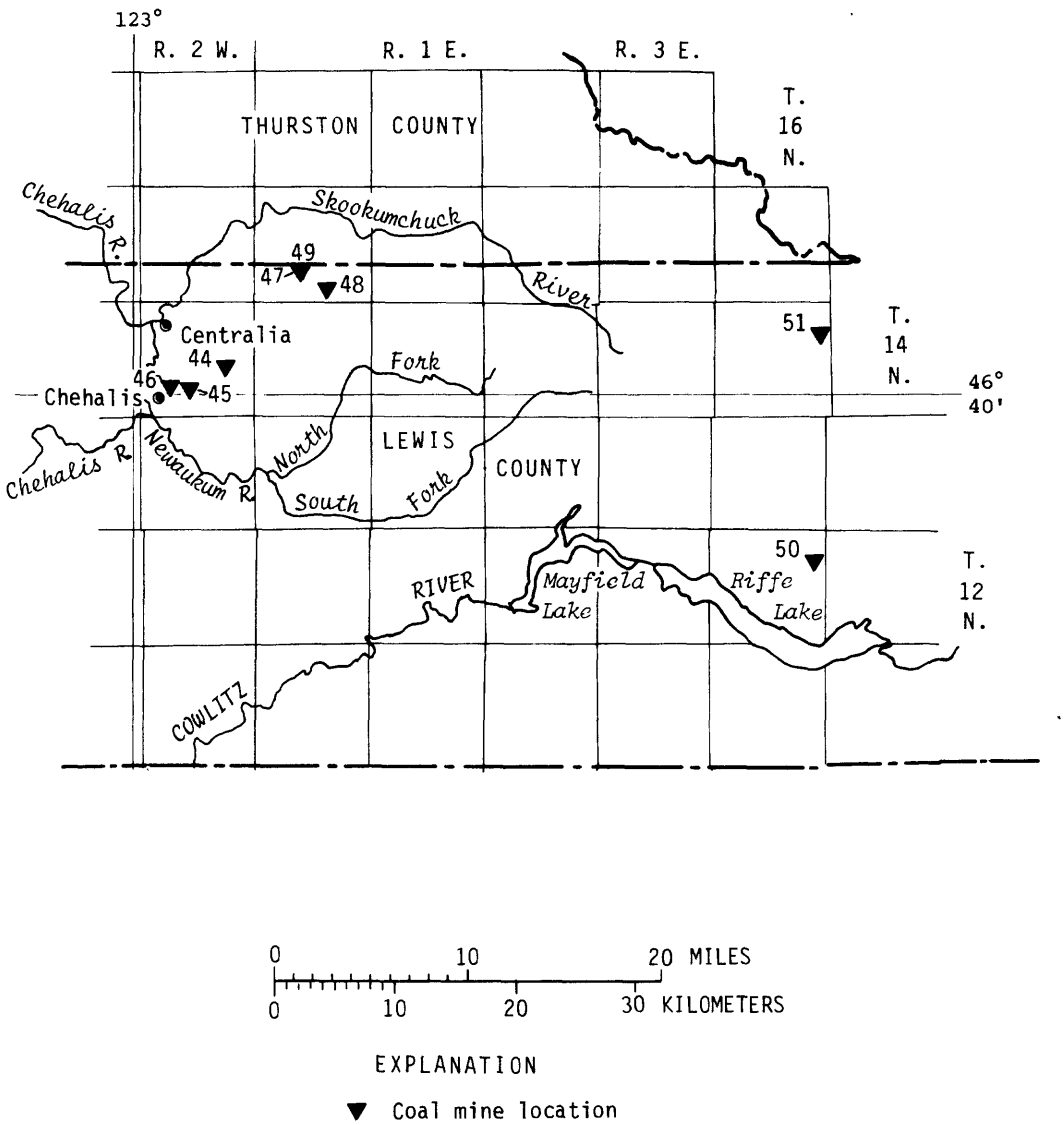


FIGURE 9.--Locations of coal mines sampled in Centralia-Chehalis coal district and Eastern Lewis County coal deposits.

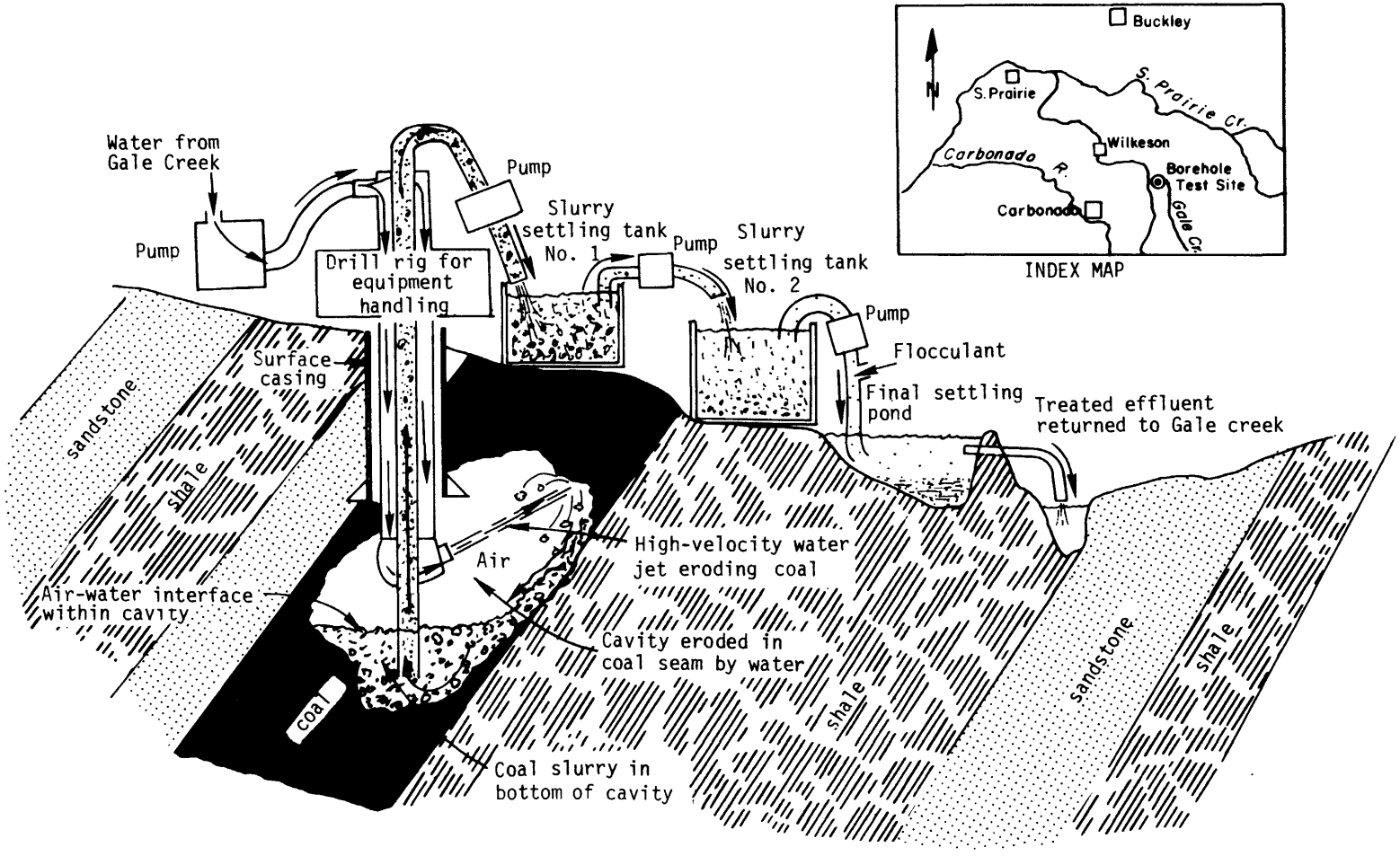


FIGURE 10.--Diagrammatic cross section showing borehole hydraulic coal mining process.

TABLE 1.--Water-quality data for the upstream station in Gallop Creek during June-November 1976

12205310 - GALLOP CR NR GLACIER, WASH

WATER QUALITY DATA

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (UMHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	BARO-METRIC PRES-SURE (MM OF HG)	TUR-BID-ITY (JTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)
JUN , 1976											
28...	1645	--	5	6.8	1.2	661	1	11.9	--	4	1
JUL											
29...	1900	3.1	27	7.6	7.2	673	0	10.4	--	18	3
AUG											
26...	1645	3.3	32	7.4	6.9	675	0	10.2	1.7	20	3
SEP											
22...	1430	1.2	52	6.8	7.1	671	0	10.5	--	27	2
OCT											
29...	1230	1.5	32	6.5	3.6	678	10	11.5	.6	18	0
NOV											
24...	1330	7.9	24	6.8	3.2	670	100	11.5	--	13	4

DATE	ACIDITY (MG/L AS H)	ACIDITY (MG/L AS CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	PERCENT SODIUM	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE FET-FLD (MG/L AS HCO3)	CAR-BONATE FET-FLD (MG/L AS CO3)	ALKA-LINITY FIELD (MG/L AS CACO3)
JUN , 1976											
28...	.1	5.0	1.4	.2	.9	31	.2	.1	4	0	3
JUL											
29...	<.1	.0	4.8	1.5	.7	8	.1	.2	19	0	16
AUG											
26...	.1	5.0	5.6	1.4	.8	8	.1	.2	21	0	17
SEP											
22...	.1	5.0	7.4	2.0	1.2	9	.1	.3	31	0	25
OCT											
29...	.1	5.0	5.4	1.2	.8	8	.1	.3	23	--	19
NOV											
24...	.1	5.0	3.7	.9	1.3	17	.2	.4	11	--	9

TABLE 1.--Water-quality data for the upstream station in Gallop Creek during June-November 1976--continued

DATE	CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	PHOS-PHORUS, ORTHO, TOTAL (MG/L AS P)	ALUM-INUM, TOTAL RECOV-ERABLE (UG/L AS AL)
JUN , 1976											
28...	1.0	2.4	.8	--	--	--	--	<.10	.040	<.010	--
JUL											
29...	.8	1.8	.6	<.1	4.0	23	.03	.21	.020	.010	110
AUG											
26...	1.3	3.7	.6	--	--	--	--	.13	.050	.010	--
SEP											
22...	7.9	2.9	1.3	--	--	--	--	.28	.020	<.010	--
OCT											
29...	12	3.5	1.1	.1	4.6	28	.04	.25	.080	.030	900
NOV											
24...	2.8	5.8	1.5	--	--	--	--	.20	.240	.140	--

DATE	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC TOTAL (UG/L AS AS)	ARSENIC DIS-SOLVED (UG/L AS AS)	CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD)	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)
JUN , 1976											
28...	--	--	--	--	--	--	--	--	--	190	--
JUL											
29...	60	<1	<1	<20	ND	<20	ND	<20	ND	70	<200
AUG											
26...	--	--	--	--	--	--	--	--	--	150	--
SEP											
22...	--	--	--	--	--	--	--	--	--	90	--
OCT											
29...	<100	1	1	<20	ND	ND	ND	<20	<2	1300	<200
NOV											
24...	--	--	--	--	--	--	--	--	--	22000	--

DATE	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY TOTAL RECOV-ERABLE (UG/L AS HG)	NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI)	NICKEL, DIS-SOLVED (UG/L AS NI)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)
JUN , 1976										
28...	--	--	--	--	--	--	--	--	6	--
JUL										
29...	<2	<10	<10	<.5	<50	ND	<20	ND	2	.02
AUG										
26...	--	--	--	--	--	--	--	--	1	.01
SEP										
22...	--	--	--	--	--	--	--	--	2	.01
OCT										
29...	ND	30	<10	<.5	<50	4	<20	ND	10	.04
NOV										
24...	--	--	--	--	--	--	--	--	33	.70

TABLE 2.--Water-quality data for the downstream station in Gallop Creek during December 1975 to December 1976

12205320 - GALLOP CR NR MOUTH AT GLACIER, WASH

WATER QUALITY DATA

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (UMHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	BARO-METRIC PRES-SURE (MM OF HG)	TUR-BID-ITY (JTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	ACIDITY (MG/L AS H)
DEC , 1975												
23...	1400	9.8	43	8.5	3.6	--	1	12.9	--	31	7	<.1
JAN , 1976												
28...	0800	74	45	7.6	3.6	741	5	12.8	1.8	20	6	<.1
FEB												
26...	1100	8.4	67	7.4	1.9	728	0	12.9	2.2	26	0	<.1
MAR												
25...	0830	7.2	41	7.2	2.5	738	30	13.1	1.6	22	0	<.1
APR												
27...	0930	--	--	--	--	--	--	--	--	--	--	--
27...	1000	7.3	58	7.6	4.5	736	4	12.4	3.7	25	1	<.1
27...	1115	--	--	--	--	--	--	--	--	--	--	--
MAY												
20...	1330	18	35	7.5	5.8	738	0	12.2	2.6	17	0	.1
JUN												
28...	1115	23	32	6.8	7.4	732	0	11.3	--	18	1	<.1
JUL												
29...	1120	7.0	49	7.4	10.7	732	0	11.0	--	24	2	.1
AUG												
26...	1045	8.3	47	7.7	9.0	739	0	11.3	2.3	24	1	<.1
SEP												
22...	0830	3.7	58	6.8	10.7	734	0	10.4	--	28	0	.1
OCT												
29...	0830	4.9	48	6.4	6.0	740	0	11.8	.8	25	3	<.1
NOV												
17...	1540	--	--	--	--	--	--	--	--	--	--	--
18...	0720	12	48	--	4.2	--	--	--	--	--	--	--
24...	0800	7.6	47	7.5	5.5	735	1	11.8	--	25	4	<.1
24...	1530	26	48	--	--	--	--	--	--	--	--	--
DEC												
09...	1105	13	--	--	--	--	--	--	--	--	--	--
09...	1600	14	28	--	--	--	--	--	--	--	--	--
10...	0745	11	--	--	--	--	--	--	--	--	--	--
23...	0815	9.8	37	7.5	3.4	735	1	12.7	--	--	--	<.1

DATE	ACIDITY (MG/L AS CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	PERCENT SODIUM	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE FET-FLD (MG/L AS HCO3)	CAR-BONATE FET-FLD (MG/L AS CO3)	ALKA-LINITY FIELD (MG/L AS CACO3)	CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2)
DEC , 1975											
23...	.0	8.4	2.5	1.3	8	.1	.6	30	0	25	.2
JAN , 1976											
28...	.0	3.9	2.4	1.2	11	.1	.5	17	0	14	.7
FEB											
26...	.0	7.1	2.1	1.5	11	.1	.7	35	--	29	2.2
MAR											
25...	.0	5.7	1.8	1.4	12	.1	.4	28	0	23	2.8
APR											
27...	--	--	--	--	--	--	--	--	--	--	--
27...	.0	5.9	2.4	1.4	11	.1	.4	29	--	24	1.2
27...	--	--	--	--	--	--	--	--	--	--	--
MAY											
20...	5.0	4.5	1.3	.7	8	.1	.2	22	0	18	1.1
JUN											
28...	.0	4.8	1.4	.9	10	.1	.4	20	0	16	5.1
JUL											
29...	5.0	6.6	1.9	1.0	8	.1	.4	27	0	22	1.7
AUG											
26...	.0	6.8	1.8	1.1	9	.1	.3	28	0	23	.9
SEP											
22...	5.0	7.8	2.0	1.5	10	.1	.4	34	0	28	8.6
OCT											
29...	.0	7.2	1.8	1.3	10	.1	.4	27	--	22	17
NOV											
17...	--	--	--	--	--	--	--	--	--	--	--
18...	--	--	--	--	--	--	--	--	--	--	--
24...	.0	6.5	2.1	1.3	10	.1	.4	26	--	21	1.3
24...	--	--	--	--	--	--	--	--	--	--	--
DEC											
09...	--	--	--	--	--	--	--	--	--	--	--
09...	--	--	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--	--	--	--
23...	.0	--	--	--	--	--	--	--	--	--	--

TABLE 2.--Water-quality data for the downstream station in Gallop Creek during December 1975 to December 1976--continued

