WATER QUALITY STATUS REPORT

BANNOCK CREEK
(Power County)

1982

Department of Health & Welfare
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POWER COUNTY

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1 April 1982

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I. BANNOCK CREEK - BASIN DESCRIPTION

The Bannock Creek Basin lies about 10 miles southwest of Pocatello, Idaho (See Figure 1). Bannock Creek drains the valley between the Deep Creek Mountains on the west and the Bannock Range on the east. It rises in Oneida County about 15 miles south of the boundary of the Fort Hall Indian Reservation. The creek flows north, crosses the Michaud Flats area of the Snake River Plain at the northern end of the two mountain ranges and enters the American Falls Reservoir. The total basin area above the I-15W bridge is 413 square miles. The area within the Reservation is 154 square miles, or 37 per cent of the total basin.

Bannock Creek receives the flow of several perennial tributaries. Three of the most important, in downstream order, are West Fork, Moonshine Creek, and Rattlesnake Creek. West Fork originates in a group of springs at the base of West Fork Canyon in the Deep Creek Mountains. It flows easterly and enters the Reservation before joining Bannock Creek. The West Fork basin includes 14.6 square miles, of which only 0.8 square miles, or five per cent, lies within the Reservation.

Moonshine Creek also originates in the east flank of the Deep Creek Mountains, north of Bannock Peak. Three tributaries, Keogh Creek, Sawmill Creek, and Squaw Creek contribute to its flow from the uplands. Much of the baseflow is apparently contributed by springs near the Arbon Valley floor, prior to the stream entering Bannock Creek. The basin contains 44.2 square miles, of which 33.3 square miles, or 75 per cent, lie within the Reservation.

The third main tributary, Rattlesnake Creek, enters the creek below Moonshine, draining the Bannock Mountains to the east of Arbon Valley. Rattlesnake Creek begins north of Bradley Mountain, and flows northwesterly, intercepting the tributary flows of Clifton Creek, Crystal Creek, and Midnight Creek. The entire basin contains 79.6 square miles, with the lower 7.7 square miles or 11 per cent within the Reservation.

Two other smaller tributaries enter Bannock Creek: Starlight Creek from the west, and Birch Creek from the east. The Starlight basin contains 15.3 square miles, of which 14.8, or 96 per cent, lies within the Reservation.

Below these tributary flows, Bannock Creek crosses, and can be diverted into the Michaud Unit of the Fort Hall Irrigation Project. The irrigation project is usually in operation from mid-April to mid-October. Throughout this time, 30 cfs of water is withdrawn from Bannock Creek at the Bannock Pump House (T. 7S, R. 33E, Sec. 6 SESW). Upstream from the Michaud Unit, several small irrigation ditches divert water from Bannock and Rattlesnake Creeks, forming the Bannock Creek Minor Irrigation Units.

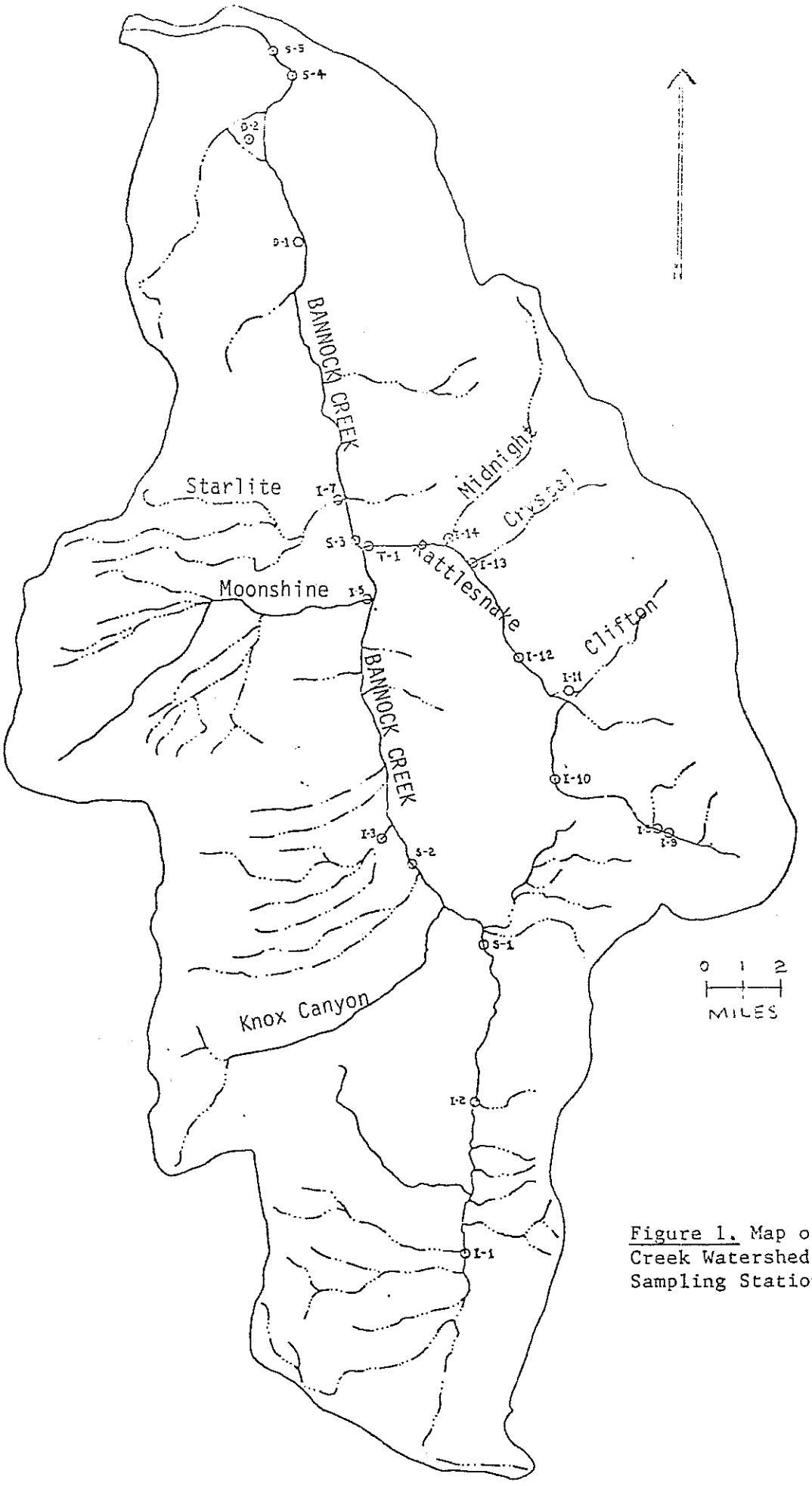


Figure 1. Map of Bannock Creek Watershed and Sampling Stations.

I. BANNOCK CREEK - BASIN DESCRIPTION (Continued)

The mean annual precipitation that falls on the Bannock Creek Basin is approximately 18 inches, ranging from ten near the Snake River Plain to approximately 25 inches at the upstream end. Using the analysis prepared by Mundorff and others (1964), the basin should yield the equivalent of 6.0 inches of water over the entire basin (see Figure 2 and Table 1).

All of the reservation portion of the Bannock Creek basin lies withing Power County, and within the Power County Soil Conservation District. The upper ten miles of Bannock Creek and approximately sixteen square miles of the basin (4% of the total) lie in Oneida County. This land is part of the Oneida County Soil Conservation District. A small part of the eastern portion of the Bannock Creek basin along the Wild Horse Divide is within Bannock County. This area is only six square miles, or 0.01% of the total basin area. It is part of the Portneuf Soil and Water Conservation District.

Figure 2. Schematic, Bannock Creek Annual Water Budget, 1978
(after Balmer and Noble, 1979)

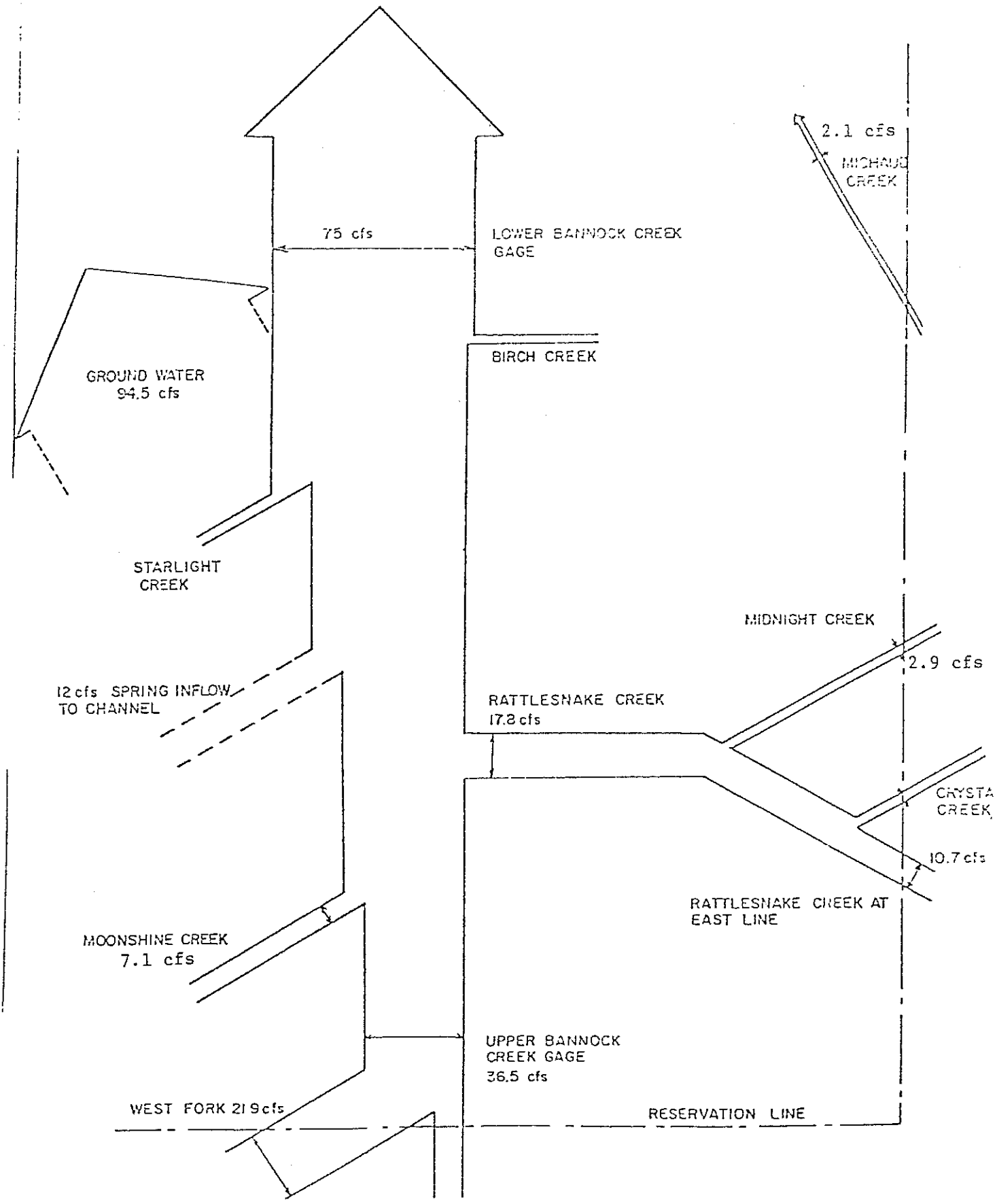


Table 1. Bannock Creek Water Budget, 1978
(after Balmer and Noble 1979)

	Inches	CFS	Acre/Feet
Input - Precipitation	18	548	396,500
Evapotranspiration	12	365	264,300
Total Runoff	6	183	132,200
Surface Water Flow	2.9	88.5	64,100
Ground Water Flow (413 Sq. mi.)	3.1	94.5	68,400

II. Methods and Materials

This study was designed to assess the impacts of non-point sources in the Bannock Creek Watershed, document loadings leaving Bannock Creek and entering American Falls Reservoir, and to identify critical areas in the watershed that are causing degradation of the water quality.

Five main-stream stations and a series of tributary and irrigation return flow stations were sampled (Table 2). Suspended sediment was measured with a depth integrating sampler (DH-48) when homogeneity of the water column could not be assured. Nutrients, minerals, and other solids were measured on grab samples collected at sub-surface, at mid-stream. Dissolved oxygen, temperature, and pH were measured potentiometrically in the field. All laboratory tests were conducted by the Idaho Bureau of Laboratories, and followed the procedures referenced in Table 3. Discharge was measured with a current meter, following standard discharge measurement procedures (U.S. Bureau of Reclamation, 1975).

Table 2 Stations sampled in the Bannock Creek Intensive Survey, all "S" stations are on the main stream of Bannock Creek

Station Number	Location	Number of Times Sampled This Study
S5	Downstream of concrete channel at I-80 bridge	6
S4	County Road 0.5 miles upstream of S5	7
S3	Below junction with Rattlesnake Creek	4
S2	Below Pauline	5
S1	4 miles below Arbon Post Office	5
T1	Rattlesnake Creek at mouth	4
I1	Bannock Creek above Arbon	2
I2	Bannock Creek at Arbon Post Office Road	2
I3	West Fork Creek at mouth	
I5	Moonshine Creek at mouth	1
I7	Starlight Creek at mouth	2
I8	Rattlesnake Creek at head of lower valley	2
I9	Rattlesnake Creek at toe of upper valley	2
I10	Rattlesnake Creek at County Road	1
I11	Clifton Creek at mouth	2
I12	Rattlesnake Creek below Crystal	2
I13	Crystal Creek at mouth	1
I14	Midnight Creek at mouth	2
D1	Big Siphon wasteway	3
D2	Bannock Drain	3

Table 3 Summary of Water chemistry methods used in the study. All references are citations in the EPA Methods Manual (U.S.E.P.A. 1979)

Variable	Method	Reference No.
Conductance	YSI Specific Conductance Meter	120.1
Tot. Hardness	Titrimetric, EDTA	130.2
pH	Electrometric Corning meter	150.1
Residue		
Non-Filterable	Gravimetric, Dried at 103-105°C	160.2
Total	Gravimetric, Dried at 103-105°C	160.3
Turbidity	Nephelometric, Hach	180.1
Arsenic	AA, Furnace	206.2
Boron	Colorimetric, Curcumin	212.3
Cadmium	AA, Furnace	213.2
Calcium	Titrimetric, EDTA	215.2
Chromium	AA, Direct Aspiration	218.1
Copper	AA, Direct Aspiration	220.1
Iron	AA, Direct Aspiration	236.1
Lead	AA, Direct Aspiration	239.1
Magnesium	AA, Direct Aspiration	242.1
Manganese	AA, Direct Aspiration	243.1
Mercury	Cold Vapor, Manual	245.1
Nickel	AA, Direct Aspiration	249.1
Potassium	AA, Direct Aspiration	258.1
Silver	AA, Furnace	272.2
Sodium	AA, Direct Aspiration	273.1
Zinc	AA, Direct Aspiration	289.1

Table 3 (Continued)

Variable	Method	Reference No.
Alkalinity	Titrimetric (pH4.5)	310.1
Chloride	Titrimetric, Mercuric Nitrate	325.3
Fluoride	Potentiometric, Ion Selective Electrode	340.2
Nitrogen	Ammonia, Colorimetric, Automated Phenate	350.1
Nitrogen	Total Kjeldahl-	351.3
Nitrate-Nitrite	Colorimetric, Manual Cadmium Reduction	353.3
Phosphorus	Colorimetric, Automated, Ascorbic Acid	365.4
Silica, Diss.	Colorimetric	370.1
Sulfate	Turbidimetric	375.4
Chemical Oxygen Demand	Titrimetric, Low Level	410.2
Oil & Grease-Total Recoverable	Gravimetric, Separatory Funnel Extraction	413.1

III. ANALYTICAL TECHNIQUES

A. Sediment Rating Curves

Sediment rating curves are a mathematical expression of the relationship between stream discharge and suspended sediment concentrations. The slope and intercept of the curve will be influenced by the hydraulic geometry of the stream, and the watershed characteristics. Curves constructed for relatively small watersheds, with relatively uniform watershed characteristics, will have uniform sediment:discharge relationships. These relationships, plotted as linear regressions, are useful predictive tools in watershed management. They quantify predicted sediment concentrations at any given discharge in the watershed. They may continually be expanded and refined by adding more points to the line and recomputing the regression. Specific problem areas will stand out as having measured sediment concentrations in excess of those predicted for a given discharge (Idaho Department of Health and Welfare).

B. Universal Soil Loss Equation (USLE)

Major erosion factors and the determined numeral relationships of these factors to soil loss rates have been incorporated in the universal soil loss equation (USLE). The USLE can be used to predict annual soil losses from sheet and rill erosion by rainfall and its associated runoff on specific fields.

The equation is:

$$A = RKLSCP$$

Where:

A = Soil loss in tons per acre per year
R = Rainfall and runoff erosivity index
K = Soil erodibility factor
LS = Combined effects of slope length and steepness
C = Cover and management factor
P = Supporting practices factor

III. B. Universal Soil Loss Equation (Continued)

In 1975, the Soil Conservation Service mapped soil loss rates in Idaho counties, based on the USLE. These maps were compiled to prepare a map of soil loss rates for the Bannock Creek basin (Figure 3). Where soil loss exceeds 5 tons/acre/year, soil is being lost at a greater rate than it is being replaced by weathering. The immediate effect is lowered crop production and eventually the entire topsoil horizon can be lost.

The USLE predicts soil erosion rates, but it does not directly predict sediment yields of affected streams. Eroded materials often move only short distances and may be deposited outside of any stream system. The sediment delivery ratio is defined as the ratio of sediment delivered at a location in the stream system to the gross erosion from the drainage area above that point. The size of the drainage area is the most important factor influencing the sediment delivery ratio because the distance of sediment transport to downstream points is greater on larger watersheds, and the opportunities for deposition enroute are more numerous. The Soil Conservation Service has developed a table relating drainage areas in square miles to the sediment delivery rating (EPA, 1975). For the present study, the following formula was derived based on the Soil Conservation Service table:

$$Y = 0.30\ X\ -0.24$$

Where:

Y = Sediment delivery ratio
X = Drainage area in square miles

For the present study, individual soil loss areas were planimetered to determine their area. The resulting area (acres) was multiplied by the soil loss rate (tons/acre/year) to give the annual soil loss (tons/year) for the individual area. The areas were totaled and the sediment delivery ratio was applied to give the sediment yield in tons/year for the entire basin.

III. C. Water Quality Index *

Bannock Creek water quality conditions were summarized and evaluated by using EPA's Water Quality Index (WQI). The Water Quality Index reduces the mass of data to a single overall measure which expresses the quality of a stream or river. The index is an aggregation of a standardized set of variables and associated criteria which provides a means for measuring and comparing water quality status with respect to fishable/swimmable water quality goals. Sub-indices are calculated for ten pollution categories. An overall WQI number for each station is then calculated from these sub-indices which are weighted by the relative severity of the criteria being exceeded for each group.

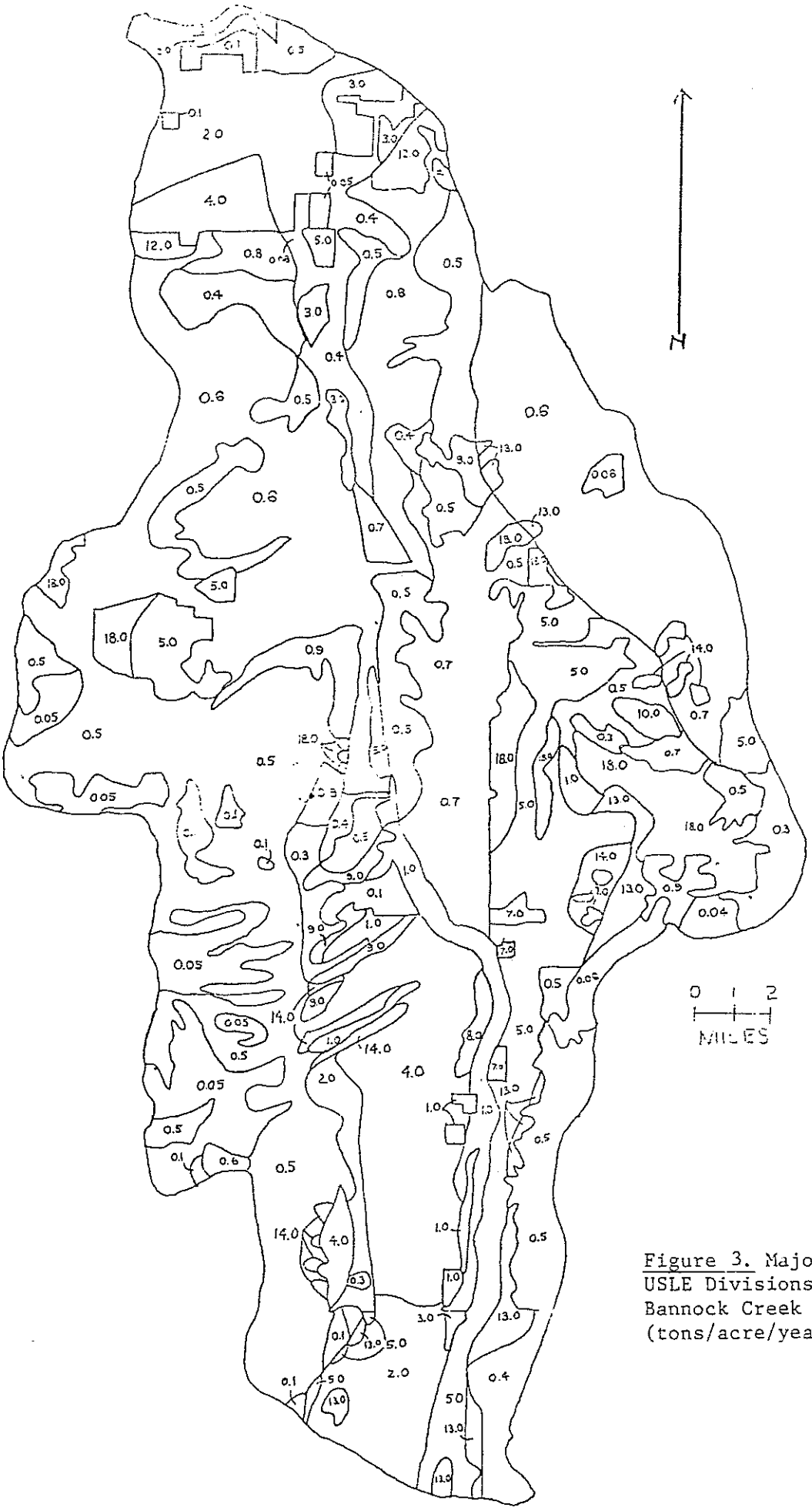


Figure 3. Major USLE Divisions on the Bannock Creek Watershed (tons/acre/year).

III. C. Water Quality Index * (Continued)

The WQI numbers span a scale from zero to 100, with zero meaning no evidence of pollution and 100 indicating severe pollution. Twenty is used as a break point for variables which exceed minimum criteria. Therefore, less than 20 indicates a stream which on the average experiences no or minimal pollution. Sixty is used as the break point indicating severe pollution.

Criteria

Criteria used in evaluating the water quality data are shown in Table 4. Criteria for the temperature, dissolved oxygen, pH, and bacteria categories are from the IDAHO WATER QUALITY STANDARDS AND WASTEWATER TREATMENT REQUIREMENTS, IDHW (1980), except for the salmonid spawning dissolved oxygen criteria. Criteria for the trophic, aesthetics, and solids categories are from the EPA Water Quality Index program which are primarily based on EPA, 1976, QUALITY CRITERIA FOR WATER.