DATE	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	PHOS-PHORUS, ORTHO, TOTAL (MG/L AS P)	ALUM-INUM, TOTAL RECOV-ERABLE (UG/L AS AL)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)
DEC , 1975											
23...	1.7	.9	--	--	--	--	.20	.030	.050	--	--
JAN , 1976											
28...	2.6	.8	.1	5.2	25	.03	.17	.050	<.010	--	50
FEB											
26...	2.7	.6	--	--	--	--	.18	.040	<.010	--	--
MAR											
25...	2.0	1.3	--	--	--	--	.21	.140	.020	--	--
APR											
27...	--	--	--	--	--	--	--	--	--	--	--
27...	1.5	.8	<.1	6.0	33	.04	.11	.040	.010	--	40
27...	--	--	--	--	--	--	--	--	--	--	--
MAY											
20...	2.5	.5	--	--	--	--	.17	.030	<.010	--	--
JUN											
28...	1.5	1.3	--	--	--	--	.13	.020	<.010	--	--
JUL											
29...	1.9	.8	<.1	5.5	32	.04	.14	.020	.020	80	20
AUG											
26...	3.1	.8	--	--	--	--	.15	.030	.010	--	--
SEP											
22...	3.2	.8	--	--	--	--	.15	.010	<.010	--	--
OCT											
29...	3.4	.9	<.1	5.8	34	.05	.31	.020	<.010	130	60
NOV											
17...	--	--	--	--	--	--	--	--	--	--	--
18...	--	--	--	--	--	--	--	--	--	--	--
24...	4.4	1.2	--	--	--	--	.30	.020	<.010	--	--
24...	--	--	--	--	--	--	--	--	--	--	--
DEC											
09...	--	--	--	--	--	--	--	--	--	--	--
09...	--	--	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--	--	--	--
23...	--	--	--	--	--	--	.35	.020	<.010	--	--

DATE	ARSENIC TOTAL (UG/L AS AS)	ARSENIC DIS-SOLVED (UG/L AS AS)	CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD)	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	IRON, DIS-SOLVED (UG/L AS FE)	IRON, FERROUS DIS-SOLVED (UG/L AS FE)
DEC , 1975											
23...	--	--	--	--	--	--	--	--	--	<10	--
JAN , 1976											
28...	--	<1	--	<2	--	ND	--	ND	350	30	20
FEB											
26...	--	--	--	--	--	--	--	--	150	--	--
MAR											
25...	--	--	--	--	--	--	--	--	490	--	--
APR											
27...	--	--	--	--	--	--	--	--	--	--	--
27...	--	<1	--	ND	--	ND	--	2	1500	--	--
27...	--	--	--	--	--	--	--	--	--	--	--
MAY											
20...	--	--	--	--	--	--	--	--	160	--	--
JUN											
28...	--	--	--	--	--	--	--	--	90	--	--
JUL											
29...	<1	<1	<20	ND	<20	ND	<20	<2	30	--	--
AUG											
26...	--	--	--	--	--	--	--	--	90	--	--
SEP											
22...	--	--	--	--	--	--	--	--	30	--	--
OCT											
29...	<1	<1	<20	ND	ND	ND	<20	ND	170	--	--
NOV											
17...	--	--	--	--	--	--	--	--	--	--	--
18...	--	--	--	--	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--	--	170	--	--
24...	--	--	--	--	--	--	--	--	--	--	--
DEC											
09...	--	--	--	--	--	--	--	--	--	--	--
09...	--	--	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--	--	--	--
23...	--	--	--	--	--	--	--	--	--	--	--

TABLE 2.--Water-quality data for the downstream station in Gallop Creek during December 1975 to December 1976--continued

DATE	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY TOTAL RECOV-ERABLE (UG/L AS HG)	NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI)	NICKEL, DIS-SOLVED (UG/L AS NI)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)
DEC , 1975											
23...	--	--	--	--	--	--	--	--	--	5	.13
JAN , 1976											
28...	--	<2	--	<10	<.5	--	ND	--	ND	53	11
FEB											
26...	--	--	--	--	--	--	--	--	--	1	.20
MAR											
25...	--	--	--	--	--	--	--	--	--	6	.12
APR											
27...	--	--	--	--	--	--	--	--	--	2340	--
27...	--	ND	--	<10	<.5	--	2	--	ND	--	--
27...	--	--	--	--	--	--	--	--	--	53	--
MAY											
20...	--	--	--	--	--	--	--	--	--	7	.33
JUN											
28...	--	--	--	--	--	--	--	--	--	2	.12
JUL											
29...	<200	ND	<10	<10	<.5	<50	ND	<20	ND	2	.04
AUG											
26...	--	--	--	--	--	--	--	--	--	2	.04
SEP											
22...	--	--	--	--	--	--	--	--	--	18	.18
OCT											
29...	<200	2	<10	<10	<.5	<50	4	<20	<20	2	.03
NOV											
17...	--	--	--	--	--	--	--	--	--	84	--
18...	--	--	--	--	--	--	--	--	--	38	1.2
24...	--	--	--	--	--	--	--	--	--	4	.08
24...	--	--	--	--	--	--	--	--	--	111	7.8
DEC											
09...	--	--	--	--	--	--	--	--	--	10	.35
09...	--	--	--	--	--	--	--	--	--	11	.42
10...	--	--	--	--	--	--	--	--	--	4	.12
23...	--	--	--	--	--	--	--	--	--	1	.03

TABLE 3.--Water-quality data for the upstream station in Loretta Creek during May 1976 to May 1977

12196153 - LORETTA CR NR DAY CR, WASH

WATER QUALITY DATA

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (UMHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	BARO-METRIC PRES-SURE (MM OF HG)	TUR-BID-ITY (JTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)
JUN, 1976											
29...	1730	1.4	63	7.1	8.6	688	0	10.2	2.5	32	0
JUL											
30...	1000	.55	96	7.7	6.5	691	0	10.7	--	47	1
AUG											
27...	1230	2.2	45	7.5	7.8	695	0	10.3	1.9	23	1
SEP											
23...	1430	.50	76	7.0	7.8	693	0	10.3	2.2	35	0
OCT											
28...	1530	4.4	35	6.4	5.7	696	1	11.0	1.0	20	10
NOV											
23...	1530	1.2	57	7.6	4.4	698	1	11.5	--	28	0
DEC											
22...	1400	2.0	46	7.6	3.3	693	0	11.9	--	23	0
JAN, 1977											
26...	1430	1.5	54	7.6	1.3	693	0	12.8	--	25	0
MAR											
02...	1300	2.6	36	7.5	2.5	690	0	12.4	--	18	2
MAY											
02...	1400	15	30	7.4	4.1	689	1	11.6	--	15	3

DATE	ACIDITY (MG/L AS H)	ACIDITY (MG/L AS CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	PERCENT SODIUM	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE FET-FLD (MG/L AS HCO3)	CAR-BONATE FET-FLD (MG/L AS CO3)	ALKA-LINITY FIELD (MG/L AS CACO3)
JUN, 1976											
29...	<.1	.0	10	1.8	2.2	13	.2	.2	41	0	34
JUL											
30...	.1	5.0	15	2.2	2.7	11	.2	.3	55	0	45
AUG											
27...	.1	5.0	7.4	1.2	1.9	15	.2	.2	27	0	22
SEP											
23...	.1	5.0	11	1.8	2.8	15	.2	.3	48	0	39
OCT											
28...	.1	5.0	6.4	1.0	1.6	15	.2	.3	12	--	10
NOV											
23...	.1	5.0	8.7	1.6	2.0	13	.2	.3	34	--	28
DEC											
22...	<.1	.0	6.8	1.4	1.9	15	.2	.2	28	--	23
JAN, 1977											
26...	<.1	.0	8.1	1.2	1.9	14	.2	.2	32	0	26
MAR											
02...	.1	5.0	5.7	.9	1.7	17	.2	.2	20	0	16
MAY											
02...	.2	10	4.1	1.2	1.2	15	.1	.1	15	0	12

TABLE 3.--Water-quality data for the upstream station in Loretta Creek during May 1976 to May 1977--continued

DATE	CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	PHOS-PHORUS, ORTHO, TOTAL (MG/L AS P)	ALUM-INUM, TOTAL RECOV-ERABLE (UG/L AS AL)
JUN , 1976											
29...	5.2	2.6	2.4	--	--	--	--	<.10	.040	<.010	--
JUL											
30...	1.8	3.1	.8	.1	7.0	58	.08	.02	.030	.060	80
AUG											
27...	1.4	4.1	1.1	--	--	--	--	.01	.050	.010	--
SEP											
23...	7.7	5.0	.8	--	--	--	--	<.10	.020	<.010	--
OCT											
28...	7.6	12	.1	<.1	5.1	33	.04	.05	.060	.010	350
NOV											
23...	1.4	3.7	1.1	--	--	--	--	.02	.020	<.010	--
DEC											
22...	1.1	3.2	1.3	--	--	--	--	.06	.030	<.010	--
JAN , 1977											
26...	1.3	2.7	1.0	<.1	5.9	37	.05	.05	.020	<.010	--
MAR											
02...	1.0	3.4	1.2	--	--	--	--	.44	.030	<.010	--
MAY											
02...	1.0	5.0	1.2	<.1	3.7	24	.03	.01	.040	.010	330

DATE	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC TOTAL (UG/L AS AS)	ARSENIC DIS-SOLVED (UG/L AS AS)	CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD)	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)
JUN , 1976											
29...	--	--	--	--	--	--	--	--	--	70	--
JUL											
30...	30	1	1	<20	ND	<20	ND	<20	ND	60	<200
AUG											
27...	--	--	--	--	--	--	--	--	--	170	--
SEP											
23...	--	--	--	--	--	--	--	--	--	110	--
OCT											
28...	230	1	1	<20	ND	ND	ND	<20	<2	270	<200
NOV											
23...	--	--	--	--	--	--	--	--	--	100	--
DEC											
22...	--	--	--	--	--	--	--	--	--	160	--
JAN , 1977											
26...	60	--	<1	--	2	--	ND	--	2	130	--
MAR											
02...	--	--	--	--	--	--	--	--	--	130	--
MAY											
02...	150	--	<1	--	ND	--	ND	--	ND	250	--

DATE	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY TOTAL RECOV-ERABLE (UG/L AS HG)	NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI)	NICKEL, DIS-SOLVED (UG/L AS NI)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)
JUN , 1976										
29...	--	--	--	--	--	--	--	--	1	.00
JUL										
30...	ND	<10	<10	<.5	<50	NO	ND	ND	2	.00
AUG										
27...	--	--	--	--	--	--	--	--	5	.03
SEP										
23...	--	--	--	--	--	--	--	--	4	.01
OCT										
28...	ND	20	<10	<.5	<50	4	ND	ND	2	.02
NOV										
23...	--	--	--	--	--	--	--	--	3	.01
DEC										
22...	--	--	--	--	--	--	--	--	2	.01
JAN , 1977										
26...	14	--	<10	<.5	--	2	--	ND	0	.00
MAR										
02...	--	--	--	--	--	--	--	--	1	.01
MAY										
02...	2	--	5	<.5	--	ND	--	4	4	.16

TABLE 4.--Water-quality data for the downstream station in Loretta Creek during May 1976 to May 1977

12196155 - LORETTA CR NR HAMILTON, WASH

WATER QUALITY DATA

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (UMHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	BARO-METRIC PRES-SURE (MM OF HG)	TUR-BID-ITY (JTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)
MAY, 1976											
18...	1130	17	36	--	5.4	--	0	11.0	--	--	--
JUN											
29...	0930	6.2	72	7.3	10.5	749	0	11.0	2.4	40	5
JUL											
30...	1430	2.4	94	7.7	12.6	755	0	10.5	1.6	45	3
AUG											
27...	0830	5.4	73	7.8	10.3	761	0	10.8	2.1	34	0
SEP											
23...	0930	2.0	79	6.8	11.7	732	0	10.6	2.7	44	1
OCT											
28...	1030	9.4	73	6.8	9.0	761	0	11.3	1.0	38	4
NOV											
23...	1030	4.1	75	7.9	6.1	764	1	12.4	--	34	2
DEC											
22...	1045	7.4	60	7.8	5.4	760	0	12.5	--	30	2
JAN, 1977											
26...	1000	7.2	69	7.6	2.2	761	0	13.4	--	33	3
MAR											
02...	1010	11	59	7.7	4.4	758	1	13.0	--	27	2
30...	1200	13	65	7.7	5.6	766	1	12.9	--	29	2
MAY											
02...	1030	16	50	7.7	8.1	755	0	11.5	--	23	1

DATE	ACIDITY (MG/L AS H)	ACIDITY (MG/L AS CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	PERCENT SODIUM	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE FET-FLD (MG/L AS HCO3)	CAR-BONATE FET-FLD (MG/L AS CO3)	ALKA-LINITY FIELD (MG/L AS CACO3)
MAY, 1976											
18...	.1	5.0	--	--	--	--	--	--	24	--	20
JUN											
29...	<.1	.0	12	2.4	2.4	12	.2	.3	43	0	35
JUL											
30...	.1	5.0	13	3.1	2.8	12	.2	.5	51	0	42
AUG											
27...	<.1	.0	10	2.1	2.4	13	.2	.4	43	0	35
SEP											
23...	.2	10	13	2.7	2.9	12	.2	.5	52	0	43
OCT											
28...	<.1	.0	11	2.6	2.5	12	.2	.5	42	--	34
NOV											
23...	<.1	.0	10	2.1	2.3	13	.2	.4	39	--	32
DEC											
22...	<.1	.0	8.7	2.1	2.2	13	.2	.3	35	--	29
JAN, 1977											
26...	<.1	.0	9.8	2.1	2.3	13	.2	.3	37	0	30
MAR											
02...	<.1	.0	8.0	1.7	2.2	15	.2	.3	31	0	25
30...	.1	5.0	8.5	1.8	2.0	13	.2	.3	33	0	27
MAY											
02...	.2	10	6.7	1.6	1.8	14	.2	.3	27	0	22

TABLE 4.--Water-quality data for the downstream station in Loretta Creek during May 1976 to May 1977--continued

DATE	CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	PHOS-PHORUS, ORTHO, TOTAL (MG/L AS P)	ALUM-INUM, TOTAL RECOV-ERABLE (UG/L AS AL)
MAY , 1976											
18...	--	--	--	--	--	--	--	.06	.030	<.010	--
JUN											
29...	3.4	3.2	2.0	--	--	--	--	.09	.020	<.010	--
JUL											
30...	1.6	5.6	1.1	<.1	7.7	59	.08	.14	.030	.010	40
AUG											
27...	1.1	5.2	1.3	--	--	--	--	.13	.030	<.010	--
SEP											
23...	13	6.0	.9	--	--	--	--	.09	.010	<.010	--
OCT											
28...	11	7.6	1.1	.1	6.3	52	.07	.34	.040	<.010	<100
NOV											
23...	.8	5.2	1.1	--	--	--	--	.21	.020	<.010	--
DEC											
22...	.9	2.7	1.4	--	--	--	--	.34	.020	<.010	--
JAN , 1977											
26...	1.5	3.5	1.2	<.1	6.7	44	.06	.45	.020	<.010	--
MAR											
02...	1.0	3.3	1.3	--	--	--	--	.44	.020	<.010	--
30...	1.1	4.4	1.5	--	--	--	--	.46	.020	<.010	--
MAY											
02...	.9	3.9	1.2	<.1	5.7	35	.05	.11	.020	<.010	--

DATE	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC TOTAL (UG/L AS AS)	ARSENIC DIS-SOLVED (UG/L AS AS)	CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD)	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)
MAY , 1976											
18...	--	--	--	--	--	--	--	--	--	--	--
JUN											
29...	--	--	--	--	--	--	--	--	--	260	--
JUL											
30...	10	1	1	<20	ND	<20	ND	<20	<2	<10	<200
AUG											
27...	--	--	--	--	--	--	--	--	--	--	--
SEP											
23...	--	--	--	--	--	--	--	--	--	90	--
OCT											
28...	30	1	1	<20	ND	ND	ND	<20	ND	130	<200
NOV											
23...	--	--	--	--	--	--	--	--	--	90	--
DEC											
22...	--	--	--	--	--	--	--	--	--	70	--
JAN , 1977											
26...	20	--	<1	--	ND	--	ND	--	<2	130	--
MAR											
02...	--	--	--	--	--	--	--	--	--	110	--
30...	--	--	--	--	--	--	--	--	--	290	--
MAY											
02...	60	--	<1	--	ND	--	ND	--	ND	80	--

TABLE 4.--Water-quality data for the downstream station in Loretta Creek during May 1976 to May 1977--continued

DATE	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY TOTAL RECOV-ERABLE (UG/L AS HG)	NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI)	NICKEL, DIS-SOLVED (UG/L AS NI)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)
MAY, 1976										
18...	--	--	--	--	--	--	--	--	6	.28
JUN										
29...	--	--	--	--	--	--	--	--	2	.03
JUL										
30...	ND	<10	<10	<.5	<50	ND	ND	ND	2	.01
AUG										
27...	--	--	--	--	--	--	--	--	7	.10
SEP										
23...	--	--	--	--	--	--	--	--	1	.01
OCT										
28...	<2	20	<10	<.5	<50	4	ND	ND	1	.03
NOV										
23...	--	--	--	--	--	--	--	--	2	.02
DEC										
22...	--	--	--	--	--	--	--	--	1	.02
JAN, 1977										
26...	2	--	<10	.5	--	3	--	ND	1	.02
MAR										
02...	--	--	--	--	--	--	--	--	0	.00
30...	--	--	--	--	--	--	--	--	6	.21
MAY										
02...	ND	--	<10	<.5	--	2	--	6	1	.04