Water Quality Condition

An annual and seasonal Water Quality Index (WQI) was calculated. The annual WQI is an overall average for the water year - months with missing data are interpolated from adjacent months. The seasonal WQI is calculated from three consecutive months with the highest WQI.

Color Code	Rating	Water Quality Index	Explanation
Blue	Very Good	0-10	High quality, no detected pollution
Blue	Good	10-20	On average no pollution, or minimally polluted
Yellow	Fair	20-40	Intermittently or moderately polluted
Yellow	Poor	40-60	Polluted, does not meet water quality goals
Red	Very Poor	60-100	Severe pollution, certain protected uses inhibited by pollutants
	I.D.		Insufficient data

* Description modified from: IDAHO WATER QUALITY STATUS REPORT 1980. Idaho Department of Health and Welfare, Division of Environment

TABLE 4 - WATER QUALITY CRITERIA

TEMPERATURE CATEGORY		
Maximum Temperature, °C	19	- Cold Water Fishery
	28	- Warm Water Fishery
OXYGEN CATEGORY		
Minimum Dissolved Oxygen, mg/l	6.0	- Cold Water Fishery
	5.0	- Warm Water Fishery
	8.0	- Salmonid Spawning & Rearing
Dissolved Oxygen Per cent Saturation - %	80	- Minimum
	120	- Maximum
pH CATEGORY		
pH - standard units	6.5	- Minimum
	8.5	- Maximum
BACTERIA CATEGORY		
Maximum Fecal Coliform number per 100 ml	50 fecal coliform/100 ml- Class AA recreation	
TROPHIC STATUS		
Maximum Nutrient, mg/l	0.30	- inorganic nitrogen
	0.05	- total phosphorous
AESTHETIC CATEGORY		
Maximum Turbidity, NTU	25	- all classes
SOLIDS CATEGORY		
Maximum Dissolved Solids, mg/l	500	- dissolved solids
	750	- conductivity, micromhos
Maximum Suspended Solids (SS), mg/l	25	- SS, Cold Water Fishery
	80	- SS, Warm Water Fishery
INORGANIC TOXICITY		
Unionized Ammonia, mg/l	.02	- unionized ammonia

IV. A. MEAN WATER QUALITY CHARACTERISTICS

Average concentration of several variables in the Bannock Creek watershed are presented in Table 5. These are average values, which lose the precision of raw data. In many cases, the seasonal extremes vary dramatically so annual means should be interpreted with caution.

B. WATER QUALITY INDEX

Water Quality Indexes (WQI) were calculated from only station: Bannock Creek near the mouth, Station S5. The results of those calculations are presented in Table 6. In general, they show the stream to be severely polluted by suspended sediments during the worst three months (April-June). During this period, the overall WQI for the creek ranges from 97.5 to 99.9. A WQI of 100 is the most polluted WQI possible. On an annual average, the WQI ranges from 69.3 to 74.4, still indicating severe pollution. Specific variables selected as yellow (WQI≥20) on an annual average are: Fecal coliform bacteria, Nitrogen plus Phosphorus, Turbidity, and Suspended Sediment.

Table 5. Mean Water Quality Characteristics

Station	Water Temp.	COD	Solids		Total Phos-phorous	NO_2 + NO_3	NH_3	Total Alka-linity	Total Hard-ness	Cond.	Turb.	Fecal Coli-form
			Total	Suspended								
S1(n=4)	7.9	19.2	803	75	0.18	0.71	0.20	277	415	1092	26.9	125.6
S2(n=4)	9.6	14.4	678	71	0.15	0.67	0.14	258	368	998	14.4	48.4
S3(n=4)	11.5	14.0	556	170	0.24	0.41	0.10	248	315	720	35.2	69.0
S4(n=4)	8.3	17.5	658	365	0.30	1.38	0.10	258	321	765	61.0	158.0
S5(n=5)	12.1	22.2	673	258	0.35	0.96	0.14	252	302	781	53.8	198.4
T1(n=4)	10.3	20.4	544	309	0.32	0.58	0.20	232	250	586	51.8	118.7
I1*	10.0	25.6	1033	429	0.46	3.31	0.19	264	348	1022	190.0	100.0
I2**	15.2	24.8	566	131	0.22	0.63	0.12	236	314	804	34.8	145.0
I3***		3.3	204	19	0.04	0.03	0.01			346	2.1	
I4												
I5(n=1)	22.0		405	19	0.07	0.06	0.05	236	272	617	2.6	16.0
I6												
I7(n=2)	9.0	6.8	405	11	0.08	0.03	0.07	236	262	599	1.6	90.0
I8(n=2)	12.0	19.5	570	390	0.34	0.74	0.11	220	252	542	56.0	80.0
I9(n=2)	9.0	138.7	3774	6870	2.28	0.64	0.19	337	232	504	16.0	100.0
I10(n=1)	8.0	23.5	788	478	0.63	0.95	0.10	225	224	619	102.0	100.0
I11(n=2)	7.0	125.0	2537	4111	1.76	1.72	0.12	256	284	732	12.0	100.0
I12(n=2)	6.0	30.2	804	810	0.51	0.88	0.12	252	304	742	82.2	100.0
I13(n=1)	5.0	13.2	296	100	0.21	0.19	0.05	195	208	395	39.0	60.0
I14(n=2	6.0	14.8	281	43	0.12	0.13	0.43	155	184	407	9.8	10.0

* I1 - Bannock Creek above Arbon (n=1)
** I2 - Bannock Creek at Arbon Post Office (n=2)
*** I3 - West Fork Creek at mouth (n=1)

+ Note that when solids concentrations are very high, test precision becomes more important. Suspended Solids may exceed Total Solids on isolated samples. In actuality, 95% confidence intervals around grab analyses would include both values.

TABLE 6. Average Monthly WQI, Bannock Creek near the mouth

Variable Selected*	Average Monthly WQI											
	Jan	Feb	Mar	*Apr	*May	June	July	*Aug	Sept.	*Oct	*Nov	Dec.
Temperature	0	0	0	2	3	5	0	3	6	4	3	1
Diss. Oxygen	0	2	4	6	7	9	11	10	9	7	4	2
pH	4	13	23	17	10	4	5	10	14	11	9	6
Fecal Coliform	6	12	18	28	38	49	36	47	58	2	4	5
Inorganic N plus Total Phosphorous	47	51	56	55	55	54	60	58	56	53	51	49
Turbidity	51	57	63	53	43	34	18	23	29	34	40	46
Susp. Solids	40	66	93	95	98	100	40	40	40	40	40	40
Radioactivity	----------No data----------											
Organic Toxicity	----------No data----------											
Metals	10	10	10	10	10	10	10	10	10	10	10	10

These were WQI values estimated from adjacent months.

VARIABLE SELECTED	ANNUAL WQI	ANNUAL AVERAGE COLOR	HIGH 3 MONTHS WQI	Color	Months
Temperature	2.2	Blue	4.2	Blue	Aug.-Oct.
Diss. Oxygen	5.9	Blue	9.8	Blue	Jul.-Sept.
pH	10.6	Blue	17.7	Blue	Feb.-Apr.
Fecal Coliform	25.1	Yellow	46.8	Yellow	Jul-Sept.
Inorganic N plus Total Phosphorous	53.7	Yellow	57.8	Yellow	Jul.-Sept.
Turbidity	41.0	Yellow	57.6	Yellow	Feb.-Apr.
Susp. Solids	61.2	Red/Yellow	97.5	Red	Apr.-June
Radioactivity	----------No data----------				
Organic Toxicity	----------No data----------				
Metals	10.0	Blue	10.0	Blue	Jan.-Mar.

Figure 4. Bannock Creek Watershed Sediment Rating Curve (n = 34)