TABLE 5.--Water-quality data in Wilkeson Creek during July 1976 to May 1977 for Station A

12094497 - WILKESON CR AT SNELL LK RD AT WILKESON, WASH

WATER QUALITY DATA

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (UMHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	BARO-METRIC PRES-SURE (MM OF HG)	TUR-BID-ITY (JTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	ACIDITY (MG/L AS H)
JUL , 1976												
22...	1500	11	70	7.6	14.2	737	0	9.8	2.4	32	0	<.1
AUG												
23...	1700	17	59	7.8	12.3	738	0	10.1	.1	33	1	<.1
SEP												
30...	1600	11	68	7.8	12.9	733	0	10.0	.4	31	0	.2
NOV												
02...	1530	32	58	7.0	7.6	745	1	11.6	.4	27	1	<.1
DEC												
07...	1550	36	57	7.6	5.0	738	2	12.2	1.9	28	3	<.1
JAN , 1977												
05...	1530	17	65	7.4	.0	744	1	14.3	.2	24	2	<.1
FEB												
09...	1500	14	61	7.8	4.7	741	1	12.5	--	26	0	.1
MAR												
09...	1630	--	63	7.4	3.8	736	4	12.7	--	21	5	.1
APR												
13...	1545	54	50	--	7.2	741	1	11.5	--	16	0	<.1
MAY												
18...	1630	111	37	7.6	7.4	740	2	11.6	--	19	2	<.1

DATE	ACIDITY (MG/L AS CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	PERCENT SODIUM	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE FET-FLD (MG/L AS HCO3)	CAR-BONATE FET-FLD (MG/L AS CO3)	ALKA-LINITY FIELD (MG/L AS CACO3)	CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2)	SULFIDE DIS-SOLVED (MG/L AS S)
JUL , 1976												
22...	.0	8.0	2.8	7.4	33	.6	.8	40	0	33	1.6	--
AUG												
23...	.0	9.6	2.2	3.2	17	.2	.6	39	0	32	1.0	--
SEP												
30...	10	8.7	2.3	3.6	20	.3	.7	43	0	35	1.1	--
NOV												
02...	.0	7.5	1.9	3.1	20	.3	.6	31	--	25	5.0	--
DEC												
07...	.0	7.8	2.0	3.0	19	.2	.5	30	--	25	1.2	--
JAN , 1977												
05...	.0	6.6	1.9	2.9	20	.3	.4	27	0	22	1.7	--
FEB												
09...	5.0	6.9	2.1	3.2	21	.3	.4	32	0	26	.8	--
MAR												
09...	5.0	5.5	1.7	2.7	22	.3	.4	19	0	16	1.2	--
APR												
13...	.0	4.4	1.2	2.2	23	.2	.4	19	--	16	--	--
MAY												
18...	.0	5.7	1.2	2.6	22	.3	.4	21	0	17	.8	.0

TABLE 5.--Water-quality data in Wilkeson Creek during July 1976 to May 1977 for Station A--continued

DATE	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	PHOS-PHORUS, ORTHO, TOTAL (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)	CADMIUM DIS-SOLVED (UG/L AS CD)
JUL , 1976												
22...	6.0	8.1	--	--	--	--	.05	.130	.010	--	--	--
AUG												
23...	4.1	1.3	<.1	11	51	.07	.08	.030	.010	20	<1	ND
SEP												
30...	3.9	1.5	--	--	--	--	.04	.030	<.010	--	--	--
NOV												
02...	3.8	1.4	--	--	--	--	.68	.050	.010	--	--	--
DEC												
07...	4.8	1.7	--	--	--	--	.43	.050	.010	--	--	--
JAN , 1977												
05...	3.7	1.6	.1	12	43	.06	.70	.020	.010	20	<1	ND
FEB												
09...	5.1	1.6	--	--	--	--	.98	.030	.010	--	--	--
MAR												
09...	4.9	1.8	--	--	--	--	1.5	.050	.010	--	--	--
APR												
13...	3.7	1.3	.1	10	33	.04	.48	.030	<.010	20	<1	ND
MAY												
18...	4.5	1.4	--	--	--	--	.60	.040	.010	--	--	--

DATE	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	IRON, FERROUS DIS-SOLVED (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY TOTAL RECOV-ERABLE (UG/L AS HG)	NICKEL, DIS-SOLVED (UG/L AS NI)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)
JUL , 1976											
22...	--	--	210	--	--	--	--	--	--	3	.09
AUG											
23...	ND	ND	250	--	3	<10	<.5	ND	ND	2	.09
SEP											
30...	--	--	270	--	--	--	--	--	--	1	.03
NOV											
02...	--	--	300	--	--	--	--	--	--	3	.26
DEC											
07...	--	--	440	--	--	--	--	--	--	7	.68
JAN , 1977											
05...	ND	ND	220	--	ND	<10	<.5	<2	<20	2	.09
FEB											
09...	--	--	230	--	--	--	--	--	--	2	.08
MAR											
09...	--	--	720	--	--	--	--	--	--	14	--
APR											
13...	ND	ND	320	--	2	<10	<.5	ND	ND	3	.44
MAY											
18...	--	--	390	70	--	--	--	--	--	9	2.7

TABLE 6.--Water-quality data in Wilkeson Creek during July 1976 to May 1977 for Station B

470608122020501 - WILKESON CR AT MINE, RIGHT BANK

WATER QUALITY DATA

DATE	TIME	SPECIFIC CONDUCTANCE (UMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	BAROMETRIC PRESSURE (MM OF HG)	TURBIDITY (JTU)	OXYGEN, DISSOLVED (MG/L)	OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	HARDNESS (MG/L AS CACO3)	HARDNESS, NONCARBONATE (MG/L CACO3)	ACIDITY (MG/L AS H)
JUL , 1976											
21...	1630	65	7.8	13.3	738	0	10.1	2.0	36	0	<.1
AUG											
23...	1500	68	7.8	12.1	737	1	10.3	1.8	31	5	.1
SEP											
30...	1300	80	7.8	13.3	734	1	10.2	.4	37	0	.3
NOV											
02...	1200	61	7.0	7.4	745	1	11.8	.6	28	1	.1
DEC											
07...	1230	81	7.7	4.8	739	2	12.3	1.3	27	0	<.1
JAN , 1977											
05...	1300	68	7.3	.0	744	1	14.4	.3	25	0	<.1
FEB											
09...	1300	72	7.8	4.6	743	1	12.5	--	31	3	.1
MAR											
09...	1300	49	7.4	3.8	734	4	12.4	--	21	4	.1
APR											
13...	1330	49	--	6.9	741	1	11.6	--	18	0	<.1
MAY											
18...	1300	47	7.6	7.4	740	2	11.6	--	19	3	<.1

DATE	ACIDITY (MG/L AS CACO3)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	PERCENT SODIUM	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE FET-FLD (MG/L AS HCO3)	CARBONATE FET-FLD (MG/L AS CO3)	ALKALINITY FIELD (MG/L AS CACO3)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)
JUL , 1976											
21...	.0	9.1	3.3	3.5	17	.3	.6	47	0	39	1.2
AUG											
23...	5.0	8.2	2.5	3.3	19	.3	.5	32	0	26	.8
SEP											
30...	15	9.7	3.2	3.8	18	.3	.7	48	0	39	1.2
NOV											
02...	5.0	7.6	2.1	3.1	19	.3	.6	33	--	27	5.3
DEC											
07...	.0	7.0	2.3	3.0	19	.3	.5	33	--	27	1.1
JAN , 1977											
05...	.0	6.3	2.2	2.9	20	.3	.4	31	0	25	2.5
FEB											
09...	5.0	8.2	2.6	3.4	19	.3	.5	34	0	28	.9
MAR											
09...	5.0	5.7	1.6	2.7	22	.3	.4	20	0	16	1.3
APR											
13...	.0	4.7	1.6	2.2	20	.2	.4	24	--	20	--
MAY											
18...	.0	5.5	1.3	2.2	20	.2	.3	20	0	16	.8

TABLE 6.--Water-quality data in Wilkeson Creek during July 1976 to May 1977 for Station B--continued

DATE	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	PHOS-PHORUS, ORTHO, TOTAL (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)
JUL , 1976											
21...	6.1	1.2	--	--	--	--	.04	.040	.010	--	--
AUG											
23...	5.2	1.3	<.1	11	48	.07	.07	.020	.010	20	<1
SEP											
30...	4.8	1.0	--	--	--	--	.04	.020	<.010	--	--
NOV											
02...	4.5	1.4	--	--	--	--	.71	.050	.010	--	--
DEC											
07...	2.9	1.7	--	--	--	--	.38	.080	.010	--	--
JAN , 1977											
05...	3.3	1.5	<.1	12	44	.06	.71	.020	.010	20	<1
FEB											
09...	5.9	1.7	--	--	--	--	.38	.030	.010	--	--
MAR											
09...	6.7	1.6	--	--	--	--	1.5	.040	.010	--	--
APR											
13...	2.6	1.3	<.1	10	35	.05	.47	.030	.010	20	<1
MAY											
18...	4.1	1.4	--	--	--	--	.60	.040	.010	--	--

DATE	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY TOTAL RECOV-ERABLE (UG/L AS HG)	NICKEL, DIS-SOLVED (UG/L AS NI)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)
JUL , 1976										
21...	--	--	--	230	--	--	--	--	--	1
AUG										
23...	ND	ND	ND	220	<2	<10	<.5	ND	ND	1
SEP										
30...	--	--	--	270	--	--	--	--	--	1
NOV										
02...	--	--	--	290	--	--	--	--	--	2
DEC										
07...	--	--	--	560	--	--	--	--	--	6
JAN , 1977										
05...	ND	ND	ND	220	ND	<10	<.5	3	ND	4
FEB										
09...	--	--	--	--	--	--	--	--	--	2
MAR										
09...	--	--	--	850	--	--	--	--	--	13
APR										
13...	ND	ND	ND	320	2	<10	<.5	ND	ND	1
MAY										
18...	--	--	--	530	--	--	--	--	--	11

TABLE 7.--Water-quality data in Wilkeson Creek during July 1976 to May 1977 for Station C

470608122020502 - WILKESON CR AT MINE, LEFT BANK

WATER QUALITY DATA

DATE	TIME	SPECIFIC CONDUCTANCE (UMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	BAROMETRIC PRESSURE (MM OF HG)	TURBIDITY (JTU)	OXYGEN, DISSOLVED (MG/L)	OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	HARDNESS (MG/L AS CACO3)	HARDNESS, NONCARBONATE (MG/L CACO3)	ACIDITY (MG/L AS H)
JUL , 1976											
21...	1700	333	7.2	10.2	738	4	8.9	.9	140	0	.3
AUG											
23...	1200	307	7.2	10.1	737	1	8.9	1.4	120	0	.4
SEP											
30...	1200	322	7.2	10.1	735	4	9.0	.2	130	0	.9
NOV											
02...	1100	162	6.8	8.7	746	1	11.0	.4	67	5	.2
DEC											
07...	1100	100	7.4	5.3	739	2	11.3	2.7	46	0	.1
JAN , 1977											
05...	1145	210	7.3	4.2	744	1	10.7	.7	82	0	.2
FEB											
09...	1200	250	7.4	7.6	743	2	9.9	--	110	0	.4
MAR											
09...	1300	46	7.5	3.8	734	4	12.4	--	20	3	.1
APR											
13...	1100	58	--	6.9	741	1	11.7	--	21	0	.1
MAY											
18...	1230	47	7.6	7.4	740	2	11.6	--	19	1	<.1

DATE	ACIDITY (MG/L AS CACO3)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	PERCENT SODIUM	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE FET-FLD (MG/L AS HCO3)	CARBONATE FET-FLD (MG/L AS CO3)	ALKALINITY FIELD (MG/L AS CACO3)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)
JUL , 1976											
21...	15	31	14	18	22	.7	1.1	185	0	152	19
AUG											
23...	20	27	13	19	25	.8	1.1	169	0	139	17
SEP											
30...	45	29	14	20	25	.8	1.2	184	0	151	19
NOV											
02...	10	16	6.6	10	24	.5	.8	76	--	62	19
DEC											
07...	5.0	11	4.4	7.1	25	.5	.7	73	--	60	4.6
JAN , 1977											
05...	10	19	8.5	14	27	.7	.8	127	0	104	10
FEB											
09...	20	24	11	17	26	.7	.9	148	0	121	9.4
MAR											
09...	5.0	5.2	1.7	2.8	23	.3	.4	21	0	17	1.1
APR											
13...	5.0	5.9	1.6	2.8	22	.3	.4	27	--	22	--
MAY											
18...	.0	5.5	1.3	2.8	24	.3	.4	22	0	18	.9

TABLE 7.--Water-quality data in Wilkeson Creek during July 1976 to May 1977 for Station C--continued

DATE	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	PHOS-PHORUS, ORTHO, TOTAL (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)
JUL , 1976											
21...	33	1.8	--	--	--	--	.01	.140	.010	--	--
AUG											
23...	24	1.6	.1	19	189	.26	.03	.100	.010	10	1
SEP											
30...	22	1.9	--	--	--	--	<.10	.120	.010	--	--
NOV											
02...	11	1.4	--	--	--	--	.56	.110	.010	--	--
DEC											
07...	5.9	1.6	--	--	--	--	.32	.060	.010	--	--
JAN , 1977											
05...	11	1.7	.1	18	136	.19	.43	.090	.010	<100	<1
FEB											
09...	15	1.9	--	--	--	--	.18	.120	.010	--	--
MAR											
09...	4.8	1.8	--	--	--	--	1.5	.200	.010	--	--
APR											
13...	3.5	1.3	<.1	11	40	.05	.46	.040	<.010	20	<1
MAY											
18...	2.2	1.3	--	--	--	--	.60	.040	.010	--	--

DATE	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY TOTAL RECOV-ERABLE (UG/L AS HG)	NICKEL, DIS-SOLVED (UG/L AS NI)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)
JUL , 1976										
21...	--	--	--	1800	--	--	--	--	--	4
AUG										
23...	ND	ND	ND	1500	2	270	<.5	ND	ND	2
SEP										
30...	--	--	--	1600	--	--	--	--	--	2
NOV										
02...	--	--	--	640	--	--	--	--	--	4
DEC										
07...	--	--	--	840	--	--	--	--	--	6
JAN , 1977										
05...	ND	ND	ND	1100	<2	140	<.5	<2	<20	4
FEB										
09...	--	--	--	1100	--	--	--	--	--	3
MAR										
09...	--	--	--	700	--	--	--	--	--	13
APR										
13...	ND	ND	ND	340	2	20	<.5	ND	ND	2
MAY										
18...	--	--	--	410	--	--	--	--	--	8

TABLE 8.--Water-quality data in Wilkeson Creek during July 1976 to May 1977 for Station D

12094499 - WILKESON CR NR SCHOOLHOUSE AT WILKESON, WASH

WATER QUALITY DATA

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (UMHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	BARO-METRIC PRES-SURE (MM OF HG)	TUR-BID-ITY (JTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	ACIDITY (MG/L AS H)
JUL , 1976												
21...	1130	12	137	7.8	12.6	744	1	10.1	1.1	58	0	<.1
AUG												
23...	0850	18	103	7.9	11.1	738	1	10.4	2.0	46	0	.1
SEP												
30...	0830	12	123	7.8	12.1	736	1	9.9	.3	51	0	.3
NOV												
02...	0830	39	76	7.0	6.4	746	1	11.6	.4	34	0	.1
DEC												
07...	0900	37	82	7.5	4.1	741	2	12.4	1.9	34	0	<.1
JAN , 1977												
05...	0830	19	82	7.3	.3	744	1	14.2	.3	35	0	.1
FEB												
09...	0900	14	99	7.7	4.4	744	1	12.2	--	44	1	.2
MAR												
09...	0830	109	73	7.5	3.7	733	5	12.6	--	23	3	.1
APR												
13...	0815	55	52	--	6.2	741	1	11.7	--	22	0	.1
MAY												
18...	0830	120	57	7.4	6.3	741	2	11.7	--	20	0	<.1

DATE	ACIDITY (MG/L AS CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	PERCENT SODIUM	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE FET-FLD (MG/L AS HCO3)	CAR-BONATE FET-FLD (MG/L AS CO3)	ALKA-LINITY FIELD (MG/L AS CACO3)	CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2)	SULFIDE DIS-SOLVED (MG/L AS S)
JUL , 1976												
21...	.0	14	5.6	6.0	18	.3	.7	71	0	58	1.8	--
AUG												
23...	5.0	12	4.0	5.1	19	.3	.6	59	0	48	1.2	--
SEP												
30...	15	13	4.5	6.1	20	.4	.8	68	0	56	1.7	--
NOV												
02...	5.0	8.7	2.9	4.0	20	.3	.6	43	--	35	6.9	--
DEC												
07...	.0	8.8	2.9	3.9	20	.3	.6	47	--	39	2.4	--
JAN , 1977												
05...	5.0	8.4	3.3	4.6	22	.3	.5	44	0	36	3.5	--
FEB												
09...	10	11	4.1	5.4	21	.4	.5	53	0	43	1.7	--
MAR												
09...	5.0	6.0	1.9	3.0	22	.3	.4	24	0	20	1.2	--
APR												
13...	5.0	5.7	2.0	2.9	22	.3	.4	30	--	25	--	--
MAY												
18...	.0	5.3	1.6	2.9	24	.3	.4	25	0	21	1.6	.0

TABLE 8.--Water-quality data in Wilkeson Creek during July 1976 to May 1977 for Station D--continued

DATE	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	PHOS-PHORUS, ORTHO, TOTAL (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)	CADMIUM DIS-SOLVED (UG/L AS CD)
JUL , 1976												
21...	11	2.2	--	--	--	--	.05	.040	.010	--	--	--
AUG												
23...	7.3	1.5	.1	12	72	.10	.07	.050	.010	10	1	ND
SEP												
30...	7.1	1.6	--	--	--	--	.04	.030	<.010	--	--	--
NOV												
02...	4.9	1.5	--	--	--	--	.71	.080	.010	--	--	--
DEC												
07...	4.1	1.6	--	--	--	--	.33	.040	.010	--	--	--
JAN , 1977												
05...	4.9	1.6	<.1	13	58	.08	.64	.030	.010	20	1	ND
FEB												
09...	7.4	1.7	--	--	--	--	.47	.040	.010	--	--	--
MAR												
09...	5.4	1.9	--	--	--	--	1.4	.070	.010	--	--	--
APR												
13...	3.5	1.3	<.1	11	42	.06	.46	.040	.010	30	<1	ND
MAY												
18...	2.6	2.1	--	--	--	--	.59	.040	.010	--	--	--

DATE	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	IRON, FERROUS DIS-SOLVED (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY TOTAL RECOV-ERABLE (UG/L AS HG)	NICKEL, DIS-SOLVED (UG/L AS NI)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)
JUL , 1976											
21...	--	--	350	--	--	--	--	--	--	2	.07
AUG											
23...	ND	ND	340	--	3	30	<.5	ND	ND	3	.15
SEP											
30...	--	--	440	--	--	--	--	--	--	1	.03
NOV											
02...	--	--	360	--	--	--	--	--	--	3	.32
DEC											
07...	--	--	730	--	--	--	--	--	--	8	.80
JAN , 1977											
05...	ND	<2	320	--	2	30	<.5	<2	20	4	.21
FEB											
09...	--	--	280	--	--	--	--	--	--	2	.08
MAR											
09...	--	--	770	--	--	--	--	--	--	16	4.7
APR											
13...	ND	ND	360	--	ND	<10	<.5	ND	ND	4	.59
MAY											
18...	--	--	500	70	--	--	--	--	--	9	2.9

TABLE 9.--Water-quality data for the Skookum area for Portal #1 during July 1976 to June 1977

470607122020301 - SKOOKUM SLOPE PORTAL # 1

WATER QUALITY DATA

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (UMHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	BARO-METRIC PRES-SURE (MM OF HG)	TUR-BID-ITY (JTU)	OXYGEN, DIS-SOLVED (MG/L)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)
JUL , 1976										
21...	1300	.03	983	7.2	11.6	738	--	.0	450	0
NOV										
02...	1700	.02	950	7.1	--	--	E0	--	--	--
MAR , 1977										
10...	1000	--	--	7.5	11.4	750	E0	.0	--	--
MAY										
18...	1530	--	970	7.4	12.0	740	--	.0	--	--
JUN										
20...	1300	--	950	7.4	11.8	739	--	.0	--	--

DATE	ACIDITY (MG/L AS H)	ACIDITY (MG/L AS CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	PERCENT SODIUM	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE FET-FLD (MG/L AS HCO3)
JUL , 1976									
21...	1.0	50	100	48	59	22	1.2	2.2	584
NOV									
02...	--	--	--	--	--	--	--	--	--
MAR , 1977									
10...	--	--	--	--	--	--	--	--	--
MAY									
18...	--	--	--	--	--	--	--	--	--
JUN									
20...	--	--	--	--	--	--	--	--	--

DATE	CAR-BONATE FET-FLD (MG/L AS CO3)	ALKA-LINITY FIELD (MG/L AS CACO3)	CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2)	SULFIDE DIS-SOLVED (MG/L AS S)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	IRON, FERROUS DIS-SOLVED (UG/L AS FE)	SEDI-MENT, SUS-PENDED (MG/L)
JUL , 1976									
21...	0	479	59	--	120	2.8	30	--	--
NOV									
02...	--	--	--	--	--	--	--	--	E0
MAR , 1977									
10...	--	--	--	11	--	--	--	160	E0
MAY									
18...	--	--	--	15	--	--	40	10	--
JUN									
20...	--	--	--	--	--	--	--	--	--

TABLE 10.--Water-quality data for the Skookum area for Portal #2 during July 1976 to June 1977

470607122020302 - SKOOKUM AREA MINE PORTAL # 2

WATER QUALITY DATA

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (UMHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	BARO-METRIC PRES-SURE (MM OF HG)	TUR-BID-ITY (JTU)	OXYGEN, DIS-SOLVED (MG/L)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)
JUL , 1976										
21...	1330	.87	353	7.0	9.3	738	9	6.7	150	0
DEC										
07...	1200	--	--	--	--	739	--	6.9	--	--
MAR , 1977										
10...	1000	--	--	7.2	9.5	750	E0	7.1	--	--
MAY										
18...	1530	--	357	7.0	9.7	741	--	4.7	--	--
JUN										
20...	1230	--	400	7.0	9.6	739	--	6.1	--	--

DATE	ACIDITY (MG/L AS H)	ACIDITY (MG/L AS CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	PERCENT SODIUM	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE FET-FLD (MG/L AS HCO3)	CAR-BONATE FET-FLD (MG/L AS CO3)
JUL , 1976										
21...	.6	30	34	16	20	22	.7	1.2	204	0
DEC										
07...	--	--	--	--	--	--	--	--	--	--
MAR , 1977										
10...	--	--	--	--	--	--	--	--	--	--
MAY										
18...	--	--	--	--	--	--	--	--	--	--
JUN										
20...	--	--	--	--	--	--	--	--	--	--

DATE	ALKA-LINITY FIELD (MG/L AS CACO3)	CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2)	SULFIDE DIS-SOLVED (MG/L AS S)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	PHOS-PHORUS, ORTHO, TOTAL (MG/L AS P)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	IRON, FERROUS DIS-SOLVED (UG/L AS FE)
JUL , 1976										
21...	167	33	--	33	1.7	.01	.180	.020	2400	--
DEC										
07...	--	--	--	--	--	--	--	--	--	--
MAR , 1977										
10...	--	--	.0	--	--	--	--	--	--	1400
MAY										
18...	--	--	.0	--	--	--	--	--	2200	1500
JUN										
20...	--	--	--	--	--	--	--	--	--	--

TABLE 11.--Water-quality data for the Skookum area for Portal #3 and Portal #7 during July to December 1976

470607122020303 - SKOOKUM AREA MINE PORTAL # 3

WATER QUALITY DATA

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (UMHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	BARO-METRIC PRES-SURE (MM OF HG)	ACIDITY (MG/L AS H)
JUL , 1976							
21...	1600	.42	350	7.0	9.8	738	.5

DATE	ACIDITY (MG/L AS CACO3)	BICAR-BONATE FET-FLD (MG/L AS HCO3)	CAR-BONATE FET-FLD (MG/L AS CO3)	ALKA-LINITY FIELD (MG/L AS CACO3)	CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2)	SULFATE DIS-SOLVED (MG/L AS SO4)
JUL , 1976						
21...	25	216	0	177	35	39

470607122020307 - SKOOKUM AREA SAMPLE POINT # 7

WATER QUALITY DATA

DATE	TIME	BARO-METRIC PRES-SURE (MM OF HG)	OXYGEN, DIS-SOLVED (MG/L)
JUL , 1976			
22...	1700	737	1.9
DEC			
07...	1200	--	4.2

TABLE 12.--Water-quality data for the Skookum area for sample point no. 8 during July 1976 to May 1977

470607122020308 - SKOOKUM AREA SAMPLE POINT # 8

WATER QUALITY DATA

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (UMHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	BARO-METRIC PRES-SURE (MM OF HG)	TUR-BID-ITY (JTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	ACIDITY (MG/L AS H)
JUL , 1976												
22...	1700	1.3	--	--	--	737	--	7.8	--	--	--	--
AUG												
23...	1350	1.4	390	7.2	9.9	737	3	7.8	1.2	160	0	.5
SEP												
30...	1115	1.4	375	7.2	9.7	735	6	8.3	.8	150	0	1.0
NOV												
02...	1130	1.2	360	6.8	9.4	745	4	8.9	.2	160	0	.5
DEC												
07...	1130	1.3	352	7.2	9.8	739	2	8.0	.3	150	0	.4
JAN , 1977												
05...	1200	--	380	7.2	9.0	744	6	8.6	.2	150	0	.4
FEB												
09...	1130	1.2	366	7.2	9.5	743	5	8.1	--	160	0	.6
MAR												
09...	1330	1.2	372	7.2	9.4	734	5	8.0	--	150	0	.6
APR												
13...	1130	1.4	385	--	9.8	741	3	7.4	--	150	0	.7
MAY												
18...	1300	1.2	383	7.1	9.8	740	4	7.1	--	160	0	.6

DATE	ACIDITY (MG/L AS CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	PERCENT SODIUM	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE FET-FLD (MG/L AS HCO3)	CAR-BONATE FET-FLD (MG/L AS CO3)	ALKA-LINITY FIELD (MG/L AS CACO3)	CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2)	SULFIDE DIS-SOLVED (MG/L AS S)
JUL , 1976												
22...	--	--	--	--	--	--	--	--	--	--	--	--
AUG												
23...	25	35	17	24	25	.8	1.3	215	0	220	22	--
SEP												
30...	50	33	17	24	25	.8	1.2	216	0	177	22	--
NOV												
02...	25	34	17	22	23	.8	1.3	212	--	174	54	--
DEC												
07...	20	33	16	25	27	.9	1.3	223	--	183	23	--
JAN , 1977												
05...	20	33	17	28	28	1.0	1.2	234	0	192	24	--
FEB												
09...	30	35	17	27	27	.9	1.2	220	0	180	22	--
MAR												
09...	30	34	16	28	29	1.0	1.2	233	0	191	24	.0
APR												
13...	35	32	17	28	29	1.0	1.2	234	--	190	--	--
MAY												
18...	30	35	17	30	29	1.0	1.3	230	0	190	29	.0

TABLE 12.--Water-quality data for the Skookum area for sample point no. 8 during July 1976 to May 1977--continued

DATE	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	PHOS-PHORUS, ORTHO, TOTAL (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)
JUL , 1976											
22...	--	--	--	--	--	--	--	--	--	--	--
AUG											
23...	30	1.8	.1	21	237	.32	.01	.210	.010	<100	1
SEP											
30...	26	1.5	--	--	--	--	.01	.160	<.010	--	--
NOV											
02...	21	1.8	--	--	--	--	<.10	.180	.010	--	--
DEC											
07...	22	1.8	--	--	--	--	.08	.190	<.010	--	--
JAN , 1977											
05...	20	1.8	.1	23	240	.33	.03	.180	<.010	<100	<1
FEB											
09...	22	2.0	--	--	--	--	.08	.190	.010	--	--
MAR											
09...	16	1.7	--	--	--	--	.08	.210	.010	--	--
APR											
13...	21	1.7	.1	21	238	.32	.02	.180	.020	<100	<1
MAY											
18...	21	1.8	--	--	--	--	.01	.190	.010	--	--

DATE	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	IRON, FERROUS DIS-SOLVED (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY TOTAL RECOV-ERABLE (UG/L AS HG)	NICKEL, DIS-SOLVED (UG/L AS NI)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)
JUL , 1976											
22...	--	--	--	--	--	--	--	--	--	--	--
AUG											
23...	ND	ND	ND	2000	--	3	360	<.5	ND	ND	4
SEP											
30...	--	--	--	1900	--	--	--	--	--	--	3
NOV											
02...	--	--	--	1700	--	--	--	--	--	--	3
DEC											
07...	--	--	--	1700	--	--	--	--	--	--	5
JAN , 1977											
05...	ND	ND	ND	1900	--	2	300	<.5	<2	ND	--
FEB											
09...	--	--	--	2000	--	--	--	--	--	--	5
MAR											
09...	--	--	--	1800	1100	--	--	--	--	--	10
APR											
13...	ND	ND	ND	1800	--	ND	280	<.5	2	ND	1
MAY											
18...	--	--	--	1700	980	--	--	--	--	--	2

TABLE 13.--Taxonomic identifications and counts of benthic invertebrates in Gallop Creek during January-December 1976

	YEAR	1976																									
	DATE	JAN 28		FEB 26		MAR 25		APR 27		MAY 20		JUN 28	JUL 29	AUG 23		SEP 22		OCT 29		NOV 23		DEC 23	
	STATION	B		B		B		B		B		B	B	A	B	A	B	A	B	A	B	B	
	REPLICATE	1	2	1	2	1	2	1	2	1	2	1	1	1	1	1	1	1	1	1	1	1	2
Phylum Arthropoda																											
Class Insecta																											
Order Ephemeroptera																											
Family Ephemerellidae																											
Ephemerella sp.	2		5	2		3	6	15	2	38	11	77	27	69	126	8	80	9	66	39	29	15
Family Leptophlebiidae																											
Paraleptophlebia sp.											1		31	1	11				8	1	1	2
Family Heptageniidae																											
Iron sp.			23	8	8	16	31	34	22	48	19	6		8		6		204		185	406	48
Ironodes sp.																					1	
Ironopsis sp.											4	4	1		93					1		2
Rhithrogena sp.	2				2			2	1	2			15		31		38	10	11	27	3	7
Cinygmula sp.				1		1	4	3	1		9	37	41	134	37	615	324	1001	670	426	202	118
Family Baetidae																						
Baetis sp.	1	2	57	45	113	101	125	164	35	100	30	1068	36	153	342	271	464	1951	439	2287	1089	276
Family Siphlonuridae																						
Ameletus sp.													43	5	14		31	5	16	4		2
Order Plecoptera																						
Family Nemouridae																						
Taenionema sp.	16		29	47	29	35	40	52		7		435	5	199	492	315	311	988	40	2134	1852	1313
Nemoura sp.			10	3	4	1	2	16	4	9	2	220	18	1042	12	609	13	541	24	316	907	33
Capnia complex			1	6									88	14	54	293	114	654	139	318	334	181
Leuctra sp.								1					4		1		1	4	1	3	18	56
Family Peltoperlidae																						
Peltoperla sp.	1							1		1		1	18	1	16		41		74	1	2	1
Family Perlidae																						
Calineuria sp.						1							7	3	4	1	9					
Family Perlodidae																						
Arcynopterix sp.									1		1		10	1	6	3	1	3	2	4	1	3
Family Chloroperlidae																						
Hastaperla sp.			2				9	3	9	2	7	2	4	3	7		6	1	6	1	18	4
Order Trichoptera																						
Family Hydropsychidae																						
Hydropsyche sp.																2						
Arctopsyche sp.	1					1		1	1	1	3	2		4		1		2		1	1	1
Family Rhyacophilidae																						
Rhyacophila sp.	3		6	1	9	8	14	15	3	28	9	12	7	19	2	27	6	18	13	84	68	28
Family Glossosomatidae																						
Anagapetus sp.				1		1	1													2		
Glossosoma sp.																	8	2		3		4
Family Brachycentridae																						
Micrasema sp.								1							1							
Family Lepidostomatidae																						
Lepidostoma sp							1									1	7			7	3	
Family Limnephilidae			6	1				2		1	1	1	8	9	2	7	3	37	13	51	83	11
Order Diptera																						
Family Deuterophlebiidae																						
Deuterophlebia sp.								1														
Family Blepharoceridae					1	1		2			2									2	2	4
Family Tipulidae																						
Hexatoma sp.																		2				
Dicranota sp.							1			1		1		5						10	2	5
Pedicia sp.									1									2		2	2	2
Ormosia sp.																				1		1
Tipula sp.																					1	
Family Psychodidae																						

Mayflies | Stoneflies | Caddisflies | True flies

TABLE 13.--Taxonomic identifications and counts of benthic invertebrates in Gallop Creek during January-December 1976--continued