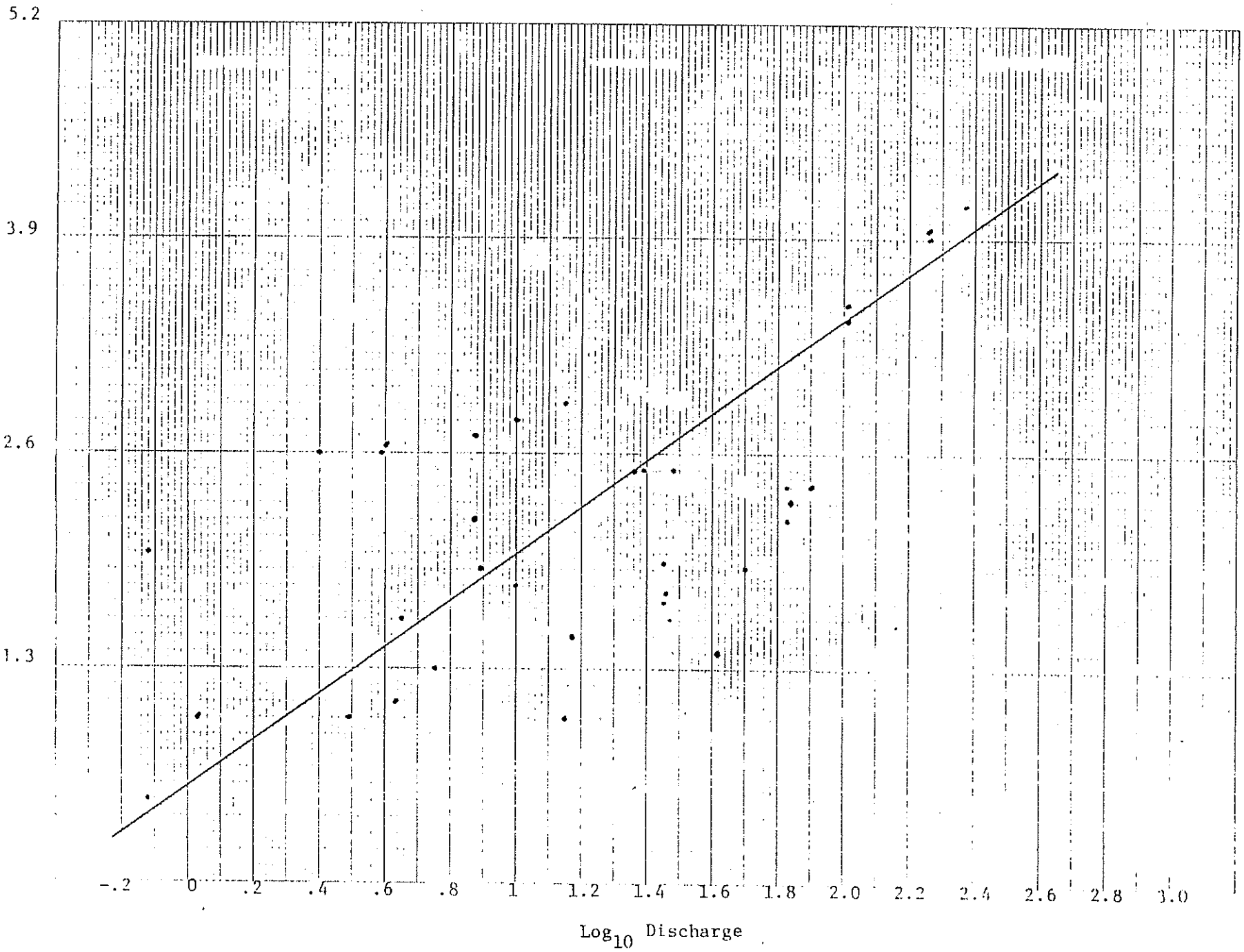
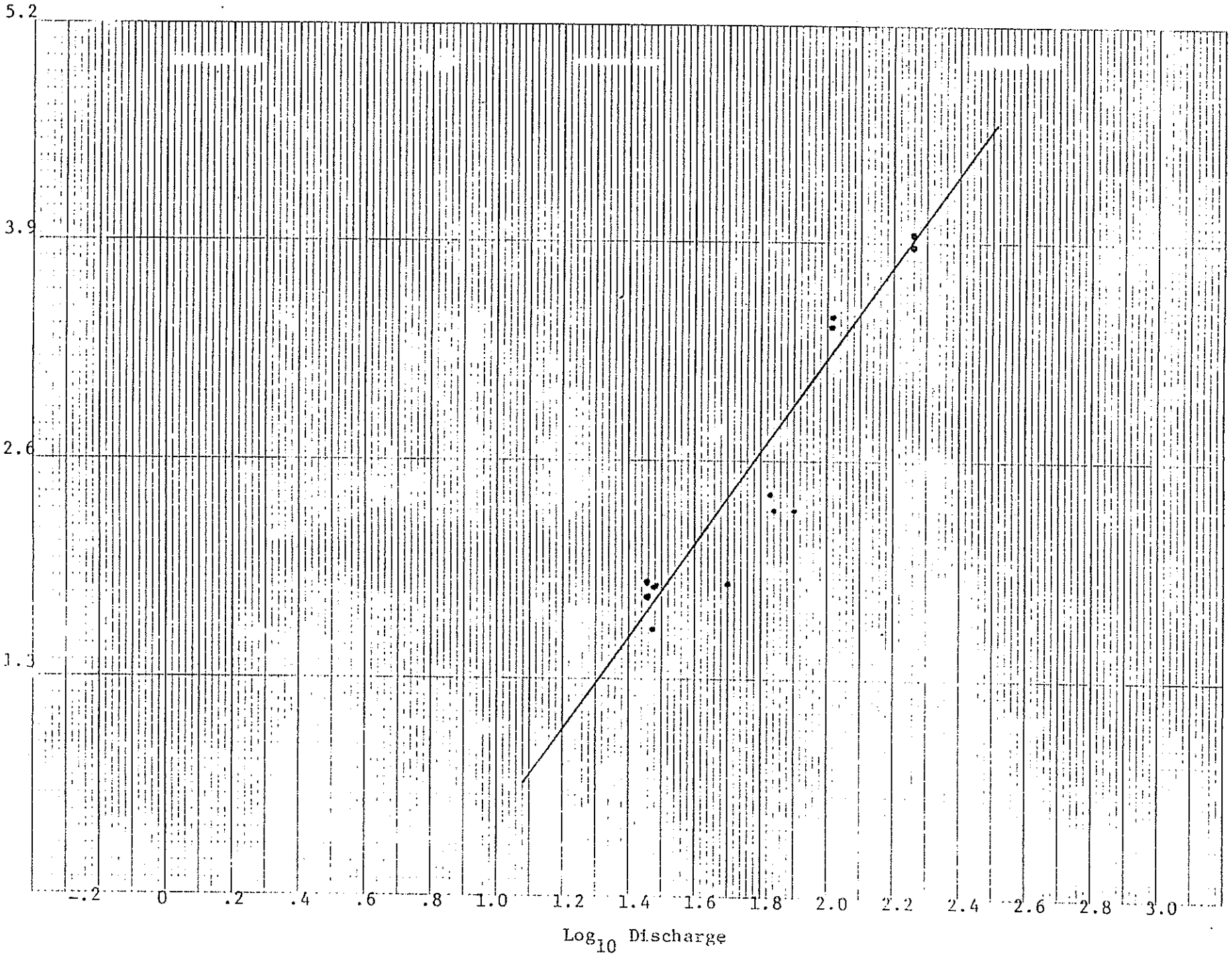
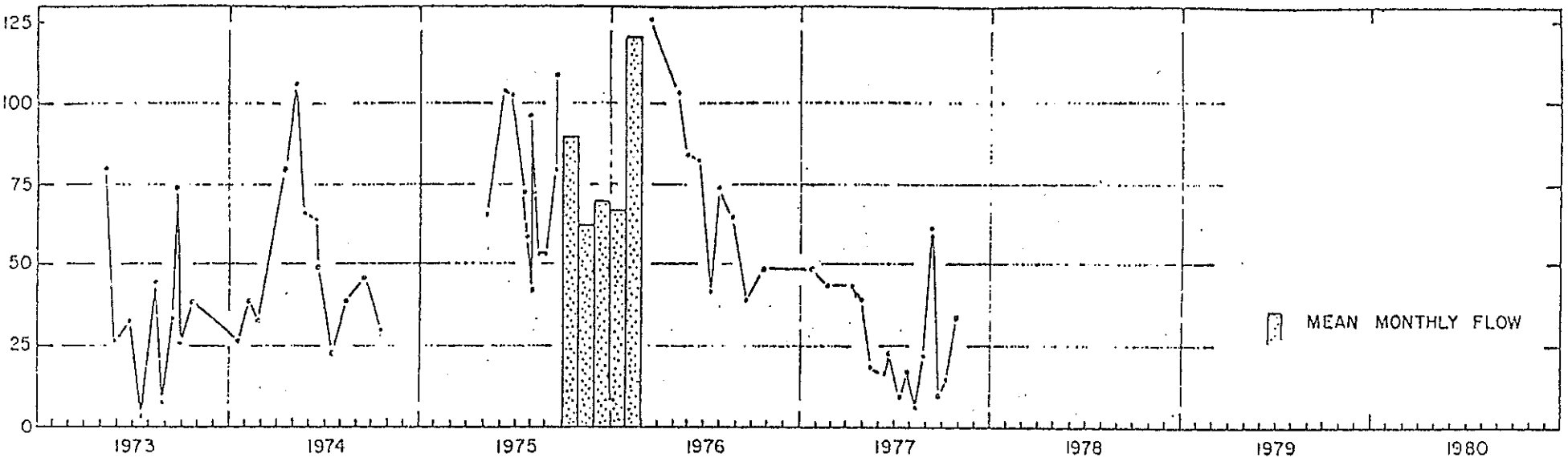


Figure 5. "Station Specific" Sediment Rating Curve: Bannock Creek Near Mouth (n = 12)





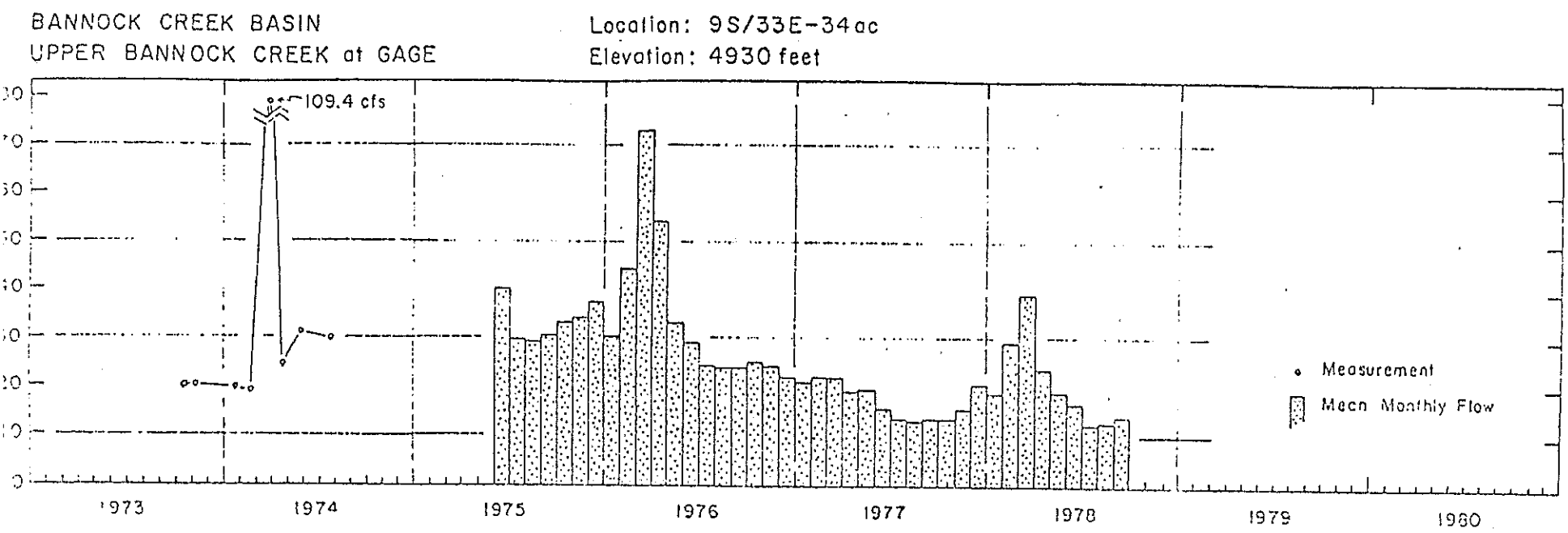


Figure 6. Streamflow Data for Bannock Creek.

Table 7. Predicted sediment transport in the Bannock Creek Watershed. Predictions based on hydrographs in Balmer and Noble (1979) and the sediment rating curve in Figure 4.

Station	Time Period May 31-May 31	Predicted Sediment Transport in tons/yr.
Upper Bannock Creek at gauge	1975-1976	2911.5
	1976-1977	443.6
	1977-1978	566.2
3 year mean = 1307.1,	s.d. = 1390.8,	c.v. = 106.4%
Lower Bannock Creek at gauge	1975-1976	68,207
	1976-1977	7,419

IV. C. SEDIMENT-DISCHARGE CURVES

All sediment and discharge data from this study (34 points) were used to generate a sediment rating curve for the Bannock Creek watershed (Figure 4). The formula for that curve is:

Watershed

$$\text{Log}_{10} \text{ Sediment (mg/l)} = 1.145 + 0.826 \text{ Log}_{10} Q$$

Q = Discharge in cfs; n = 34; $r^2 = 0.42$

A second curve (Figure 5) was developed for the data collected "near the mouth", as a station specific curve. The formula for that curve is:

$$\text{Log}_{10} \text{ Sediment (mg/l)} = -2.27 + 0.267 \text{ Log}_{10} Q$$

Q = Discharge in cfs; n = 12; $r^2 = 0.95$

The watershed formula was used in conjunction with a hydrograph presented by Balmer and Noble (1979) to predict sediment yield in previous years.

The mean monthly discharges from 1975 (Figure 6) were individually entered (as Q) into the sediment:discharge curve. Sediment (in mg/l) was predicted. Sediment concentration, multiplied by flow for that month, gave loadings in tons per month. The sum of twelve such calculations resulted in predicted annual sediment transport in tons per year (Table 7).

IV. D. USLE Prediction of Sediment Yield

Sediment yield predicted by the USLE and the sediment delivery ratio amounts to 51,365 tons/year at the mouth of Bannock Creek (See Fig. 7).

Table 8 Soil Loss and Sediment Yield in Bannock Creek and Rattlesnake Creek

Basin	Drainage Area (square miles)	Per Cent Dryfarm	Annual Soil Loss (tons/year)	Sediment Delivery Ratio	Annual Sediment Yield (tons/year)
Bannock Creek	413	24.4%	733,779	0.07	51,365
Rattlesnake Creek	80	43.2%	103,194	0.10	10,319

V. A. RELATIONSHIP BETWEEN USLE AND SEDIMENT RATING CURVE PREDICTIONS

Annual sediment yield predicted by the USLE (51,365 tons) agrees closely with the yield predicted by the sediment rating curve and hydrographs for 1975-1976 (68,207 tons). (The yield of 7,419 tons for 1976-1977 is substantially lower since that year was a drought year.) The methodology of basin modeling in this case is a valid one and can be used in similar studies in the future.

B. CRITICAL EROSION AREAS IN THE BANNOCK CREEK WATERSHED

Critical areas were considered to be those areas with erosion rates of five tons/acre/year or higher. These areas are mapped on Figure 6. Upper Bannock Creek and Rattlesnake Creek are stream segments severely impacted by agriculture.

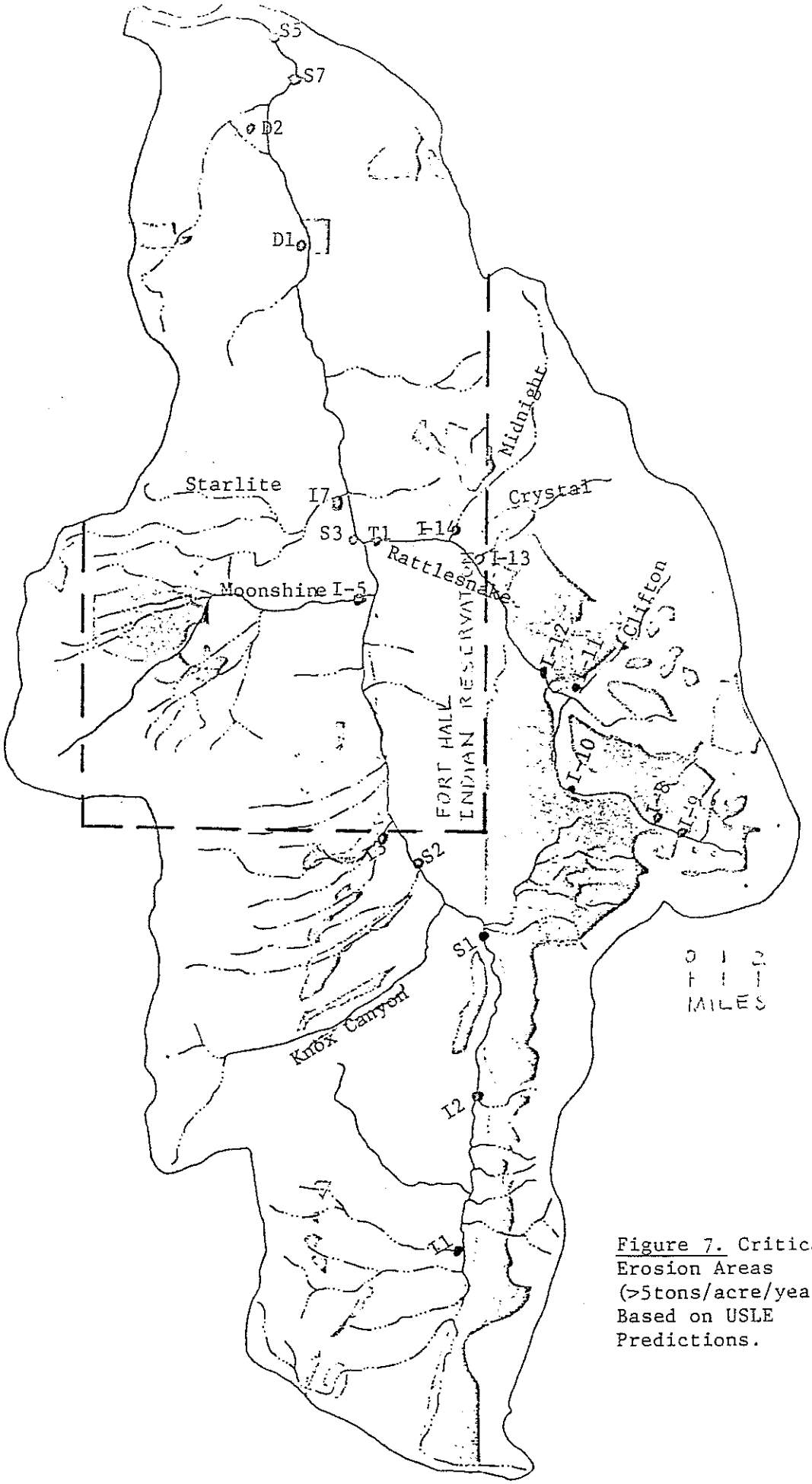


Figure 7. Critical Erosion Areas (>5tons/acre/year) Based on USLE Predictions.

V. C. Implications for Future Studies

These results have illustrated the use of the USLE model in predicting soil loss from agricultural watersheds; however, the delivery ratio is a critical element of USLE applications; more work should be done to calibrate watershed specific delivery ratios or to document the generality of present ratios.

Sediment rating curves are also critical elements of a water quality study. The curve drawn for this report is indicative of conditions on Bannock Creek during 1980. We would expect to see a measurable reduction in both slope and intercept with the institution of improved management practices. Curves for sub-watersheds such as Rattlesnake Creek may be significantly higher and/or steeper than for the rest of the creek. The shape of the curve for Bannock Creek, and the elevated points for Rattlesnake Creek, stress two important implications for future studies:

1. Data at peak discharge is critical in determining a sediment rating curve. The curve has no generality or utility without peak flow data.

2. Station selections are very important in Non-point Source Water Quality studies, as is sample frequency. More samples on Rattlesnake Creek and less on other sub-watersheds, or more high flow samples may have measurably changed the shape of our curve.

Future investigations would do well to use the USLE in the planning stages of a study. Then stations could be chosen to represent land use problems as well as "background" sections of the watershed. Collection frequency should be modified to adequately represent the entire hydrograph. Low flow sediment transport rate will be relatively uniform over long periods of time. High flow (ascending and descending limb, as well as peak flow) valves are critical to the ecology and geomorphology of the creek, but they occupy a minimal portion of the year. Sample effort should be maximal during this period.

VI. SUMMARY

Bannock Creek is a small, agricultural watershed in southeast Idaho. The basin is partially on the Fort Hall Indian Reservation, several large farms, and leases of Indian ground are active in the watershed.

Bannock Creek and its tributaries were sampled for suspended sediment load and chemical quality during 1980 and 1981. Five main stream stations and a series of tributary stations were utilized. The data were used to develop a sediment rating curve for the watershed, and a more specific curve for the creek near the mouth. Land uses in the watershed were mapped. The Universal Soil Loss Equation (USLE) was used to predict soil loss from the watershed. USLE predictions and sediment rating curve measurements were comparable within relatively wide limits.

Chemical quality of the creek was summarized with a Water Quality Index (WQI). Those results show the stream to be severely polluted with sediment between April and June. Serious water quality problems exist on an annual basis with regard to sediment, fecal coliform bacteria, nutrients, and turbidity.

Several critical erosion areas in the watershed are presented on a basin map. It is recommended that Best Management Practices, and other aggressive erosion control practices be instituted in these areas.

Literature Cited

Balmer, D. & R. Noble. 1979. Water Resources of the Fort Hall Indian Reservation. Report to Fort Hall Tribal Commission. Robinson and Noble, Inc., Portland, Oregon

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APPENDIX A

DATA FOR BANNOCK CREEK STATIONS

206027 0
42 32 50.0 112 32 05.0 2
DANNUCK CR BELOW ARBON P O ACROVER PAULINE
16077 IDAHO POWER
PACIFIC NORTHWEST 130600
UPPER SNAKE RIVER
21IDSOEV 800315
0000 CLASS 00 CSN-KSP 0536388-0429467

/21IPA/AMBNT/STREAM

INDEX 1310001 002740 09220 9200
MILES 0324.30 0731.20 725.50 034.40

PARAMETER			RMK	NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAR	STAND ER	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010 WATER	TEMP	CENT		5	6.50000	51.7500	7.19375	1.10673	3.21714	16.0000	1.00000	80/01/22	80/12/01
00011 WATER	TEMP	FAHN		1	55.8000					55.8000	55.8000	80/01/22	80/01/22
00042 ALTITUDE	REF	AB MSL		1	5040.00					5040.00	5040.00	01/01/01	01/01/01
00061 STREAM	FLOW,	INST-CFS		2	0.11000	7.14420	2.67280	.437457	1.89000	6.00000	0.22000	80/06/12	80/12/01
00076 TURB	TRBIMIR	HACH FTU		5	18.4000	297.300	17.2421	.937181	7.71181	43.0000	3.40000	80/03/01	80/12/01
00095 CNDUCTVY	AT 25C	MICROMHO		6	1053.67	95879.0	214.194	.207217	87.4443	1218.00	702.000	80/01/22	80/12/01
00116 TTLNSVE	SURVEY	IDENT		6	801607	.000000	.000009		.000000	801607	801607	80/01/22	80/12/01
00300 DO		MG/L		5	7.75999	5.65308	2.37762	.306394	1.06330	10.6000	4.50000	80/01/22	80/12/01
00301 DO	SATUR	PERCENT		1	72.9000					72.9000	72.9000	80/01/22	80/01/22
00335 COD	LOWLEVEL	MG/L		3	19.2000	43.0804	6.60912	.344225	3.81577	25.6000	12.4000	80/01/22	80/01/30
00400 PH		SU		4	7.84999	.051708	.227526	.028984	.113763	8.15000	7.65000	80/06/12	80/12/01
00403 LAB	PH	SU		3	7.55000	.052597	.229340	.030376	.132410	7.75000	7.30000	80/01/22	80/12/01
00410 T ALK	CACO3	MG/L		5	277.400	645.375	25.4042	.091580	11.3611	301.000	236.000	80/01/22	80/12/01
00425 NO3 ALK	CACO3	MG/L		3	269.333	914.406	30.2391	.112274	17.4586	295.000	236.000	80/01/22	80/07/30
00430 CO3 ALK	CACO3	MG/L	K	3	1.00000	.000000	.000000		.000000	1.00000	1.00000	80/01/22	80/07/30
00500 RESIDUE	TOTAL	MG/L		6	730.000	26992.8	164.295	.225227	67.0731	901.000	445.000	80/01/22	80/12/01
00530 RESIDUE	TOT NFLT	MG/L		4	41.7500	3267.58	57.1628	1.36911	28.5814	127.000	6.00000	80/06/12	80/12/01
00610 NH3+NH4-	N TOTAL	MG/L		5	.184200	.011315	.106370	.577473	.047570	.300000	.089000	80/01/22	80/12/01
00625 TOT KJEL	N	MG/L		5	1.66000	.141955	.376766	.226968	.168495	2.23000	1.30000	80/01/22	80/12/01
00630 NO3+NO2	N-TOTAL	MG/L		5	.763999	.278129	.527380	.672619	.235821	1.22000	.188000	80/01/22	80/12/01
00665 PHOS-TOT		MG/L P		5	.168000	.005170	.071903	.427993	.032156	.260000	.100000	80/01/22	80/12/01
00900 TOT HARD	CACO3	MG/L		5	421.200	3147.27	56.1005	.133192	25.0869	498.000	324.000	80/01/22	80/12/01
00915 CALCIUM	CA-TOT	MG/L		4	98.7500	208.917	14.4539	.146369	7.22697	115.000	80.0000	80/01/22	80/07/30
00927 MGNSIUM	MG,TOT	MG/L		4	30.2250	34.6367	5.88530	.194695	2.94265	42.9000	24.5000	80/01/22	80/07/30
00929 SODIUM	NA,TOT	MG/L		4	75.9000	377.857	19.4385	.256107	9.71927	89.5000	47.2000	80/01/22	80/07/30
00937 PTSSIUM	K,TOT	MG/L		3	6.46666	1.77341	1.33169	.205932	.768854	7.60000	5.00000	80/01/22	80/07/30
00940 CHLORIDE	TOTAL	MG/L		3	164.580	321.412	56.7373	.344740	32.7573	200.000	99.1400	80/01/22	80/07/30
00945 SULFATE	SO4-TOT	MG/L		3	54.3333	310.336	17.6163	.324227	10.1709	69.0000	34.0000	80/01/22	80/07/30
00951 FLUORIDE	F,TOTAL	MG/L		3	.200667	.005433	.073711	.270417	.042557	.250000	.140000	80/01/22	80/07/30
00956 SILICA	TOTAL	MG/L		3	37.4667	73.8633	8.59437	.229387	4.96196	45.7000	29.1000	80/01/22	80/07/30
01002 ARSENIC	AS,TOT	UG/L	K	2	10.0000	.000000	.000000		.000000	10.0000	10.0000	80/01/22	80/03/01
01022 BORON	B,TOT	UG/L		2	315.000	2450.00	49.4975	.157135	35.0000	350.000	280.000	80/01/22	80/03/01
01027 CADMIUM	CD,TOT	UG/L	K	2	1.00000	.000000	.000000		.000000	1.00000	1.00000	80/01/22	80/03/01
01042 COPPER	CU,TOT	UG/L		1	10.0000					10.0000	10.0000	80/03/01	80/03/01
			K	1	10.0000					10.0000	10.0000	80/01/22	80/01/22
			TOT	2	10.0000	.000000	.000000		.000000	10.0000	10.0000	80/01/22	80/03/01
01045 IRON	FE,TOT	UG/L		2	695.000	151250	388.909	.559581	275.000	970.000	420.000	80/01/22	80/03/01
01051 LEAD	PB,TOT	UG/L	K	2	50.0000	.000000	.000000		.000000	50.0000	50.0000	80/01/22	80/03/01
01055 MANGNESE	MN	UG/L		2	240.000	200.000	14.1421	.058926	10.0000	250.000	230.000	80/01/22	80/03/01
01092 ZINC	ZN,TOT	UG/L		2	6.50000	40.5000	6.36396	.979071	4.50000	11.0000	2.00000	80/01/22	80/03/01
01501 ALPHA	TOTAL	PC/L	K	1	.100000					.100000	.100000	80/01/22	80/01/22