		YEAR	1976																											
		DATE	JAN 28		FEB 26		MAR 25		APR 27		MAY 20		JUN 28	JUL 29	AUG 23		SEP 22		OCT 29		NOV 23		DEC 23	
		STATION	B		B		B		B		B		B	B	A	B	A	B	A	B	A	B	B	
		REPLICATE	1	2	1	2	1	2	1	2	1	2	1	1	1	1	1	1	1	1	1	1	1	2
True flies		Psychoda sp.																	1		3	1	1	
		Maruina sp.																3	1	1				
		Family Ceratopogonidae																						
		Atrichogon sp.														1				1				
		Family Chironomidae	1	2	44	66	238	200	146	241	37	160	943	2516	235	4691	102	3748	29	952	122	1278	1981	445
		Tribe Tanytarsini												4										
		Family Stratiomydae																				1	2	
		Family Simuliidae			3	6	5	33	19	16	1	87	84	184	1	233	1	62	1	504	6	667	297	63
		Family Dixidae												1				7	1				1	
		Family Empididae																						
		Hemerodromia sp.							1			1	2	24		7		16		18	2	45	36	7
		Chelifera sp.																					1	
Spring-tails		Order Collembola																						
		Family Poduridae				3	9		1								1	14	2		5	2	3	3
		Family Sminthuridae														1						1		
Beetles		Order Coleoptera																						
		Family Dysticidae														1								
		Family Elmidae														1		1				2		
		Family Heteroceridae								1														
		Class Arachnoidea																						
		Subclass Arachnida																						
Water mites		Order Acarina																						
		Family Limnocharidae															1				3	1		
		Family Sperchonidae					1	1					1		4	5	2	2		3	1	3	1	
		Family Atractideidae												3	1	2	4	4			1		2	
		Family Lebertiidae												2		3		6		5		2	1	3
		Family Protziidae								1			1	5				1						
		Family Arrenuridae												2			2					2	3	
		Family Oribateidae												1		1		1		3		1	1	3
		Others													6	2	2	1	6	3	1	3	10	
Seed shrimps		Class Crustacea																						
		Order Ostracoda																						
		Family Cypridae													17		12		16	1	16	1		
		Order Copepoda																						
		Suborder Cyclopoida																	1					
		Suborder Harpacticoida																					22	
Aquatic earth-worms		Phylum Annelida																						
		Class Oligochaeta												2	1	1		3		3	3	26	30	7
Snails		Phylum Mollusca																						
		Class Gastropoda																						
		Order Basommatophora																						
		Family Planorbidae													2						1			
Bivalves		Class Pelecypoda																						
		Order Heterodonta																						
		Family Sphaeridae																						
		Pisidium sp.													3									
Flat worms		Phylum Platyhelminthes																						
		Class Turbellaria													26	1	8		2					
Round worms		Phylum Nematoda													1							1		

TABLE 14.--Taxonomic identifications and counts of benthic invertebrates in Loretta Creek during June 1976-May 1977

	YEAR	1976																1977								
	DATE	JUN 24	JUL 30			AUG 27			SEP 23			OCT 28	NOV 23			DEC 22		JAN 26			MAR 2		MAR 30	MAY 2	
	STATION	B	A		B	A		B	A		B	A	A		B	A		A		B	A		B	A	B
	REPLICATE	1	1	2	1	1	2	1	1	2	1	1	1	2	1	1		1	2	1	1	2	1	1	1
Phylum Arthropoda																										
Class Insecta																										
Order Ephemenoptera																										
Mayflies	Family Ephemerellidae																									
	Ephemerella sp.	84	11	19	26	59	59	25	11	84	5	34	22	47	15	24		5	8	24	3	7	96	35	201
	Family Leptophlebiidae																									
	Paraleptophlebia sp.	1		1	2		2	1			4		1	2	23	2		1	1	23	1		18	3	6
	Family Heptageniidae																									
	Iron sp.	80			71	1	2	41	35	137	6	567	517	629	14	480		357	174	94	430	366	352	467	372
	Ironodes sp.										5				7					11			5		
	Ironopsis sp.										16				6										
	Rhithrogena sp.		3			6	3	5	13	35		13	5	49	3	3		3	4	1	4	5	4		3
	Cinygmula sp.		50	58		36	24	6	9	37	8	14	70	71	19	100		89	119	63	39	26	38	56	21
	Cinygma sp.					1																2			
	Family Baetidae																									
	Baetis sp.	181	47	40	187	168	422	343	256	44	1286	780	141	793	4825	641		874	409	1267	367	459	832	155	558
	Family Siphlonuridae																									
	Ameletus sp.		118	163	2	181	43	13	33	61	5	9	48	61	19	22		8	14	11	8	2	9	28	6
Order Plecoptera																										
Stoneflies	Family Nemouridae																									
	Taenionema sp.				12		72	3	6	1	15	13	3	16	45	3		2	5	30	1	19	29		2
	Nemoura sp.	47			75	14	12	139	7	15	142	13	17	10	126	70		90	33	76	12	23	87	22	83
	Capnia complex	2	12	16	3	43	13	2	26	102	10	122	115	174	287	191		45	18	15	4	1		13	1
	Leuctra sp.					1	1		4				1						5	1			1	8	1
	Family Peltoperlidae																									
	Peltoperla sp.	4				4	2	1	1	7	3	8	3	15		4		10	13	3	2	2	11	11	2
	Family Perlidae																									
	Calineuria sp.	2	6	3	11	7	3	3	1	3	4					3		1	3	1	5	1		4	
	Family Pteronarcidae																									
	Pteronarcys sp.						1								1					2			3		1
	Pteronarcella sp.							1																	
	Family Perlodidae																									
	Arcynopterix sp.	5			1	1		1			6	1	3	4	3	3		1	4	1		2	4	1	4
	Isogenus sp.							9					2												
	Family Chloroperlidae																									
	Hastaperla sp.	6			1	8	2	12	1		13	1	16	13	22	1		11	11	31		1	31	27	14
Order Trichoptera																										
Caddisflies	Family Hydropsychidae																									
	Hydropsyche sp.	1						37			23				1					9			4	3	7
	Arctopsyche sp.																			1					
	Family Rhyacophilidae																									
	Rhyacophila sp.	48	6	7	11	7	12	9	3	6	22	2	5	2	18	1		12	12	17	5	12	89	11	67
	Family Glossosomatidae																									
	Glossosoma sp.													1									1		1
	Agapetus sp.				1			10																1	
	Anagapetus sp.																							1	
	Family Brachycentridae																									
	Micrasema sp.	1							1	2		1						1	1	2		1	2	1	1
	Family Lepidostomatidae																									
	Lepidostoma sp.				2			2			2		1		21	2				7			3		1
	Family Limnephilidae			1		4		2	1	2		1	22	21	20	2		10	6	11	1	4	16	9	1

TABLE 14.--Taxonomic identifications and counts of benthic invertebrates in Loretta Creek during June 1976-May 1977

	YEAR	1976																		1977									
	DATE	JUN 24	JUL 30			AUG 27			SEP 23			OCT 28	NOV 23			DEC 22	JAN 26			MAR 2		MAR 30	MAY 2	
	STATION	B	A		B	A		B	A		B	A	A		B	A	A		B	A		B	A	B
	REPLICATE	1	1	2	1	1	2	1	1	2	1	1	1	2	1	1	1	2	1	1	2	1	1	1
True flies	Order Diptera																							
	Family Blepharoceridae	1														1				2	1	1	7	1	3
	Family Tipulidae																								
	Hexatoma sp.										1					1									
	Dicranota sp.	3			1			5			7					1				1			4	3	2
	Ormosia sp.											2	1							1					
	Family Psychodidae																								
	Pericoma sp.								2											1					
	Psychoda sp.							2												1			2		
	Maruina sp.					1					1														4
	Family Ceratopogonidae						1	2			2									2					
	Family Chironomidae	2479	57	75	4487	436	280	3638	138	301	5130	404	396	560	13554	441	569	551	3248	257	214	1484	453	851
	Family Simulidae	1438		1	159	25	7	801	3		292	24	11	11	11864	26	38	64	299	39	55	873	21	476
	Family Dixidae																								
	Dixa sp.			3	1			3		1	1														1
	Family Empididae																								
	Hemerodromia sp.	2						5			5	1		4	1	2		1	11			1	1	22
	Chelifera sp.	137			39			2							1	11							1	
	Family Stratiomydae																1							
Spring-tails	Order Collembola																							
	Family Poduridae				1		1		1	1			2		1	1	1	1						7
	Family Sminthuridae																1							
Beetles	Order Coleoptera																							
	Family Elmidae	1			3			1			2				2				4			1		2
	Family Hydrophilidae																							
	Laccobius sp.										3													
Water mites	Class Arachnoidea																							
	Subclass Arachnida																							
	Order Acarina																							
	Family Atractideidae	61			46			31			28	2		7		1	2				1	6	1	
	Family Sperchonidae	3	2	7	4	4	4	4	2	3	7	3			1				1	1				1
	Family Lebertidae	6			9	2	1	5	1	2			3	2			1	1	1			1	1	6
	Family Arrenuridae							1			1	1	1											2
	Family Oribateidae	5	1		1	2	2	3		1					1				1			2		1
	Others				9		1	7		2	4	1			1	2	1		4			9	1	2
Seed shrimps	Class Crustacea																							
	Order Ostracoda																							
	Family Cypridae			3		19	5	2	2	18		2	75	34	1	5		1	2	1	1	1	9	
	Order Copepoda																							
	Suborder Cyclopoida												1											
	Suborder Harpacticoida					18	11			1		1	28	12		7	2						1	2
	Order Isopoda																							
	Family Asellidae													1										
Aquatic earth-worms	Phylum Annelida																							
	Class Oligochaeta	2			2					1	5			7	1	5		2	7			13	4	15
Snails	Phylum Mollusca																							
	Class Gastropoda								1	1		1												
Flat worms	Phylum Platyhelminthes																							
	Class Turbellaria		17	22	3	9	29		13	13		7	16	6		13	1	24	12	4			7	1

TABLE 15.--Taxonomic identifications and counts of benthic invertebrates in Wilkeson Creek during August 1976 to April 1977

YEAR	1976															
DATE	AUGUST 23				SEPTEMBER 30								NOVEMBER 2			
STATION	A	B	C	D	A		B		C		D		A	B	C	D
REPLICATE	1	1	1	1	1	2	1	2	1	2	1	2	1	1	1	1
Phylum Arthropoda																
Class Insecta																
Order Ephemeroptera																
Family Ephemerellidae																
Ephemerella sp.	38	54	39	19	245	175	72	140	93	42	23	3	131	95	213	9
Family Leptophlebiidae																
Paraleptophlebia sp.	8	15	10		56	33	4	20	43	21	20	3	46		97	23
Family Heptageniidae																
Iron sp.	43	23		117	145	35	114	62	44		169	176	37	152	33	65
Ironodes sp.	4			2		17						3	11	10	6	6
Ironopsis sp.																
Rhithrogena sp.	30	34		38	219	194	165	157			118	169	101	83	34	73
Cinygmula sp.	387	764	2	115	1437	1632	683	880	3		654	398	1263	2048	716	342
Cinygma sp.																
Family Baetidae																
Baetis sp.	1823	1473	63	1732	4065	4872	1580	2523		18	3734	2729	2713	2195	1668	1808
Family Siphlonuridae																
Ameletus sp.	1	9				13					8	3	2	1	7	9
Order Plecoptera																
Family Nemouridae																
Taenionema sp.	38	49		27	138	110	53	88			185	160	487	425	425	353
Nemoura sp.	449	557	418	167	273	401	63	320	321	111	345	132	109	75	231	72
Capnia complex sps.	3	15	393	1	44	120	6	61	551	245	34	6	104	23	102	19
Leuctra sp.		2								1			1		2	
Family Peltoperlidae																
Peltoperla sp.																
Family Pteronarcella																
Pteronarcella sp.																
Family Perlidae																
Calineuria californica		1	1	1	2	6	6	1			1			6		1
Hesperoperla pacifica	32	22		9	16	9	1	10	1		3	4	1	2	1	2
Family Perlodidae		18		13	18	22	14	24			20	10		6	8	5
Arcynopterix sp.	3	1			3			4	8	11			19		15	
Isogenus sp.			8		1	2										
Isoperla sp.							1						9	7		
Family Chloroperlidae																
Hastaperla sp.	16	14	12	2	7	11	4	3	60	39	21		15	5	44	7
Paraperla sp.													1			
Order Trichoptera																
Family Hydropsychidae																
Hydropsyche sp.	1352	481	67	203	461	232	102		4	2	258	257	39	37	102	26
Arctopsyche sp.	49	5	4	5	5	88	3						2			
Family Rhyacophilidae																
Rhyacophila sp.	707	117	58	163	299	368	31		79	24	224	59	167	45	75	34
Family Glossosomatidae																
Glossosoma sp.	86	29			163	88	59	3	1		3	6	75	59	7	5
Family Brachycentridae																
Micrasema sp.				2	2	2	1	1		1	1	1	13	1	3	3
Family Lepidostomatidae																
Lepidostoma sp.	1		1			1			1	1		1	2		4	
Family Limnephilidae	1								1	1			9	3	9	

1977																										
DECEMBER 6								FEBRUARY 9								MARCH 9				APRIL 13						
A		B		C		D		A		B		C		D		A	B	C	D	A		B		C	D	
1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	1	1	1	2	1	1		1	1	
371	189	192	256	132	207	34	64	231	27	188	162	130	24	78	71	123	34	293	48	56	177	272		227	158	
56	45	17	40	83	121	27	17	26	1	21	12	41	14	9	16		1	37	30	9	14	51		12	19	
77	26	41	39	9	9	36	35	24	12	21	43	3		20	23	93	117	88	38	16	186	87		297	146	
	31	28	25			6	25	27	7	7	25		2	20	15	4		5	1							
						3		1						1												
37	65	54	47	2	3	71	75	19	21	13	25	8	2	42	22	7	7	21		20	4			1	16	
2539	2884	1638	2053	41	114	907	1274	1077	1345	1645	817	122	18	840	954	523	8	1075	415	298	419	503		718	494	
	1																									
1235	2368	1635	1071	171	235	1832	2604	3618	1800	2496	2824	336	193	2521	2696	584	138	978	93	280	918	905		500	873	
7	11	2	13		4	14	32	9		8	1	2	2		2	2	1	11	15	5	4	9		3		
126	684	376	330	100	153	434	598	291	175	147	213	133	65	366	183	62	12	93	2	30	9	12		8	11	
155	278	139	154	274	298	123	161	63	8	82	87	173	165	63	63	20	8	110	23	2	5	61		14	36	
234	305	154	259	156	235	107	128	51	9	29	10	19	15	37	60	4		17			6	3				
8	2	1		1	2	1	1	2				3	1		2	5		3	3	2		3			2	
											1				1											
		1											2													
2	3	4	5	1	2			3	2	2	5	1	2		1	4	1	7	1			3		1	1	
20	3	3	3	2	2	2								2	2	1	1	1	1	5	8	4		2	4	
	38		7			6	13	35	1	17	17	7	4	10	8	23		15	6	4	30	37		11		
		2		4	12		1	2		1		3	1	1	1			1	1							
	22	17					3			16								5						6		
23		19	23	1	4	12	13	24	1		20	6		11	17	2	2	4	1	4	1	2				
31	47	18	34	32	69	16	12	21		32	3	19	9	17	8	17	2	36	12	9	9	33		2	47	
20	32	15	15	3	10	15	20	22	5	22	11	8	5	11	7	36	10	16	1	17	50	51		58	12	
						2	1		1	1					1			1				2				
79	227	98	67	67	52	70	103	166	43	64	112	37	41	87	78	71	25	63	13	49	106	86		51	30	
41	61	22	44	3	2	6	1	19	6	13	49	2	3	3	3	82	41	15	10	13	25	43		44	97	
4	7	6	1	5	4	4	3	23	5	8	7	4	3	2	4	1		3	1	3	2	4			1	
7		1		16	7					1		2	1					16	4					2	4	
2	11	3	5	5	38	4	9	41	38	23	32	50	8	10	5		7	110	26	20	7	23		359	32	

TABLE 15.--Taxonomic identifications and counts of benthic invertebrates in Wilkeson Creek during August 1976 to April 1977--Continued

YEAR	1976															
DATE	AUGUST 23				SEPTEMBER 30								NOVEMBER 2			
STATION	A	B	C	D	A		B		C		D		A	B	C	D
REPLICATE	1	1	1	1	1	2	1	2	1	2	1	2	1	1	1	1
Order Diptera																
Family Blepharoceridae	1			6		1							1			5
Family Tipulidae																
Hexatoma sp.	2		1			1			1							
Ormosia sp.													1			
Dicramota sp.	3	1			3	1			7	9			4	3	7	
Pedicia sp.	3					1									1	
Family Tabernidae															1	
Family Stratiomydae																1
Family Psychodidae																
Pericoma sp.	1	2				2			2						1	2
Psychoda sp.													2			
Maruina sp.	1				1	1										
Family Ceratopogonidae	2					2							2			
Family Chironomidae	2636	3277	2503	3191	2476	5081	520	2478	4617	3259	4242	1303	3669	1068	3274	1565
Tribe Tanytarsini	32	220		78	19	2	29	15	2		15	18	5	107	13	11
Family Simuliidae	2070	837	85	3735	459	1278	149	309	42	17	658	1050	235	3408	887	2100
Family Dixidae																
Dixa sp.	2	2			1											
Family Liriopeidae																
Bittacomorpha sp.									1							
Family Empididae																
Hemerodromia sp.					1	1			2			1	1	1		
Chelifera sp.	4	8	8	4	10	12	4	26	10	36	28	5		6	1	14
Order Collembola																
Family Poduridae						1							1	2	1	1
Family Sminthuridae																
Order Coleoptera																
Family Haliplidae																
Family Elmidae	23	4	3	1	12	10	2	3	3		6	4	6		4	3
Family Helodidae																
Family Dysticidae		1		1							1					
Class Arachnoidea																
Subclass Arachnida																
Order Acarina																
Family Atractideidae	87	82	1	31	59	69	28	43	11		97	5	5	6	6	13
Family Lebertiidae	3	5	7	5	5	2		1		2	2	1	1		3	
Family Sperchonidae	11	3	2					3	5	2		2				4
Family Protziidae					7	5	3				5		1			
Family Arrenuridae		4														
Family Oribateidae	4	1	3	4	2	4		7	1		4				2	
Others	20	2	2	11	2	6	2	7	2	1	10	7	6	2	4	5
Phylum Coelenterata																
Hydroids																
Phylum Platyhelminthes																
Class Turbellaria												2				1
Phylum Annelida																
Class Clittelata																
Subclass Oligochaeta	10	8	16		23	17	7	18	10	10	10	1	1	10	23	5
Class Hirudinea																
Order Rynchobdellida											2					1
Phylum Arthropoda																
Class Crustacea																
Subclass Ostracoda																
Family Cypridae	1		3			1			209	207					50	
Order Copepoda																
Suborder Calanoida																
Suborder Cyclopoida			1						4	5				1		
Suborder Harpacticoida							2		1		1				2	1
Phylum Mollusca																
Class Pelecypoda																
Order Heterodonta																
Family Sphaeridae																
Pisidium sp.																