2080270
42 32 50.0 112 32 05.0 2
BANNOCK CR BELOW ARBON P D ABOVER PAULINE
16077 IDAHO POWER
PACIFIC NORTHWEST 130600
UPPER SNAKE RIVER
21IDSURN 800315
0000 CLASS 00 CSN-RSP 0538386-0429487

/TYPA/AMBNT/STREAM

INDEX 1310001 002740 09220 9200
MILES 0324.30 0731.20 725.50 034.40

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAR	STAND ER	MAXIMUM	MINIMUM	BEG DATE	END DATE
03501	BETA	TOTAL	PC/L		1	7.40000					7.40000	7.40000	80/01/22	80/01/22
31501	TOT COLI	MFIMENDO	/100ML		5	235.600	50766.8	225.315	.956345	100.764	600.000	70.0000	80/01/22	80/12/01
31616	FEC COLI	MFM-FCBK	/100ML		6	118.000	17024.0	130.476	1.10573	53.2666	360.000	8.00000	80/01/22	80/12/01
31679	FECSTREP	MF M-ENT	/100ML		6	391.500	149866	387.125	.988824	158.043	1000.00	44.0000	80/01/22	80/12/01
70507	PHOS-T	ORTHO	MG/L P		4	.075000	.002300	.047958	.639446	.023979	.130000	.030000	80/01/22	80/12/01
				K	1	.010000					.010000	.010000	80/06/12	80/06/12
				TOT	5	.062000	.002570	.050695	.817664	.022672	.130000	.010000	80/01/22	80/12/01
71900	MERCURY	HG, TOTAL	UG/L	K	2	.500000	.000000	.000000		.000000	.500000	.500000	80/01/22	80/03/07
80154	SUSP SED	CONC	MG/L		3	75.3333	1166.34	34.1517	.453341	19.7174	105.000	38.0000	80/01/22	80/06/12

STORET RETRIEVAL DATE 82/02/26 - INVENT - VERSION OF SEP. 1981

2080271
42 34 45.0 112 39 10.0 2
BANNOCK CR BELOW PAULINE
16077 IDAHO POWER
PACIFIC NORTHWEST 130600
UPPER SNAKE RIVER
21USGRV 800315
0000 CLASS 00 CSN-RSP 0538389-0429489

/21YPAZA;1601/STREAM

INDEX 1310001 002740 09220 9200
MILES 0324.30 0731.20 775.50 031.00

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAR	STAND ER	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		5	8.40000	45.9250	6.77680	.806762	3.03066	16.0000	2.50000	80/02/22	80/12/01
00011	WATER	TEMP	FAHN		1	36.5000					36.5000	36.5000	80/01/22	80/01/22
00042	ALTITUDE	FEET	AB MSL		1	4980.00					4980.00	4980.00	01/01/01	01/01/01
00061	STREAM	FLOW,	INST-CFS		2	7.29000	15.9048	3.98808	.547062	2.82000	10.1100	4.47900	80/06/12	80/12/01
00076	TURB	FIELDMTR	NACH FTU		5	13.9000	220.348	14.8441	1.06833	6.63850	36.0000	2.20000	80/03/07	80/12/01
00095	CNDUCTVY	AT 25C	MICROMHO		6	938.100	67008.7	258.861	.275922	105.679	1144.00	562.000	80/01/22	80/12/01
00110	INTRSVL	SURVEY	IDENT		6	801607	.000000	.000000		.000000	801607	801607	80/01/22	80/12/01
00300	DO		MG/L		5	10.5000	.370117	.608373	.057940	.272072	11.2000	9.60000	80/01/22	80/12/01
00301	DO	SATUR	PERCENT		1	93.4000					93.4000	93.4000	80/01/22	80/01/22
00335	COD	LOWLEVEL	MG/L		3	14.3333	113.572	10.6570	.743960	6.15283	23.1000	2.49000	80/01/22	80/07/30
00400	PH		SU		4	8.28999	.005023	.224996	.030759	.127498	8.50000	7.97000	80/06/12	80/12/01
00403	LAB	PH	SU		3	7.71666	.013923	.120183	.016352	.072053	7.85000	7.60000	80/01/22	80/12/01
00410	T ALK	CACO3	MG/L		5	262.400	1429.31	37.8071	.144062	16.9073	286.000	196.000	80/01/22	80/12/01
00425	BICB ALK	CACO3	MG/L		3	254.067	2585.31	50.8466	.199959	29.3563	286.000	196.000	80/01/22	80/07/30
00430	CO3 ALK	CACO3	MG/L	K	3	1.00000	.000000	.000000		.000000	1.00000	1.00000	80/01/22	80/07/30
00500	RESIDUE	TOTAL	MG/L		6	634.333	34999.8	187.082	.294925	76.4032	805.000	379.000	80/01/22	80/12/01
00530	RESIDUE	TOT NFLT	MG/L		4	20.2500	278.250	16.6808	.823745	8.34042	43.0000	9.00000	80/06/12	80/12/01
00610	NH3+NH4-	N TOTAL	MG/L		5	.136000	.011256	.106097	.780122	.047448	.284000	.027000	80/01/22	80/12/01
00625	TOT KJEL	N	MG/L		5	1.15400	.121931	.349187	.299921	.156161	1.60000	.760000	80/01/22	80/12/01
00630	NO2+NO3	N-TOTAL	MG/L		5	.715999	.212330	.460793	.643506	.206073	1.14000	.220000	80/01/22	80/12/01
00665	PHOS-TOT		MG/L P		5	.144000	.003930	.062706	.539766	.028038	.220000	.080000	80/01/22	80/12/01
00680	TOT NPOC	CARBN	MG/L		5	375.600	5704.93	75.5311	.201075	33.7785	432.000	299.000	80/01/22	80/12/01
00715	CALCIUM	CA-TOT	MG/L		4	59.5000	427.666	20.6801	.231063	10.3400	112.000	42.0000	80/01/22	80/07/30
00727	MGNESIUM	MG,TOT	MG/L		4	34.8000	79.6002	8.92525	.256473	4.46263	50.5000	21.5000	80/01/22	80/07/30
00929	SODIUM	NA,TOT	MG/L		4	66.9999	500.275	22.3668	.333633	11.1834	92.0000	33.8000	80/01/22	80/07/30
00937	POTASSIUM	K,TOT	MG/L		3	7.66666	.763496	.873783	.113972	.504479	8.80000	6.80000	80/01/22	80/07/30
00940	CHLORIDE	TOTAL	MG/L		3	136.410	3538.34	59.4839	.436156	34.3430	176.000	69.9300	80/01/22	80/07/30
00945	SULFATE	SO4-TOT	MG/L		3	40.0000	549.060	23.4308	.585884	13.5278	61.0000	19.0000	80/01/22	80/07/30
00951	FLUORIDE	F,TOTAL	MG/L		3	.250000	.000700	.026457	.105830	.015275	.270000	.220000	80/01/22	80/07/30
00956	SILICA	TOTAL	MG/L		3	40.4667	122.664	11.0754	.273671	6.39437	56.5000	30.7000	80/01/22	80/07/30
01002	ARSENIC	AS,TOT	UG/L	K	2	10.0000	.000000	.000000		.000000	10.0000	10.0000	80/01/22	80/03/01
01022	BORON	B,TOT	UG/L		2	295.000	450.000	21.2132	.071969	15.0000	280.000	280.000	80/01/22	80/03/01
01027	CADMIUM	CD,TOT	UG/L	K	2	1.00000	.000000	.000000		.000000	1.00000	1.00000	80/01/22	80/03/01
01042	COPPER	CU,TOT	UG/L	K	2	10.0000	.000000	.000000		.000000	10.0000	10.0000	80/01/22	80/03/01
01045	IRON	FE,TOT	UG/L		2	750.000	561800	749.533	.999040	530.000	1280.00	220.000	80/01/22	80/03/01
01051	LEAD	PB,TOT	UG/L	K	2	50.0000	.000000	.000000		.000000	50.0000	50.0000	80/01/22	80/03/01
01055	MANGANESE	MN	UG/L		2	175.000	2450.00	49.4975	.282843	35.0000	210.000	140.000	80/01/22	80/03/01
01092	ZINC	ZN,TOT	UG/L		1	13.0000					13.0000	13.0000	80/03/01	80/03/01
				K	1	1.00000					1.00000	1.00000	80/01/22	80/01/22
				TOT	2	7.00000	72.0000	8.48528	1.21218	6.00000	13.0000	1.00000	80/01/22	80/03/01
01501	ALPHA	TOTAL	PC/L		1	6.50000					6.50000	6.50000	80/01/22	80/01/22

STORET RETRIEVAL DATE 82/02/26 - INVENT - VERSION OF SEP. 1981

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                                                    20802 71
                                                    42 34 45.0 112 34 10.0  2
                                                    BANNOCK CR BELOW PAULINE
                                                    16077 IDAHO                    POWER
                                                    PACIFIC NORTHWEST              130600
                                                    UPPER SNAKE RIVER
/TYPA/AMBNT/STREAM                                  Z11DSURV  800315
                                                     0000  CLASS 00 CSN-RSP 0538389-0429489

INDEX 1310001  002740  09220  9200
MILES 0324.30 0731.26 725.50 031.00
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PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAR	STAND ER	MAXIMUM	MINIMUM	BEG DATE	END DATE
03501	BETA	TOTAL	PC/L		1	8.20000					8.20000	8.20000	80/01/22	80/01/22
31501	TOT COLI	MFIMENDO	/100ML		5	222.800	41359.2	203.370	.912790	90.9497	560.000	44.0000	80/01/22	80/12/01
31616	FEC COLI	MFM-FCBR	/100ML		6	43.6667	3106.27	55.7339	1.27635	22.7533	120.000	2.00000	80/01/22	80/12/01
31679	FECSTREP	MF M-ENT	/100ML		6	204.333	29253.5	171.036	.837046	69.8253	470.000	44.0000	80/01/22	80/12/01
70507	PHOS-T	ORTHO	MG/L P		4	.057500	.003492	.059090	1.02766	.029545	.140000	.010000	80/01/22	80/12/01
				K	1	.010000					.010000	.010000	80/06/12	80/06/12
				TOT	5	.048000	.003070	.055408	1.15432	.024779	.140000	.010000	80/01/22	80/12/01
71900	MERCURY	HG, TOTAL	UG/L	K	2	.500000	.000000	.000000		.000000	.500000	.500000	80/01/22	80/03/07
80154	SUSP SED	CONC	MG/L		3	70.6667	2872.34	53.5942	.758408	30.9426	126.000	19.0000	80/01/22	80/06/12

STORET RETRIEVAL DATE 82/02/26 - INVENT - VERSION OF SEP. 1981

2080272
42 47 05.0 112 36 05.0 2
BANNOCK CR BL RATTLESNAKE CR (USGS DISC SITE)
16077 IDAHO POWER
PACIFIC NORTHWEST 150000
UPPER SNAKE RIVER
21USGSRV 800315
0000 CLASS 00 USN-RSP 0536390-0429491

Z1YPAZAMBNT/STReAM

INDEX 1310001 002740 09220 9200
MILES 0324.30 0731.20 725.50 020.80

PARAMETER			RMK	NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAR	STAND ER	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010 WATER	TEMP	CENT		4	9.62500	36.2292	6.01907	.625357	3.00953	16.6000	4.00000	80/03/07	80/12/01
00042 ALTITUDE	FEET	AB MSL		1	4700.00					4700.00	4700.00	01/01/01	01/01/01
00061 STREAM	FLOW,	INST-CFS		2	54.5500	319.005	17.8755	.327511	12.6399	67.2200	41.9400	80/06/12	80/12/01
00076 TURB	TRBIDITR	HACH FTU		5	25.1800	645.692	25.4105	1.00915	11.3639	67.0000	2.20000	80/03/07	80/12/01
00095 CNDUCTVY	AT 25C	MICROMHO		5	673.000	21618.7	147.033	.218260	65.7552	950.000	502.000	80/03/07	80/12/01
00116 INTNSVE	SURVEY	IDENT		5	801607	.000000	.000000		.000000	801607	801607	80/03/07	80/12/01
00300 DO		MG/L		4	9.25000	.010140	.100676	.097306	.050039	10.0000	8.60000	80/03/07	80/12/01
00335 COD	LOWLEVEL	MG/L		2	14.0100	121.368	11.0167	.786348	7.79000	21.8000	6.22000	80/03/07	80/07/30
00400 PH		SU		4	8.10999	.004779	.069156	.031017	.127258	8.46000	7.68000	80/06/12	80/12/01
00403 LAB	PH	SU		2	7.90000	.020004	.141436	.017903	.100011	8.00000	7.80000	80/03/07	80/12/01
00410 T ALK	CACO3	MG/L		4	247.000	424.000	20.5913	.083365	10.2956	277.000	231.000	80/03/07	80/12/01
00425 MCOS ALK	CACO3	MG/L		2	257.000	800.000	28.2843	.110055	20.0000	277.000	237.000	80/03/07	80/07/30
00430 CO3 ALK	CACO3	MG/L	K	2	1.00000	.000000	.000000		.000000	1.00000	1.00000	80/03/07	80/07/30
00500 RESIDUE	TOTAL	MG/L		5	480.000	24676.0	157.086	.327262	70.2510	727.000	326.000	80/03/07	80/12/01
00530 RESIDUE	TOT NFLT	MG/L		4	49.2500	2724.25	52.1943	1.05976	26.0972	124.000	5.00000	80/06/12	80/12/01
00610 NH3+NH4-	N TOTAL	MG/L		4	.101000	.005029	.070913	.702111	.035457	.198000	.029000	80/03/07	80/12/01
00625 TOT KJEL	N	MG/L		4	.992499	.072092	.268500	.270529	.134250	1.39000	.800000	80/03/07	80/12/01
00630 NO2&NO3	N-TOTAL	MG/L		4	.422500	.106425	.329279	.779359	.164640	.841000	.040000	80/03/07	80/12/01
00665 PHOS-TOT		MG/L P		4	.207500	.009492	.097425	.469520	.048713	.330000	.100000	80/03/07	81/12/01
00900 TOT HARD	CACO3	MG/L		4	305.000	4580.00	67.6757	.221867	33.8378	464.000	257.000	80/03/07	80/12/01
00916 CALCIUM	CA-TOT	MG/L		3	71.6667	160.336	12.6624	.176684	7.31063	86.0000	62.0000	80/03/07	80/07/30
00927 MGNSIUM	MG,TOT	MG/L		3	27.3333	39.0839	6.25171	.228721	3.60993	34.5000	23.0000	80/03/07	80/07/30
00929 SODIUM	NA,TOT	MG/L		5	38.3333	182.162	13.4967	.352069	7.19237	53.7000	28.4000	80/03/07	80/07/30
00937 POTSSIUM	K,TOT	MG/L		2	6.05000	1.44502	1.20209	.175408	.850007	7.70000	6.00000	80/03/07	80/07/30
00940 CHLORIDE	TOTAL	MG/L		2	60.4550	2659.39	51.5693	.841130	36.4650	116.900	43.9700	80/03/07	80/07/30
00945 SULFATE	SO4-TOT	MG/L		2	31.0000	512.000	22.6274	.729916	16.0000	47.0000	15.0000	80/03/07	80/07/30
00951 FLUORIDE	F,TOTAL	MG/L		2	.255000	.001250	.035356	.138650	.025000	.280000	.230000	80/03/07	80/07/30
00956 SILICA	TOTAL	MG/L		2	33.1000	16.9210	4.11351	.124308	2.90009	36.0000	30.2000	80/03/07	80/07/30
01002 ARSENIC	AS,TOT	UG/L	K	1	10.0000					10.0000	10.0000	80/03/07	80/03/07
01022 BORON	B,TOT	UG/L		1	230.000					230.000	230.000	80/03/07	80/03/07
01027 CADMIUM	CD,TOT	UG/L	K	1	1.00000					1.00000	1.00000	80/03/07	80/03/07
01042 COPPER	CU,TOT	UG/L	K	1	10.0000					10.0000	10.0000	80/03/07	80/03/07
01045 IRON	FE,TOT	UG/L		1	2060.00					2060.00	2060.00	80/03/07	80/03/07
01051 LEAD	PB,TOT	UG/L	K	1	50.0000					50.0000	50.0000	80/03/07	80/03/07
01055 MANGNESE	MN	UG/L		1	200.000					200.000	200.000	80/03/07	80/03/07
01092 ZINC	ZN,TOT	UG/L		1	7.00000					7.00000	7.00000	80/03/07	80/03/07
31501 TOT COLI	MFIMENGO	/100ML		4	247.500	96691.7	219.298	.886033	109.649	503.000	60.0000	80/06/12	80/12/01
31616 FEC COLI	MFM-FCBR	/100ML		5	62.6000	1759.80	41.9499	.669945	18.7665	130.000	20.0000	80/03/07	80/12/01
31679 FCOLIGEP	MF M-ENDO	/100ML		5	318.000	29670.0	172.250	.541666	77.0325	540.000	100.000	80/03/07	80/12/01
70507 PHOS-I	ORTHO	MG/L P		4	.070000	.002733	.052281	.746877	.026141	.130000	.030000	80/03/07	80/12/01
71900 MERCURY	HG,TOTAL	UG/L	K	1	.500000					.500000	.500000	80/03/07	80/03/07

2080272
42 42 05.0 112 36 05.0 2
BANNOCK CR BL RATTLESNAKE CR (USGS MISC SITE)
16077 IDAHO POWER
PACIFIC NORTHWEST 130600
UPPER SNAKE RIVER
211DSURV 800315
0000 CLASS 00 USN-RSP 0538390-0429491

/TYPA/AMBNT/STREAM

INDEX 1310001 002740 09220 9200
MILES 0324.30 0731.20 725.50 020.80

PARAMETER			RMK	NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAR	STAND ER	MAXIMUM	MINIMUM	BEG DATE	END DATE
80154 SUSP SED	CONC	MG/L		2	169.500	84.5000	9.19239	.054232	6.50000	176.000	163.000	80/03/07	80/06/12

2080273
42 12 40.0 112 37 50.0 2
BANNOCK CR NR MOUTH, W OF ARIMO VALLEY ROAD
16077 IDAHO POWER
PACIFIC NORTHWEST 13000
UPPER SNAKE RIVER
21UBSURV 800315
0000 CLASS 00 USN-NSP 05080501-04050402

/TYPA/AMBNT/STREAM

INDEX 1316001 062746 09220 9200
MILES 0324.30 0731.20 725.50 005.40

PARAMETER			RMK	NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAR	STAND ER	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010 WATER	TEMP	CENT		7	7.35714	29.5596	4.95570	.673599	1.87210	13.5000	1.00000	80/01/22	80/12/01
00011 WATER	TEMP	FAHN		1	33.8000					57.0000	33.8000	80/01/22	80/01/22
00042 ALTITUDE	FEET	AB MSL		1	4380.00					4380.00	4380.00	81/01/01	81/01/01
00061 STREAM	FLOW,	INST-CFS		3	49.0333	417.268	20.4271	.416597	11.7956	67.1400	28.3000	80/06/05	80/12/01
00070 TURB	TRBIDMTR	HACH FIU		6	38.3333	1437.47	37.9139	.989059	15.4787	110.000	11.0000	80/02/07	80/12/01
00095 CNDUCTVY	AT 25C	MICROMHO		7	731.714	4597.00	67.8012	.092661	25.6264	823.000	661.000	80/01/22	80/12/01
00110 INTRSVE	SURVEY	IDENT		7	801607	.000000	.000000		.000000	801607	801607	80/01/22	80/12/01
00300 DO		MG/L		7	8.92857	3.22241	1.79511	.201052	.678487	12.0000	7.00000	80/01/22	80/12/01
00301 DO	SATUR	PERCENT		1	99.2000					99.2000	99.2000	80/01/22	80/01/22
00335 COD	LOWLEVEL	MG/L		4	17.4550	128.260	11.3252	.648822	5.66259	31.6000	4.93000	80/01/22	80/01/30
00400 PH		SU		6	8.20333	.149756	.3869 3	.046831	.157965	8.80000	7.81000	80/03/07	80/12/01
00403 LAB	PH	SU		4	7.90000	.000704	.0261676	.010304	.040536	8.00000	7.80000	80/01/22	80/12/01
00410 T ALK	CACO3	MG/L		4	254.500	429.666	20.7284	.081497	10.3642	280.000	232.000	80/01/22	80/12/01
00425 HCO3 ALK	CACO3	MG/L		3	257.000	584.909	24.1758	.093826	13.9579	280.000	232.000	80/01/22	80/07/30
00430 CO3 ALK	CACO3	MG/L	K	3	1.00000	.000000	.000000		.000000	1.00000	1.00000	80/01/22	80/07/30
00500 RESIDUE	TOTAL	MG/L		7	575.286	20529.3	143.281	.249060	54.1550	816.000	430.000	80/01/22	80/12/01
00530 RESIDUE	TOT NFLT	MG/L		5	79.0000	5041.00	71.0000	.898716	31.7647	207.000	20.0000	80/06/05	80/12/01
00610 NH3+NH4-	N TOTAL	MG/L		6	.096167	.001297	.036019	.374548	.014705	.105000	.060000	80/01/22	80/12/01
00625 TOT KJEL	N	MG/L		6	1.14667	.101188	.401482	.350130	.163909	1.47000	.500000	80/01/22	80/12/01
00630 NO2+NO3	N-TOTAL	MG/L		6	1.05667	.529378	.727584	.688209	.297069	2.36000	.400000	80/01/22	80/12/01
00665 PHOS-TOT		MG/L P		6	.225000	.019350	.139105	.618244	.056789	.450000	.040000	80/01/22	80/12/01
00900 TOT HARD	CACO3	MG/L		4	316.000	992.000	31.4960	.099671	15.7480	348.000	280.000	80/01/22	80/12/01
00916 CALCIUM	CA-TOT	MG/L		3	79.0000	76.0000	8.71780	.110352	5.03324	89.0000	69.0000	80/01/22	80/07/30
00927 MGNSIUM	MG,TOT	MG/L		3	29.4000	11.4304	3.38089	.114556	1.95196	31.5000	25.5000	80/01/22	80/07/30
00929 SODIUM	NA,TOT	MG/L		3	44.0667	73.9740	8.60065	.195256	4.96570	52.0000	35.2000	80/01/22	80/07/30
00937 PTSSIUM	K,TOT	MG/L		3	7.06667	1.09340	1.04567	.147965	.603945	8.20000	6.50000	80/01/22	80/07/30
00940 CHLORIDE	TOTAL	MG/L		3	84.5700	1645.57	32.3352	.382349	18.6699	106.300	47.4100	80/01/22	80/07/30
00945 SULFATE	SO4-TOT	MG/L		3	50.0000	.000000	.000000		.000000	50.0000	50.0000	80/01/22	80/07/30
00951 FLUORIDE	F,TOTAL	MG/L		3	.270000	.000100	.010102	.269268	.005832	.280000	.260000	80/01/22	80/07/30
00956 SIL,CA	TOTAL	MG/L		3	34.7333	52.0043	7.25702	.208935	4.18934	42.7000	28.5000	80/01/22	80/07/30
01002 ARSENIC	AS,TOT	UG/L	K	2	10.0000	.000000	.000000		.000000	10.0000	10.0000	80/01/22	80/03/01
01022 BORON	B,TOT	UG/L		2	250.000	50.0000	7.07107	.028730	5.00000	260.000	250.000	80/01/22	81/03/01
01027 CADMIUM	CD,TOT	UG/L	K	2	1.00000	.000000	.000000		.000000	1.00000	1.00000	80/01/22	80/03/01
01042 COPPER	CU,TOT	UG/L		1	10.0000					10.0000	10.0000	80/03/01	80/03/01
			K	1	10.0000					10.0000	10.0000	80/03/01	80/03/01
			TOT	2	10.0000	.000000	.000000		.000000	10.0000	10.0000	80/01/22	81/01/22
01045 IRON	FE,TOT	UG/L		2	2515.00	4961240	2227.35	.885040	1575.00	4090.00	940.000	80/01/22	80/03/01
01051 LEAD	PB,TOT	UG/L	K	2	50.0000	.000000	.000000		.000000	50.0000	50.0000	80/01/22	80/03/01
01055 MANGNESE	MN	UG/L		2	155.000	14450.0	120.208	.775535	85.0000	240.000	70.0000	80/01/22	80/03/01
01092 ZINC	ZN,TOT	UG/L		2	11.0000	98.0000	9.89949	.899954	7.00000	18.0000	4.00000	80/01/22	80/03/01
01501 ALPHA	TOTAL	PC/L		1	4.90000					4.90000	4.90000	80/01/22	80/01/22