1977																																
DECEMBER 6									FEBRUARY 9								MARCH 9						APRIL 13									
A		B		C		D		A		B		C		D		A	B	C	D		A	B	C	D								
1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	1	1	1	2	1	1	1	1							
	10	5			7	4	2	4					5	6	1				6	4			3								
7	1 13	8	12	20	1 22	5	3	3	2 1	2	1	1 6	7	1	1 2	1		6	3	1			1	6							
2	2							2								4					5	4	1								
		3	3		2		4					1			1				3												
1						6																									
1	1	1			1	1				1									1		1	4		5							
41D6	17142	6911	10646	8024	9219	6017	15777	14435	3888	5660	10038	4512	4008	9453	12146	1978	63	3191	2011	1399	1716	3376	859	1902							
47		6	5		3	8	6	2	1	1	3			1		2	2		5	7	6	3		8							
808	5712	5377	5549	154	124	9448	15296	11499	5230	8530	14965	165	290	12038	9548	1122	1847	798	158	3089	1271	1256	346	1334							
	1							1																							
1	1		1	2				3	1					1		3					12		2	1							
10	2	3	3	6	1	2	3				4	4			4	1	2	3	3	3		16	15	12							
2			3			1	3 1				2	7 1	1	3 1								1 1	7	1							
				1																											
4	7	2		1 1	2	1	1	1				1 1 2	1 3 1	1		4	1		1	1	1	8		3							
		2			1 4	3		4 2 2	1 2	1			1 2	1 1	5 1	7 4	1 4	2 1 1	2		11 3	10	12 8 10	10 1							
1 1 6	1		1	1		3	5		1	2	2 5 1	1		1		1				1	1	5 18	3	1							
4	1		2 3		2 1		2	3	1	1 1			1	3	1 3	2 6	1 1	4 9	3 6	3 3	8	1 5	3 17	7							
1																	1							1							
							1																								
61	3	10	13	11	24	1	8	2	1		2	25	3	2		2		4	5	7	20	30	3	247							
3	2	1	2	13	32		6					125	69			1			1	1											
				1								1 1																			
5		1		3				1		1												1									
																1								1							

TABLE 16.--Periphytic algae found in Gallop, Loretta, and Wilkeson Creeks during the period of study
(E = estimated dominant form, + = observed form)

	GALLOP CREEK						LORETTA CREEK					WILKESON CREEK										
	1976						1976				1977	1976							1977			
	APR	MAY	JUN	JUL	AUG	OCT	JUN	JUL	AUG	OCT	JAN	AUG				OCT			JAN			
Station	B	B	B	B	A B	A B	A	A B	A B	A B	A B	A	B	C	D	A	B	C	D	A	B	C	D
Division Cyanophyta																							
Class Mycophyceae																							
Order Chroococales																							
Family Chroococaceae																							
Agmenellum sp.																+							
Anacystis sp.																							+
Order Oscillatoriales																							
Family Oscillatoriaceae																							
Lyngbya sp.				+				E +									+		+				
Oscillatoria sp.	+				+ +		+	+	+ +		+		+		+					+			+
Spirulina sp.																	+						
Family Rivulariaceae																							
Amphithrix sp.													E										
Family Scytonemataceae																							
Plectonema sp.			E			+				+ +									E	+			
Division Chrysophyta																							
Class Bacillariophyceae																							
Order Pennales																							
Family Achnantaceae																							
Achnanthes sp.	E	+	E	E	E E	E E	E	+ E	+ E	+ E	E	E	+	+	+	+			E	E	+		E
Cocconeis sp.	+			+	+ +	+ E	+	+ +	+ +	E +	+	E	E	+	E	E	E		E			+	+
Rhoicosphaenia sp.									+	+													+
Family Cymbellaceae																							
Cymbella sp.	+	+	+	+	+ +	+	E	+ +	+ +	+ +				+	+	+	+	+	+	+	+		E
Family Diatomaceae																							
Diatoma sp.	+	E	+	+	+ +	E	E	E E	+ +	+ +	+												+
Family Eunotiaceae																							
Eunotia sp.			+	+	+ +	+ +		+	+ +					+	+				E	+	+		+
Family Fragilariaceae																							
Fragilaria	+	+	+	+	E +	+	+	+	+ +			+											
Hannea sp.	E	+		+	E E		+	+	+			E											
H. arcus						+ +				+													
Synedra sp.	+	+		+	+ +			+	+			E		+		+	+	+	+	E	E	+	E
Family Gomphomenaceae																							
Gomphomena sp.	E	+	+	+	+	+	+	+ +	+ +	E +		+ +		+		+	+		+	+	+	+	E
Family Meridionaceae																							
Meridion sp.		+			+			+		+										+	+		+
Family Naviculaceae																							
Frustulia sp.					+			+	+				+						+				
Navicula sp.	+			+	+ +	+ +		+ E	+	+		+	+	+	+	E	+	E	+		+	+	E
Pinnularia sp.		+							+						+								
Family Nitzchiaceae																							
Nitzchia sp.	+	+	+	+	+		+	+ E	+	+ +	+	+ +		+		E	+		+	+	+	+	+
Class Chrysophyceae																							
Order Chrysocapsales																							
Family Hydruraceae																							
Hydrurus sp.	+		+																				
Family Surirellaceae																							
Surirella sp.								+	+ +	+								+	+				
Order Centrales																							
Family Coscinodiscaceae																							
Melosira sp.								+	+	+													
Division Chlorophyta																							
Class Chlorophyceae																							
Order Ulotrichales																							
Family Chaetophoraceae																							
Stigeoclonium sp.			+	+	+ +	+		E +	E +	E +												+	+
Family Ulotrichaceae																							
Ulothrix sp.	+		+		+	+		+	+								+						+
Order Zignematales																							
Family Desmidiaceae																							
Cosmarium sp.					+																		+
Closterium sp.										+													
Staurastrun sp.									+														
Family Zignemataceae																							
Mougeotia sp.			+		+																		
Order Oedogoniales																							
Family Oedogoniaceae																							
Oedogonium sp.			+		+				+	+													
Order Tetrasporales																							
Family Tetrasporaceae																							
Tetraspora sp.					+				+														

TABLE 17.--Water-quality data for coal-mine drainages in Washington, October 1975-September 1977

[Numbers assigned to each mine correspond to location in figures 2-5, and figure 9]

	Whatcom County coal deposits				Skagit County coal deposits		
	Polson tunnel (Discovery tunnel) 1	Van Zandt mine 2	Blue Canyon mine 3	Alger mine 4	Cokedale mine near Sedro Wooley 5	Blumart mine near Big Lake 6	Cumberland mine near Hamilton 7
Latitude	48°50'25"	48°47'21"	48°41'15"	48°38'59"	48°32'35"	48°23'13"	48°30'24"
Longitude	121°55'28"	122°13'54"	122°16'59"	122°21'23"	122°09'54"	122°10'36"	121°59'15"
Date	11-18-76	12-10-76	6-15-76	2-23-77	12-10-76	6-27-77	6-27-77
Time	0950	1000	1730	1000	1500	1245	1510
Instantaneous discharge (ft^3/s)	0.87	0.93	e0.002	e0.01	e0.30	0.02	0.10
Specific conductance (micromhos at 25°C)	67	23	522	82	344	310	675
pH (units)	6.7	7.2	7.5	7.1	6.7	7.3	8.4
Temperature (°C)	2.8	5.3	10.2	7.8	9.9	8.4	9.2
Turbidity (JTU)	--	--	--	e0	.0	.0	--
Dissolved oxygen (DO), mg/L	10.6	12.4	7.5	9.2	.0	10.1	10.8
Hardness as $CaCO_3$ (Ca, Mg), mg/L	37	--	110	--	150	--	120
Noncarbonate hardness as $CaCO_3$, mg/L	3	--	0	--	0	--	0
Acidity as $CaCO_3$, mg/L	15	0	30	10	45	15	0
Dissolved calcium (Ca), mg/L	12	--	30	--	26	--	34
Dissolved magnesium (Mg), mg/L	1.6	--	8.9	--	20	--	9.5
Dissolved sodium (Na), mg/L	1.5	--	78	--	16	--	130
Dissolved potassium (K), mg/L	.2	--	4	--	2	--	3
Bicarbonate as $CaCO_3$, mg/L	41	14	340	46	220	190	410
Carbonate $CaCO_3$, mg/L	0	--	0	--	--	--	0
Alkalinity as $CaCO_3$, mg/L	34	11	280	38	180	150	340
Dissolved sulfate (SO_4), mg/L	4.5	--	3.6	--	5.0	10	50
Dissolved chloride (Cl), mg/L	1.0	--	3.8	--	2.4	--	2.7
Dissolved fluoride (F), mg/L	.1	--	.3	--	.2	--	.7
Dissolved silica (SiO_2), mg/L	4.5	--	11	--	10	--	6.7
Solids, sum of constituents, mg/L	46	--	309	--	191	--	440
Dissolved aluminum (Al), ug/L	50	--	10	--	0	--	20
Dissolved arsenic (As), ug/L	0	--	0	--	1	--	3
Dissolved beryllium (Be), ug/L	--	--	--	--	--	--	--
Dissolved cadmium (Cd), ug/L	0	--	0	--	0	--	0
Dissolved chromium (Cr), ug/L	0	--	1	--	0	--	0
Dissolved cobalt (Co), ug/L	--	--	--	--	--	--	--
Dissolved copper (Cu), ug/L	0	--	0	--	0	--	20
Total iron (Fe), ug/L	940	250	1,200	140	410	210	550
Dissolved lead (Pb), ug/L	3	--	2	--	1	--	1
Dissolved manganese (Mn), ug/L	10	--	110	--	60	--	8
Total mercury (Hg), ug/L	.0	--	.0	--	.0	--	.1
Dissolved nickel (Ni), ug/L	2	--	0	--	2	--	4
Dissolved silver (Zn), ug/L	--	--	--	--	--	--	--
Dissolved zinc (Zn), ug/L	30	--	0	--	20	--	4
Suspended sediment, mg/L	--	e0	e0	e0	0	e0	--

e Estimated.

TABLE 17.--Water-quality data for coal-mine drainages in Washington, October 1975-September 1977--Continued

	Newcastle-Grand Ridge coal area				
	Taylor mine No. 1 8	Taylor mine No. 2 9	Taylor mine No. 3 10	Taylor mine No. 4 11	McQuade prospect (Prince No. 1) 12
Latitude	47 27'23"	47 25'17"	47 25'12"	47 25'17"	47 31'25"
Longitude	121 54'26"	121 53'56"	121 53'47	121 54'13"	122 04'04"
Date	6-24-76	6-24-76	6-24-76	6-24-76	3-2-76
Time	1600	1630	1715	1745	1230
Instantaneous discharge (ft^3/s)	e0.01	e0.01	e0.2	e0.03	e1.0
Specific conductance (micromhos at 25°C)	34	520	485	263	1,630
pH (units)	*8.3	6.3	6.4	6.6	6.4
Temperature (°C)	8.5	8.8	9.0	7.4	13.0
Turbidity (JTU)	--	--	--	--	--
Dissolved oxygen (DO), mg/L	10.0	4.4	.3	4.4	4.7
Hardness as $CaCO_3$ (Ca, Mg), mg/L	--	--	--	--	820
Noncarbonate hardness as $CaCO_3$, mg/L	--	--	--	--	490
Acidity as $CaCO_3$, mg/L	5	60	45	25	230
Oissolved calcium (Ca), mg/L	--	--	--	--	180
Dissolved magnesium (Mg), mg/L	--	--	--	--	90
Dissolved sodium (Na), mg/L	--	--	--	--	26
Dissolved potassium (K), mg/	--	--	--	--	4
Bicarbonate as $CaCO_3$, mg/L	--	--	--	--	400
Carbonate $CaCO_3$, mg/L	--	--	--	--	--
Alkalinity as $CaCO_3$, mg/L	--	--	--	--	330
Dissolved sulfate (SO_4), mg/L	--	--	--	--	520
Dissolved chloride (Cl), mg/L	--	--	--	--	2.2
Dissolved fluoride (F), mg/L	--	--	--	--	.1
Dissolved silica (SiO_2), mg/L	--	--	--	--	14
Solids, sum of constituents, mg/L	--	--	--	--	--
Dissolved aluminum (Al), ug/L	--	--	--	--	20
Dissolved arsenic (As), ug/L	--	--	--	--	0
Dissolved beryllium (Be), ug/L	--	--	--	--	0
Dissolved cadmium (Cd), ug/L	--	--	--	--	1
Dissolved chromium (Cr), ug/L	--	--	--	--	0
Dissolved cobalt (Co), ug/L	--	--	--	--	2
Dissolved copper (Cu), ug/L	--	--	--	--	1
Total iron (Fe), ug/L	30	1,400	1,100	5,800	300
Dissolved lead (Pb), ug/L	--	--	--	--	10
Dissolved manganese (Mn), ug/L	--	--	--	--	200
Total mercury (Hg), ug/L	--	--	--	--	.0
Dissolved nickel (Ni), ug/L	--	--	--	--	5
Dissolved silver (Ag), ug/L	--	--	--	--	0
Dissolved zinc (Zn), ug/L	--	--	--	--	10
Suspended sediment, mg/L	e0	e0	e0	e0	e0

* Value may not be representative of water from mine.
e Estimated.

TABLE 17.--Water-quality data for coal-mine drainages in Washington, October 1975-September 1977--Continued

	Newcastle-Grand Ridge coal area--continued					
	Bagley No. 3 seam 13	Tunnel to No. 3 seam 14	Culvert from shaft No. 1 Bagley seam 15	Tunnel to No. 9 seam 16	Highway Dept. drain to No. 1 seam 17	Grand Ridge south of Reynolds mine 18
Latitude Longitude	47 31'15" 122 03'57"	47 31'28" 122 02'17"	47 31'21" 122 02'11"	47 32'14" 122 00'23"	47 32'13" 122 00'21"	47 33'27" 121 59'50"
Date	3-11-76	3-2-76	3-2-76	3-2-76	3-2-76	3-11-76
Time	1530	1045	1100	1430	1445	1345
Instantaneous discharge (ft^3/s)	e0.02	e0.05	e2.0	e0.5	e0.3	e0.33
Specific conductance (micromhos at 25°C)	780	170	840	335	295	63
pH (units)	6.4	6.8	6.6	7.0	6.9	6.2
Temperature (°C)	9.7	8.2	13.9	8.8	8.8	6.6
Turbidity (JTU)	--	--	--	--	--	--
Dissolved oxygen (DO), mg/L	5.3	*9.2	*5.1	1.5	9.4	11.0
Hardness as $CaCO_3$ (Ca, Mg), mg/L	--	--	--	160	--	--
Noncarbonate hardness as $CaCO_3$, mg/L	--	--	--	2	--	--
Acidity as $CaCO_3$, mg/L	230	20	230	35	40	10
Dissolved calcium (Ca), mg/L	--	--	--	39	--	--
Dissolved magnesium (Mg), mg/L	--	--	--	14	--	--
Dissolved sodium (Na), mg/L	--	--	--	13	--	--
Dissolved potassium (K), mg/L	--	--	--	2	--	--
Bicarbonate as $CaCO_3$, mg/L	--	--	--	190	--	--
Carbonate $CaCO_3$, mg/L	--	--	--	--	--	--
Alkalinity as $CaCO_3$, mg/L	--	--	--	150	--	--
Dissolved sulfate (SO_4), mg/L	--	--	--	28	--	--
Dissolved chloride (Cl), mg/L	--	--	--	1.9	--	--
Dissolved fluoride (F), mg/L	--	--	--	.2	--	--
Dissolved silica (SiO_2), mg/L	--	--	--	16	--	--
Solids, sum of constituents, mg/L	--	--	--	--	--	--
Dissolved aluminum (Al), ug/L	--	--	--	10	--	--
Dissolved arsenic (As), ug/L	--	--	--	0	--	--
Dissolved beryllium (Be), ug/L	--	--	--	0	--	--
Dissolved cadmium (Cd), ug/L	--	--	--	1	--	--
Dissolved chromium (Cr), ug/L	--	--	--	0	--	--
Dissolved cobalt (Co), ug/L	--	--	--	0	--	--
Dissolved copper (Cu), ug/L	--	--	--	0	--	--
Total iron (Fe), ug/L	1,500	300	70	1,100	10	*0
Dissolved lead (Pb), ug/L	--	--	--	4	--	--
Dissolved manganese (Mn), ug/L	--	--	--	110	--	--
Total mercury (Hg), ug/L	--	--	--	.0	--	--
Dissolved nickel (Ni), ug/L	--	--	--	0	--	--
Dissolved silver (Ag), ug/L	--	--	--	0	--	--
Dissolved zinc (Zn), ug/L	--	--	--	10	--	--
Suspended sediment, mg/L	e0	e0	e0	e0	e0	e0

* Value may not be representative of water from mine.
e Estimated.

TABLE 17 --Water-quality data for coal-mine drainages in Washington, October 1975-September 1977--Continued

	Green River coal district							
	Test drill hole to mine No. 11 19	Kummer mine 20	Upper test hole at Flaming Geyser State Park 21	Durnham mine 22	McKay mine 23	Fulton mine north 24	Gem seam No. 17 (air course) 25	Hyde Tunnel (Black Diamond) 26
Latitude	47°18'13"	47°16'43"	47°16'18"	47°20'30"	47°17'46"	47°17'50"	47°17'19"	47°17'18"
Longitude	122°00'42"	121°59'57"	122°00'07"	121°50'20"	121°57'32"	121°57'19"	121°57'59"	121°54'57"
Date	3-3-76	3-3-76	3-3-76	3-10-76	2-24-76	2-24-76	2-24-76	2-24-76
Time	1430	1230	1045	1500	1100	1135	1430	1415
Instantaneous discharge (ft^3/s)	--	e1.5	e0.25	e0.02	e1.8	e2.0	--	e2.0
Specific conductance (micromhos at 25°C)	2,020	150	170	930	619	245	113	108
pH (units)	7.3	6.4	8.2	6.5	6.8	7.0	--	6.9
Temperature (°C)	17.3	9.4	10.2	10.0	10.9	8.3	7.4	8.0
Turbidity (JTU)	--	--	--	--	1.0	--	--	e.0
Dissolved oxygen (DO), mg/L	1.1	8.3	.4	.4	.9	7.5	--	6.7
Hardness as $CaCO_3$ (Ca, Mg), mg/L	110	--	--	--	290	--	--	45
Noncarbonate hardness as $CaCO_3$, mg/L	0	--	--	--	5	--	--	0
Acidity as $CaCO_3$, mg/L	110	40	5	160	66	15	--	5
Dissolved calcium (Ca), mg/L	20	--	--	--	67	--	--	13
Dissolved magnesium (Mg), mg/L	14	--	--	--	29	--	--	3.1
Dissolved sodium (Na), mg/L	450	--	--	--	20	--	--	5.5
Dissolved potassium (K), mg/L	8	--	--	--	3	--	--	.5
Bicarbonate as $CaCO_3$, mg/L	1,340	--	--	--	340	--	--	60
Carbonate $CaCO_3$, mg/L	--	--	--	--	--	--	--	--
Alkalinity as $CaCO_3$, mg/L	1,100	--	--	--	280	--	--	49
Dissolved sulfate (SO_4), mg/L	3.5	--	--	--	57	--	--	3.6
Dissolved chloride (Cl), mg/L	21	--	--	--	1.4	--	--	2.3
Oissolved fluoride (F), mg/L	1.3	--	--	--	.1	--	--	.2
Dissolved silica (SiO_2), mg/L	12	--	--	--	13	--	--	12
Solids, sum of constituents, mg/L	--	--	--	--	--	--	--	--
Dissolved aluminum (Al), ug/L	10	--	--	--	0	--	--	30
Dissolved arsenic (As), ug/L	18	--	--	--	0	--	--	0
Dissolved beryllium (Be), ug/L	0	--	--	--	0	--	--	0
Dissolved cadmium (Cd), ug/L	0	--	--	--	0	--	--	0
Dissolved chromium (Cr), ug/L	0	--	--	--	0	--	--	0
Dissolved cobalt (Co), ug/L	0	--	--	--	0	--	--	0
Dissolved copper (Cu), ug/L	0	--	--	--	0	--	--	0
Total iron (Fe), ug/L	530	100	920	530	250	60	--	240
Dissolved lead (Pb), ug/L	3	--	--	--	3	--	--	4
Dissolved manganese (Mn), ug/L	20	--	--	--	200	--	--	40
Total mercury (Hg), ug/L	.0	--	--	--	.0	--	--	.0
Dissolved nickel (Ni), ug/L	0	--	--	--	0	--	--	0
Dissolved silver (Ag), ug/L	0	--	--	--	0	--	--	0
Dissolved zinc (Zn), ug/L	0	--	--	--	0	--	--	0
Suspended sediment, mg/L	e0	e0	e0	e0	e0	e0	e0	e0

e Estimated.

TABLE 17.--Water-quality data for coal-mine drainages in Washington, October 1975-September 1977--Continued

	Green River coal district		Roslyn coal area				
	Bayne mine 27	Hiawatha mine (near Elk) 28	Roslyn No. 2 mine 29	Roslyn Cascade No. 3 (fanhouse) 30	Roslyn No. 5 Townsend 31	Roslyn No. 6 mine 32	Lakeside Coal Co. (Lakedale mine) 33
Latitude	47 17'53"	47 20'54"	47 13'50"	47 13'20"	47 12'56"	47 13'45"	47 15'20"
Longitude	121 54'21"	121 53'12"	120 58'58"	121 01'40"	120 58'07"	120 58'43"	121 02'57"
Date	3-10-76	3-10-76	10-22-75	12-15-76	10-22-75	10-22-75	11-3-75
Time	1300	1600	1130	1125	1530	1100	1300
Instantaneous discharge (ft^3/s)	e0.2	e0.03	e0.5	e0.75	e0.01	0.5	0.20
Specific conductance (micromhos at 25°C)	1,730	475	525	1,240	298	298	188
pH (units)	6.5	6.8	7.1	7.3	7.1	7.0	7.1
Temperature (°C)	10.3	10.1	9.0	11.4	8.4	6.5	8.0
Turbidity (JTU)	--	--	--	.1	--	--	--
Dissolved oxygen (DO), mg/L	1.4	.3	--	.2	--	--	--
Hardness as $CaCO_3$ (Ca, Mg), mg/L	--	--	--	77	--	--	--
Noncarbonate hardness as $CaCO_3$, mg/L	--	--	--	0	--	--	--
Acidity as $CaCO_3$, mg/L	215	30	--	5	--	--	--
Dissolved calcium (Ca), mg/L	--	--	--	23	--	--	--
Dissolved magnesium (Mg), mg/L	--	--	--	4.7	--	--	--
Dissolved sodium (Na), mg/L	--	--	--	280	--	--	--
Dissolved potassium (K), mg/L	--	--	--	3	--	--	--
Bicarbonate as $CaCO_3$, mg/L	--	--	--	860	--	--	--
Carbonate $CaCO_3$, mg/L	--	--	--	0	--	--	--
Alkalinity as $CaCO_3$, mg/L	--	--	--	705	--	--	--
Dissolved sulfate (SO_4), mg/L	--	--	--	7.0	--	--	--
Dissolved chloride (Cl), mg/L	--	--	--	3.2	--	--	--
Dissolved fluoride (F), mg/L	--	--	--	.2	--	--	--
Dissolved silica (SiO_2), mg/L	--	--	--	7.9	--	--	--
Solids, sum of constituents, mg/L	--	--	--	753	--	--	--
Dissolved aluminum (Al), ug/L	50	--	--	0	--	--	--
Dissolved arsenic (As), ug/L	--	--	--	1	--	--	--
Dissolved beryllium (Be), ug/L	--	--	--	--	--	--	--
Dissolved cadmium (Cd), ug/L	--	--	--	0	--	--	--
Dissolved chromium (Cr), ug/L	--	--	--	0	--	--	--
Dissolved cobalt (Co), ug/L	--	--	--	--	--	--	--
Dissolved copper (Cu), ug/L	--	--	--	0	--	--	--
Total iron (Fe), ug/L	2,400	430	--	240	--	--	--
Dissolved lead (Pb), ug/L	--	--	--	3	--	--	--
Dissolved manganese (Mn), ug/L	--	--	--	70	--	--	--
Total mercury (Hg), ug/L	--	--	--	.1	--	--	--
Dissolved nickel (Ni), ug/L	--	--	--	1	--	--	--
Dissolved silver (Ag), ug/L	--	--	--	--	--	--	--
Dissolved zinc (Zn), ug/L	--	--	--	10	--	--	--
Suspended sediment, mg/L	e0	e0	--	e0	--	--	--

e Estimated.

TABLE 17 --Water-quality data for coal-mine drainages in Washington, October 1975-September 1977--Continued

	Wilkeson-Carbonado coalfield						
	Burnett mine (water level entry) 34	Skookum area mine Portal No. 1 35	Skookum area mine Portal No. 2 36	Skookum area mine portal No. 3 37	Skookum sample Pt. No. 8 38	Quarry No. 1 mine 39	Carbon Hill No. 1, Bruiser gangway, Carbonado 40
Latitude	47°07'54"	47°06'07"	47°06'07"	47°06'07"	47°06'07"	47°06'15"	47°04'33"
Longitude	122°02'50"	122°02'03"	122°02'03"	122°02'03"	122°02'03"	122°01'42"	122°03'26"
Date	8-5-77	7-21-76	7-21-76	7-21-76	8-23-76	8-5-77	8-4-77
Time	1700	1300	1330	1600	1350	1500	1315
Instantaneous discharge (ft^3/s)	e1.5	0.03	0.87	0.42	1.4	0.003	e0.20
Specific conductance (micromhos at 25°C)	1,040	983	353	350	390	170	500
pH (units)	7.7	7.3	7.0	7.0	7.2	7.0	7.0
Temperature (°C)	12.7	11.6	9.3	9.8	9.4	9.1	9.6
Turbidity (JTU)	e.0	3	--	--	6.0	e.0	6.0
Dissolved oxygen (DO), mg/L	9.3	.0	6.7	4.2	7.8	8.7	5.3
Hardness as $CaCO_3$ (Ca, Mg), mg/L	--	450	150	--	160	--	--
Noncarbonate hardness as $CaCO_3$, mg/L	--	0	0	--	0	--	--
Acidity as $CaCO_3$, mg/L	40	50	30	25	25	15	5
Dissolved calcium (Ca), mg/L	--	--	34	--	35	--	--
Dissolved magnesium (Mg), mg/L	--	48	16	--	17	--	--
Dissolved sodium (Na), mg/L	--	59	20	--	24	--	36
Dissolved potassium (K), mg/L	--	2	1	--	1	--	--
Bicarbonate as $CaCO_3$, mg/L	240	58	200	216	220	67	300
Carbonate $CaCO_3$, mg/L	--	0	0	--	0	--	0
Alkalinity as $CaCO_3$, mg/L	200	480	160	177	220	55	250
Dissolved sulfate (SO_4), mg/L	89	120	33	39	30	22	9.4
Dissolved chloride (Cl), mg/L	--	2.8	1.7	--	1.8	--	2.4
Dissolved fluoride (F), mg/L	--	--	--	--	.1	--	.1
Dissolved silica (SiO_2), mg/L	--	--	--	--	21	--	24
Solids, sum of constituents, mg/L	--	--	--	--	237	--	--
Dissolved aluminum (Al), ug/L	--	--	--	--	0	--	40
Dissolved arsenic (As), ug/L	--	--	--	--	1	--	1
Dissolved beryllium (Be), ug/L	--	--	--	--	0	--	--
Dissolved cadmium (Cd), ug/L	--	--	--	--	0	--	0
Dissolved chromium (Cr), ug/L	--	--	--	--	0	--	--
Dissolved cobalt (Co), ug/L	--	--	--	--	--	--	--
Dissolved copper (Cu), ug/L	--	--	--	--	0	--	--
Total iron (Fe), ug/L	5,900	30	2,400	--	2,000	2,000	--
Dissolved lead (Pb), ug/L	--	--	--	--	3	--	1
Dissolved manganese (Mn), ug/L	--	--	--	--	360	--	220
Total mercury (Hg), ug/L	--	--	--	--	.0	--	.0
Dissolved nickel (Ni), ug/L	--	--	--	--	0	--	4
Dissolved silver (Ag), ug/L	--	--	--	--	--	--	--
Dissolved zinc (Zn), ug/L	--	--	--	--	0	--	10
Suspended sediment, mg/L	e0	e0	e0	--	4	e0	e0

e Estimated.

TABLE 17 --Water-quality data for coal-mine drainages in Washington, October 1975-September 1977 --Continued

	Wilkeson-Carbonado coalfield		Fairfax-Ashford coal area	Centralia-Chehalis coal deposit		
	Carbon Hill No. 2, Bruiser tunnel, Carbonado 41	Carbon Hill water level at Carbonado bunker 42	Fairfax mine 43	Sunshine No. 1 mine 44	Reliance No. 2 45	Rosenthal No. 1 46
Latitude	47°04'31"	47°04'50"	47°00'41"	46°40'50"	46°40'19"	46°40'19"
Longitude	122°03'23"	122°03'26"	122°01'04"	122°54'24"	122°56'16"	122°51'49"
Date	8-4-77	8-4-77	8-4-77	8-1-77	8-1-77	8-1-77
Time	1415	1700	1000	1530	1030	1350
Instantaneous discharge (ft^3/s)	e1.5	e0.2	0.10	e0.02	e0.03	e0.001
Specific conductance (micromhos at 25°C)	510	287	506	562	272	215
pH (units)	7.7	6.9	7.2	5.6	7.1	6.9
Temperature (°C)	9.7	9.4	9.1	14.0	10.7	16.4
Turbidity (JTU)	e.0	e.0	3.0	e.0	e.0	e.0
Dissolved oxygen (DO), mg/L	--	4.6	4.4	5.2	9.9	--
Hardness as $CaCO_3$ (Ca, Mg), mg/L	--	--	150	--	--	--
Noncarbonate hardness as $CaCO_3$, mg/L	--	--	0	--	--	--
Acidity as $CaCO_3$, mg/L	25	25	30	110	50	140
Dissolved calcium (Ca), mg/L	--	--	32	--	--	--
Dissolved magnesium (Mg), mg/L	--	--	17	--	--	--
Dissolved sodium (Na), mg/L	--	--	52	--	--	--
Dissolved potassium (K), mg/L	--	--	1	--	--	--
Bicarbonate as $CaCO_3$, mg/L	290	140	300	37	61	120
Carbonate $CaCO_3$, mg/L	--	--	0	--	--	--
Alkalinity as $CaCO_3$, mg/L	240	120	250	30	50	96
Dissolved sulfate (SO_4), mg/L	13	22	16	250	71	5.8
Dissolved chloride (Cl), mg/L	--	--	2.3	--	--	--
Dissolved fluoride (F), mg/L	--	--	.2	--	--	--
Dissolved silica (SiO_2), mg/L	--	--	14	--	--	--
Solids, sum of constituents, mg/L	--	--	283	--	--	--
Dissolved aluminum (Al), ug/L	--	--	40	--	--	--
Dissolved arsenic (As), ug/L	--	--	0	--	--	--
Dissolved beryllium (Be), ug/L	--	--	--	--	--	--
Dissolved cadmium (Cd), ug/L	--	--	0	--	--	--
Dissolved chromium (Cr), ug/L	--	--	0	--	--	--
Dissolved cobalt (Co), ug/L	--	--	--	--	--	--
Dissolved copper (Cu), ug/L	--	--	0	--	--	--
Total iron (Fe), ug/L	1,500	920	1,100	1,00	2,100	18,000
Dissolved lead (Pb), ug/L	--	--	0	--	--	--
Dissolved manganese (Mn), ug/L	--	--	120	--	--	--
Total mercury (Hg), ug/L	--	--	.0	--	--	--
Dissolved nickel (Ni), ug/L	--	--	2	--	--	--
Dissolved silver (Ag), ug/L	--	--	--	--	--	--
Dissolved zinc (Zn), ug/L	--	--	4	--	--	--
Suspended sediment, mg/L	e0	e0	0	e0	e0	e0

e Estimated.