2080273
42 52 40.0 112 37 50.0 2
BANNOCK CR NR MOUTH, W OF ARIMON VALLEY ROAD
16077 IDAHO POWER
PACIFIC NORTHWEST 130600
UPPER SNAKE RIVER
2110SURV 800315
0000 CLASS 00 CSN-KSP 0538391-0429492

/TYPA/AMBNT/STREAM

INDEX 1310001 002740 09220 9200
MILES 0324.30 0731.20 725.50 005.40

PARAMETER			RMK	NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAR	STAND ER	MAXIMUM	MINIMUM	BEG DATE	END DATE
03501	BETA	TOTAL	PC/L	1	9.60000					9.60000	9.60000	80/01/22	80/01/22
31501	TOT COLI	MFIMENDO	/100ML	6	410.333	181337	425.836	1.03778	173.847	1200.00	30.0000	80/01/22	80/12/01
31616	FEC COLI	MFM-FCBR	/100ML	6	167.500	30355.9	174.229	1.04018	71.1289	450.000	6.00000	80/01/22	80/12/01
			K	1	2.00000					2.00000	2.00000	80/10/20	80/10/20
			TOT	7	143.857	29209.5	170.908	1.18804	64.5971	450.000	2.00000	80/01/22	80/12/01
31679	FECSTREP	MF M-ENT	/100ML	7	515.714	179096	423.197	.820603	159.953	1300.00	130.000	80/01/22	80/12/01
70507	PHOS-T	ORTHO	MG/L P	6	.108333	.005937	.077050	.711228	.031455	.230000	.030000	80/01/22	80/12/01
71900	MERCURY	HG, TOTAL	UG/L	K 2	.500000	.000000	.000000		.000000	.500000	.500000	80/01/22	80/03/07
80154	SUSP SED	CONC	MG/L	3	365.000	103243	321.314	.880313	185.511	711.000	76.0000	80/01/22	80/06/05

STORET RETRIEVAL DATE 82/02/26 - INVENT - VERSION OF SEP. 1981

/TYPA/AMBNT/STRLAM

[illegible] 1310601 002740 09220 9200
MILES 0324.30 0731.20 725.50 004.00

PARAMETER			RMK	NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAR	STAND ER	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010 WATER	TEMP	CENT		6	9.75000	34.9750	5.91397	.606561	2.41437	17.5000	3.00000	80/03/07	80/12/01
00042 ALTITUDE	FEET	AB MSL		1	4360.00					4360.00	4360.00	81/01/01	81/01/01
00061 STRLAM	FLOW,	INST-CFS		2	47.6350	747.684	27.3438	.574026	19.3350	66.9700	28.3000	80/06/05	80/12/01
00076 TURB	TRBLMTR	HACH FTU		6	34.7500	1160.17	34.1786	.983556	13.9533	97.0000	12.0000	80/03/07	80/12/01
00095 CNDUCTVY	AT 25C	MICRMHO		6	759.000	6216.80	78.8467	.103791	32.1890	848.000	661.000	80/03/07	80/12/01
00110 INTNSVE	SURVEY	IDENT		6	801607	.000000	.000000		.000000	801607	801607	80/03/07	80/12/01
00300 DO		MG/L		6	8.41666	1.53575	1.23890	.147144	.505600	10.0000	6.70000	80/03/07	80/12/01
00335 COD	LOWLEVEL	MG/L		3	22.2233	263.785	16.2291	.730275	9.36990	37.2000	4.90000	80/03/07	81/07/30
00400 PH		SU		6	8.40499	.224365	.473672	.056356	.193376	9.29000	7.90000	80/03/07	80/12/01
00403 LAB	PH	SU		3	7.90000	.000070	.008735	.001106	.005044	7.90000	7.90000	80/03/07	80/12/01
00410 T ALK	CACO3	MG/L		3	249.333	124.373	11.1524	.044729	6.43851	262.000	241.000	80/03/07	80/12/01
00425 HCO3 ALK	CACO3	MG/L		2	251.500	220.500	14.8492	.059043	10.5000	262.000	241.000	80/03/07	80/07/30
00430 CO3 ALK	CACO3	MG/L	K	1	1.00000					1.00000	1.00000	80/03/07	80/03/07
00500 RESIDUE	TOTAL	MG/L		6	578.333	23505.6	153.311	.265037	62.6070	796.000	445.000	80/03/07	80/12/01
00530 RESIDUE	TOT NFLT	MG/L		5	77.0000	6934.50	83.2730	1.08146	37.2431	224.000	21.0000	80/06/05	80/12/01
00610 NH3+NH4-	N TOTAL	MG/L		5	.116400	.010276	.101372	.870894	.045330	.240000	.043000	80/03/07	80/12/01
00625 TOT KJEL	N	MG/L		5	1.02600	.249882	.499764	.487215	.223454	1.74000	.490000	80/03/07	80/12/01
00630 NO2&NO3	N-TOTAL	MG/L		5	.748799	.181497	.426025	.568944	.190524	1.33000	.414000	80/03/07	80/12/01
00665 PHOS-TOT		MG/L P		5	.242000	.021470	.165741	.684881	.074127	.490000	.040000	80/03/07	80/12/01
00900 TOT HARD	CACO3	MG/L		3	301.333	485.437	22.0326	.073117	12.7200	320.000	280.000	80/03/07	80/12/01
00916 CALCIUM	CA-TOT	MG/L		2	72.5000	12.5000	3.53553	.048765	2.50000	75.0000	70.0000	80/03/07	80/07/30
00927 MGNSIUM	MG,TOT	MG/L		2	26.2500	10.1250	3.18198	.112686	2.25000	28.5000	24.0000	80/03/07	80/07/30
00929 SODIUM	NA,TOT	MG/L		2	43.4500	54.0901	7.35525	.169274	5.15000	48.6000	38.3000	80/03/07	80/07/30
00937 PTSSIUM	K,TOT	MG/L		2	7.30000	1.25001	1.13136	.154965	.800000	8.10000	6.50000	80/03/07	80/07/30
00940 CHLORIDE	TOTAL	MG/L		2	78.2450	1310.30	36.2017	.462693	25.6050	103.900	52.5900	80/03/07	80/07/30
00945 SULFATE	SO4-TOT	MG/L		2	51.0000	8.00000	2.82843	.055459	2.00000	53.0000	49.0000	80/03/07	80/07/30
00951 FLUORIDE	F,TOTAL	MG/L		2	.300000	.010200	.127279	.424263	.090000	.390000	.210000	80/03/07	80/07/30
00956 SILICA	TOTAL	MG/L		2	37.0000	52.0210	7.21256	.194883	5.10005	42.1000	32.0000	80/03/07	80/07/30
01002 ARSENIC	AS,TOT	UG/L	K	1	10.0000					10.0000	10.0000	80/03/07	80/03/07
01022 BORON	B,TOT	UG/L		1	270.000					270.000	270.000	80/03/07	80/03/07
01027 CADMIUM	CD,TOT	UG/L	K	1	1.00000					1.00000	1.00000	80/03/07	80/03/07
01042 COPPER	CU,TOT	UG/L		1	10.0000					10.0000	10.0000	80/03/07	80/03/07
01045 IRON	FE,TOT	UG/L		1	5230.00					5230.00	5230.00	80/03/07	80/03/07
01051 LEAD	PB,TOT	UG/L		1	60.0000					60.0000	60.0000	80/03/07	80/03/07
01055 MANGNESE	MN	UG/L		1	240.000					240.000	240.000	80/03/07	80/03/07
01092 ZINC	ZN,TOT	UG/L		1	13.0000					13.0000	13.0000	80/03/07	80/03/07
01501 ALPHA	TOTAL	PC/L		1	9.60000					9.60000	9.60000	80/03/07	80/03/07
01502 BETA	TOTAL	PC/L		1	20.3000					20.3000	20.3000	80/03/07	80/03/07
31501 TOT COLI	MPN,MFBD	/100ML		5	882.000	654970	810.500	.918941	362.462	1500.00	140.000	80/10/05	80/12/01
31616 FEC COLI	MPN-HCPR	/100ML		5	315.200	38473.2	196.900	.624307	88.0007	600.000	130.000	80/03/07	81/12/01
			K	1	2.00000					2.00000	2.00000	80/10/20	80/10/20

26E0274
42 51 05.0 112 39 25.0 2
BADNOCK CR @ I-80N (0565 MISC SITE)
16077 IDAHO POWER
PACIFIC NORTHWEST 130600
UPPER SNAKE RIVER
21IDSURV 800315
0000 CLASS 00 CSN-RSP 0536892-0429494

STORET RETRIEVAL DATE 82/02/26 - INVENT - VERSION OF SEP. 1981

2060274
42 53 05.0 112 38 25.0 2
BANNOCK CR @ I-80N (USGS MISC SITE)
16077 IDAHO POWER
PACIFIC NORTHWEST 130600
UPPER SNAKE RIVER
21IDSURV 800315
0000 CLASS 00 CSN-KSP 0538392-0429494

/TYPA/AMBNT/STREAM

INDEX 1310001 002740 09220 9200
MILES 0324.30 0731.20 725.50 004.60

PARAMETER			RMK	NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAR	STAND ER	MAXIMUM	MINIMUM	BEG DATE	END DATE
31616 FEC COLI	MFM-FCBR	/100ML	TOT	6	266.333	45947.9	214.355	.804836	87.5099	660.000	2.00000	80/03/07	80/12/01
31679 FECSTREP	MF M-ENT	/100ML		6	436.666	89147.0	298.575	.683760	121.893	990.000	120.000	80/03/07	80/12/01
70507 PHOS-T	ORTHO	MG/L P		5	.104400	.006007	.077503	.742370	.034661	.190000	.020000	80/03/07	80/12/01
71900 MERCURY	HG, TOTAL	UG/L	K	1	.500000					.500000	.500000	80/03/07	80/03/07
80154 SUSP SED	CONC	MG/L		2	257.500	760.500	27.5772	.107096	19.5000	277.000	238.000	80/03/07	80/06/05