TABLE 17.--Water-quality data for coal-mine drainages in Washington, October 1975-September 1977--Continued

	Centralia-Chehalis coal district			Eastern Lewis County coal deposits	
	Black Prince mine 47	Belle Slope mine 48	Tono No. 1 (South drainage) 49	Atlas mine (Hi-carbon) 50	Ladd mine 51
Latitude	46°45'27"	46°44'23"	46°46'00"	46°32'18"	46°42'25"
Longitude	122°48'48"	122°45'53"	122°48'45"	122°14'40"	122°15'13"
Date	7-22-77	7-22-77	4-16-75	9-1-77	9-1-77
Time	1430	1300	1620	0915	1615
Instantaneous discharge (ft^3/s)	e0.20	e0.1	0.50	e0.15	e0.30
Specific conductance (micromhos at 25°C)	520	1,250	315	168	686
pH (units)	6.0	6.3	6.4	7.2	7.4
Temperature (°C)	9.6	14.5	8.2	8.0	9.3
Turbidity (JTU)	.0	.0	.0	.0	1.0
Dissolved oxygen (DO), mg/L	8.3	1.5	--	7.8	5.5
Hardness as $CaCO_3$ (Ca, Mg), mg/L	--	200	140	76	160
Noncarbonate hardness as $CaCO_3$, mg/L	--	110	110	0	0
Acidity as $CaCO_3$, mg/L	50	80	0	10	30
Dissolved calcium (Ca), mg/L	--	57	33	23	49
Dissolved magnesium (Mg), mg/L	--	14	13	4.6	9.6
Dissolved sodium (Na), mg/L	--	170	--	6.0	89
Dissolved potassium (K), mg/L	--	6	--	.5	2
8icarbonate as $CaCO_3$, mg/L	--	110	37	94	410
Carbonate $CaCO_3$, mg/L	--	0	0	0	0
Alkalinity as $CaCO_3$, mg/L	--	87	30	77	340
Dissolved sulfate (SO_4), mg/L	210	440	110	6.9	21
Dissolved chloride (Cl), mg/L	--	4.5	--	1.5	2.1
Dissolved fluoride (F), mg/L	--	.1	--	.1	.2
Dissolved silica (SiO_2), mg/L	--	31	--	14	8.7
Solids, sum of constituents, mg/L	--	775	--	103	384
Dissolved aluminum (Al), ug/L	--	10	--	10	20
Dissolved arsenic (As), ug/L	--	0	--	0	0
Dissolved beryllium (Be), ug/L	--	--	--	--	--
Dissolved cadmium (Cd), ug/L	--	0	--	0	0
Dissolved chromium (Cr), ug/L	--	0	--	0	0
Dissolved cobalt (Co), ug/L	--	--	--	--	--
Dissolved copper (Cu), ug/L	--	1	1	0	0
Total iron (Fe), ug/L	8,300	39,000	1,000	70	100
Dissolved lead (Pb), ug/L	--	2	2	2	1
Dissolved manganese (Mn), ug/L	--	500	--	30	140
Total mercury (Hg), ug/L	--	.0	.0	.0	.0
Dissolved nickel (Ni), ug/L	--	4	--	0	0
Dissolved silver (Ag), ug/L	--	--	--	--	--
Dissolved zinc (Zn), ug/L	--	20	20	0	0
Suspended sediment, mg/L	e0	0	0	0	0

e Estimated.

TABLE 18.--Water-quality data for borehole-hydraulic mining test site, June 29, 1976

Site	Time	Specific conductance (micromhos at 25°C)	pH (units)	Temperature (°C)	Milligrams per liter: Turbidity (NTU)	Dissolved oxygen	Hardness (Ca,Mg)	Noncarbonate hardness	Acidity (H^+)	Dissolved calcium (Ca)	Dissolved magnesium (Mg)	Dissolved sodium (Na)	Dissolved potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Dissolved sulfate (SO_4)	Dissolved chloride (Cl)	Dissolved flouride (F)	Dissolved silica (SiO_2)
Gale Creek above borehole site	1100	50	7.1	11.4	7	9.6	26	0	0.1	6.9	2.2	3.8	0.9	32	0	1.5	1.4	0.1	17
Settling tank no. 1																			
Slurry 1[a]	1330	74	7.7	14.0	2,000	--	23	0	.0	8.6	2.8	9.8	.9	90	0	1.5	1.4	.1	16
Slurry 2	1400	65	7.8	15.3	720	--	--	--	.0	--	--	--	--	82	--	1.2	--	--	--
Slurry 3	1530	61	7.5	14.8	430	8.5	--	--	.0	--	--	--	--	63	--	1.5	--	--	--
Slurry 4	1640	53	7.9	15.0	540	9.0	--	--	.0	--	--	--	--	66	--	5.2	--	--	--
Slurry 5	1905	55	7.6	15.6	520	7.4	--	--	.0	--	--	--	--	72	--	1.7	--	--	--
Slurry 6	2005	56	8.0	15.4	460	7.3	--	--	.0	--	--	--	--	65	--	1.3	--	--	--
Settling tank no. 2																			
Slurry 1[a]	1640	52	7.7	15.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Slurry 2	1620	65	7.8	14.0	480	8.9	8	0	.0	6.8	2.7	9.1	.7	77	0	1.0	1.0	.1	16
Slurry 3	1710	53	8.0	15.2	--	9.2	--	--	--	--	--	--	--	--	--	--	--	--	--
Slurry 4	2010	58	8.0	15.6	--	8.8	--	--	--	--	--	--	--	--	--	--	--	--	--

Site	Time	Milligrams per liter: Dissolved solids (sum of constituents)	Micrograms per liter: Dissolved aluminum (Al)	Dissolved arsenic (As)	Dissolved calcium (Ca)	Dissolved chromium (Cr)	Dissolved copper (Cu)	Iron, total (Fe)	Dissolved lead (Pb)	Dissolved manganese (Mn)	Dissolved nickel (Ni)	Dissolved zinc (Zn)	Carbon, dissolved organic (C) (mg/L)	Carbon, suspended organic (C) (mg/L)	Suspended sediment concentration (mg/L)
Gale Creek above borehole test site	1100	50	30	0	0	10	0	1,600	1	30	2	10	--	--	10
Settling tank no. 1															
Slurry 1	0830	86	30	1	1	10	0	130,000	2	30	6	10	2.5	1.8	8,340
Settling tank no. 2															
Slurry 1	1620	76	30	0	1	10	0	29,000	2	20	--	3	10	--	9,590

[a]Slurry numbers refer to different samples taken at each settling tank

TABLE 19.--Mines found dry, draining but inaccessible, or not located in the general coal-bearing areas of Washington

Site name (by general coal-bearing areas)	Township, range, section	Dry		Draining		Remarks
		Observed	Reported	Observed	Reported	
Whatcom County coal deposits						
Glen Echo mine	38/4E-4	X				Owned by West Coast Mines, Inc.
Skagit County coal deposits						
Lake Murray	33/4E-36		X			Mine entrance caved in.
*Mt. Vernon	33/4E-26					Mine unknown by residents.
Issaquah-Grand Ridge coal area						
*Reynolds mine	24/6E-13					
*Black Nugget mine	24/6E-14					
Indian coal mine	23/6E-19	X				Collapsed tunnel.
Mine No. 1 across Cedar River	23/6E-29		X			
*Unnamed mine	23/7E-1					Mine location covered by addition to Interstate 90.
*Unnamed mine	23/5E-36	X				
Fire King coal mine	23/5E-25	X				
Green River coal district						
Mine across Green River from Flaming Geyser State Park	21/6E-27	X				Collapsed tunnel.
Mine near Kummer mine	21/6E-26	X				Do.
Durham mine No. 1	21/7E-2	X				
Gem mine	21/6E-27	X				Owned by Gem Coal Co.; collapsed tunnels.
Unnamed mine	21/6E-25					
Unnamed mine	21/6E-36	X				
New Hyde mine	21/7E-29	X				
Gibbon's No. 3 mine	21/7E-16	X				
Unnamed mine	21/7E-2	X				
Unnamed mine	22/6E-25	X				Old shaft gone, now a strip mine.
Unnamed mine	22/6E-25	X				Collapsed shaft.
Unnamed mine	22/6E-24	X				Two mines, a dry shaft and an abandoned strip mine (contaminated water).
Unnamed mine	22/7E-28	X				
Unnamed mine	22/6E-36	X				
Roslyn coal area						
Patrick mine (Roslyn Cascade No. 4)	20/14E-12	X				
Mine No. 2	20/14E-16	X				
Mine No. 6	20/15E-16	X				
Mine No. 9	20/15E-2	X				
Fanhouse mine No. 5	20/15E-21	X				
Mine No. 7	20/15E-22	X				
Taneum - Manastash coal area						
Prospect No. 1	16/19E-33	X				
Shaft No. 2	18/15E-14	X				Three prospects visited.
Shaft No. 3	18/15E-10	X				
*Unnamed shafts	18/15E-22					Covered by road.
*Tunnel No. 5	19/15E-26					
Shaft No. 6	19/15E-34	X				
Wilkeson-Carbonado coalfield						
Burnett No. 1 (air portal)	19/6E-16		X			Portal sealed with cement.
*Section 21 tunnel	19/6E-21					Two tunnels along road grade on topographic map.
Section 28 tunnel near Spiketon Road						Collapsed entry.
Section 28 tunnel south of Wilkeson	19/6E-28	X				Several adits on hillslope south of Wilkeson.
Section 27 tunnel	19/6E-27	X				45° slope with water; unsafe; reported by resident to be dry all year.
Peacock, Acme, Champion, and Pittsburgh mines	19/6E-22	X				Four adits at Karter's Lake; reported by resident to be dry all year.
*Winsome mine	19/6E-23					Reported to be 2 miles NE of Wilkeson; may drain to South Prairie Creek.
Unnamed mine	29/6E-27	X				Adit in Wilkeson Creek.
Unnamed mine	19/6E-27	X				Do.
Unnamed mine	19/6E-34	X				Collapsed slope entry in Carbonado watershed.
Carbonado tunnel	18/6E-4	X				Collapsed tunnel.
Wingate Hill tunnels	18/6E-5			X		Inaccessible; draining same seams are Carbon Hill mine; south bank of Carbon River

TABLE 19.--Continued

Site name (by general coal-bearing areas)	Township, range, section	Dry		Draining		Remarks
		Observed	Reported	Observed	Reported	
Fairfax-Ashford coal area						
Unnamed mine near Fairfax	18/6E-26	X				Collapsed entrance; tailings present.
Mashel mine near Ashford	15/6E-27		X			
Centralia-Chehalis coal district						
Superior No. 2 mine	14/2W-29	X				Reported to drain in winter.
Sheldon mine	14/2W-33		X			
Leonard mine	14/2W-28		X			
Reliance No. 1 mine	14/2W-28		X			
Superior No. 1 mine	14/2W-29	X				Reported dry all year.
Twin City mine	14/2W-29	X				
*Salzer Valley King mine	14/2W-22					
Gibson mine	14/2W-23	X				
T and T mine	14/2W-23		X			
Golden Glow No. 1 mine	14/2W-23		X			Reported dry all year.
Golden Glow No. 2 mine	14/2W-23		X			Do.
*Richmond mine	15/2W-34					Unknown by resident.
*Eureka mine	14/2W-2					Unknown by property owner and resident.
*Florence mine	14/2W-2					Do.
*Potlatch mine	14/2W-3					Do.
Wabash mine	15/2W-33	X				
Non-Poreil mine	15/2W-29	X				
Stoker mine	15/2W-29		X			
Monarch No. 2 mine	15/2W-30		X			
*Perth mine	15/2W-29					Unknown by property owner.
Black Bear	16/1W-31	X				Area logged and graded over.
Black Cherry	16/1W-31	X				Do.
Black Jewel	16/1W-31	X				Do.
*D and F mine	15/1E-18					Unknown by residents.
*Majestic (Thompson mine)	15/1E-18					Do.
Eastern Lewis County coal deposits						
Cambridge mine	14/5E-17	X				Collapsed entrance.
Divide mine	14/5E-29	X				Do.
Bell mine near Morton	13/4E-26			X		Inaccessible.
Coal Canyon mine near Morton	13/4E-36	X				Three slope entries, one with standing water.
Weikel mine	14/10E-13	X				
Kelso-Castle Rock coal area						
Huntington and Ely mine	9/2W-24		X			Mine entrance graded over, now under highway.
Silver Lake mine (Coal Bank Rapids)	10/1W-30	X				Caved in.
*Tower Prospect	10/1W-10					Entrance reported to be on river bank of Toutle River.
*Idlemon mine	9/2W-1					
*Schuff mine	10/2W-27					Unknown by property owner.

* Unable to locate.

TABLE 20.--Summary statistics for water-quality analyses from the coal-bearing areas in Washington, October 1975-September 1977

Physical-chemical constituents	Mean	Standard deviation	Maximum	Minimum	Number of analyses used
Specific conductance (micromhos at 25°C)	510	453	1,700	23	51
pH (units)	7.0	.5	8.4	5.6	50
Temperature (°C)	9.7	2.5	16.4	2.8	51
Dissolved oxygen (DO), mg/L	5.6	3.7	12.4	.0	43
Hardness as $CaCO_3$ (Ca, Mg), mg/L	189	184	820	37	18
Noncarbonate hardness as $CaCO_3$, mg/L	40	118	490	0	18
Acidity as $CaCO_3$, mg/L	53	64	230	0	46
Dissolved calcium (Ca), mg/L	45	40	180	12	18
Dissolved magnesium (Mg), mg/L	19	21	90	1.6	18
Dissolved sodium (Na), mg/L	82	116	450	1.5	18
Dissolved potassium (K), mg/L	2.5	2.1	8	.2	17
Bicarbonate as $CaCO_3$, mg/L	245	270	1,340	14	30
Carbonate $CaCO_3$, mg/L	0	--	0	0	17
Alkalinity as $CaCO_3$, mg/L	217	226	1,100	11	30
Dissolved sulfate (SO_4), mg/L	78	127	520	3.5	29
Dissolved chloride (Cl), mg/L	3.4	4.5	21	1.0	18
Dissolved fluoride (F), mg/L	.3	.3	1.3	.1	16
Dissolved silica (SiO_2), mg/L	14	7	31	4.5	16
Dissolved aluminum (Al), ug/L	19	17	50	0	17
Dissolved arsenic (As), ug/L	2	5	18	0	16
Dissolved cadmium (Cd), ug/L	0	--	1	0	16
Dissolved chromium (Cr), ug/L	0	--	1	0	15
Dissolved copper (Cu), ug/L	1	5	20	0	17
Total iron (Fe), ug/L	2,300	6,400	39,000	0	44
Dissolved lead (Pb), ug/L	3	2	10	0	17
Dissolved manganese (Mn), ug/L	140	140	500	8	16
Total mercury (Hg), ug/L	0	--	.1	.0	17
Dissolved nickel (Ni), ug/L	2	2	4	0	16
Dissolved zinc (Zn), ug/L	8	9	20	0	17

TABLE 21.--Averages and weighted averages for sulfur content of Washington coals

	Percent sulfur	
	Average	Weighted average*
General coal-bearing area		
Whatcom County coal deposits	0.98	0.73
Skagit County coal deposits	.55	.37
Issaquah-Grand Ridge coal area	.75	.63
Green River coal district	.62	.57
Roslyn coal area	.40	.41
Taneum Manastash coal area**	--	--
Wilkeson-Carbonado coalfield	.62	.69
Fairfax-Ashford coal area	.63	.54
Centralia-Chehalis coal district	1.82	1.12
Eastern Lewis County coal deposits	.67	.64
Kelso-Castle Rock coal area	1.38	.63

Explanation:

*Weighted averages is based on total tonnage for all coal areas for which proximate analyses were available.
**Proximate analyses not available.